DRAFT

Resource Conservation and Recovery Act
Hazardous Waste Facility Management Permit

Permit No. AK9 69033 0742

March 2021

Issued to:

United States Coast Guard (USCG)
Base Kodiak, Alaska

This page intentionally blank

Permit No. AK9 69033 0742
Expiration Date: March 31, 2031
DRAFT

HAZARDOUS WASTE MANAGEMENT FACILITY PERMIT

U.S. Environmental Protection Agency Region 10 (AWT-121)
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101
(206) 553-1253

Issued in accordance with the Resource Conservation and Recovery Act (RCRA) as amended, 42 U.S.C. §6901 et. seq., and the Hazardous and Solid Waste Amendments of 1984 (HSWA), and the regulations promulgated thereunder in Title 40 of the Code of Federal Regulations (C.F.R.) Parts 124 and 260 through 271).

ISSUED TO: UNITED STATES COAST GUARD (USCG)
EPA I.D. No.: AK9 69033 0742

This Permit is effective as of April 1, 2021, and shall remain in effect until March 31, 2031, unless revoked and reissued under 40 C.F.R. § 270.41, or terminated under 40 C.F.R. § 270.43, or continued in accordance with 40 C.F.R. § 270.51(a). This Permit will be reviewed five (5) years after the date of issuance, in accordance with Section 3005(c)(3) of RCRA, 42 U.S.C. § 6925(c)(3), and 40 C.F.R. § 270.50, and will be modified to assure that the facility continues to comply with the currently applicable requirements of Sections 3004 and 3005 of RCRA, 42 U.S.C. §§ 6924 and 6925.

ISSUED BY: The U.S. ENVIRONMENTAL PROTECTION AGENCY

_____
Timothy B. Hamlin, Director
Land, Chemicals, and Redevelopment Division
U.S. Environmental Protection Agency, Region 10

Date _____

This page intentionally blank

TABLE OF CONTENTS

PERMIT COVER DOCUMENT/SIGNATURE PAGE..... 1
TABLE OF CONTENTS..... 3
LIST OF ATTACHMENTS..... 5
INTRODUCTION..... 7
DEFINITIONS..... 9
PART I - STANDARD CONDITIONS 11
PART II - GENERAL FACILITY CONDITIONS 23

A. Design and Operation of Facility
B. Required Notice
C. General Waste Analysis
D. Security
E. General Inspection Requirements
F. Training for Personnel Involved with Hazardous Waste Management Activities
G. General Requirements for Ignitable, Reactive, or Incompatible Wastes
H. Location Standards
I. Preparedness and Prevention
J. Contingency Plan
K. Manifest System
L. Record Keeping and Reporting
M. Closure and Post-Closure
N. Pollution Prevention Program
O. Equivalent Materials
P. Organic Air Emission Requirements

PART III – STORAGE IN CONTAINERS 29

A. Waste Identification
B. Condition of Containers
C. Compatibility of Waste with Containers
D. Management of Containers
E. Inspection of Containers and Containment System
F. Containment
G. Special Requirements for Incompatible Waste
H. Prohibitions of Storage of Restricted Wastes

PART IV – POST-CLOSURE 35
PART V – CORRECTIVE ACTION FOR CONTAMINATED GROUNDWATER 37
PART VI – CORRECTIVE ACTION FOR CONTAMINATED GROUNDWATER 51
PART VII – COMPLIANCE GROUNDWATER MONITORING 61
PART VIII – DETECTION GROUNDWATER MONITORING 69
PART IX – CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS 75

LIST OF TABLES

Table 1 Corrective Action Monitoring Program 87
Table 2 Compliance Monitoring Program 88
Table 3 Effectiveness Monitoring Program 89
Table 4 Groundwater Protection Standards 90

LIST OF FIGURES

Figure 1 Map of Facility
Figure 2 Map of Site 3 (Laundry)
Figure 3 Map of Site 7A (Barrel Storage Area One)
Figure 4 Map of Site 6A (MOGAS)

LIST OF ATTACHMENTS

The following Attachments describing specific requirements from the Permittee's RCRA permit application are hereby incorporated as enforceable conditions of this Permit. In the event of any inconsistencies between a permit condition and an Attachment, the permit condition shall prevail.

Attachment 1 - RCRA Part A Permit Application and Facility Description

Attachment 2 – Base Kodiak Hazardous Waste Storage Building, Waste Analysis Plan

Attachment 3 - Personnel Training Outline

Attachment 4A - Consolidated Post-Closure Plan: Site 3 – Coast Guard Laundry, Site 7A – Barrel Storage Area No.1 and Site 6A - MOGAS

Appendix A: RCRA Quarterly Sampling and Analysis Plan

Appendix B: Post-Closure Groundwater Monitoring Quality Assurance Project Plan

Attachment 4B – Closure Plan for the Hazardous Waste Storage Building (Building N-48)

Attachment 5 - Container Storage Area Plans and Specification Process Information

Attachment 6 - Procedures to Prevent Hazards

Attachment 7 - Solid Waste Management Units and Schedule of Compliance

Attachment 8 – RCRA Corrective Action Plan

Attachment 9 - Well Decommissioning Plan

Attachment 10 – Land Use Control Assurance Plan for Environmental Cleanup Activities

Attachment 11 – Summaries of Selected Remedies

This page intentionally blank

INTRODUCTION

Permittee: U.S. Coast Guard Base Kodiak
EPA ID Number: AK9 69033 0742

Pursuant to the Resource Conservation and Recovery Act of 1976, as amended, 42 U.S.C. § 6901 et seq., (RCRA), and the Hazardous and Solid Waste Amendments pf 1984 (HSWA), and regulations promulgated thereunder by the U.S. Environmental Protection Agency (EPA) (codified and to be codified in Title 40 of the Code of Federal Regulations); a permit is hereby issued to United States (U.S.) Coast Guard (USCG; hereafter called the Permittee) to operate hazardous waste container storage units in Building N-48, and for post-closure of Site 3 (Laundry), Site 6A (MOGAS), and Site 7A (Barrel Storage Area One), and for corrective action, at the USCG Base Kodiak, Kodiak, facility, geographically located in the Municipality of Kodiak, Alaska, at latitude 57 degrees 45 minutes North and longitude 152 degrees 15 minutes West.

The Permittee must comply with all terms and conditions of this hazardous waste facility permit. This Permit consists of the conditions contained herein (including those in any attachments), and the applicable regulations contained in 40 C.F.R. Parts 260 through 264, 266, 268, 270, and 124. Any management of hazardous waste subject to 40 C.F.R. Parts 264 or 265, which is not authorized by this Permit, is prohibited.

Nothing in this Permit shall limit the Agency’s authority to undertake, or require any person to undertake, response action or corrective action under any law, including, but not limited to, Section 104 or 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. Sections 9604 and 9606, and Section 7003 of RCRA, 42 U.S.C. Section 6973. Nor shall any permit condition relieve the Permittee of any obligations under any law, including, but not limited to, Section 103 of CERCLA, 42 U.S.C. Section 9603 to report releases of hazardous wastes, constituents, or substances to, at, or from the facility.

Applicable federal regulations are those which are in effect on the date of final administrative action on this Permit and any self-implementing statutory provisions and related regulations which, according to the requirements of RCRA (as amended), are automatically applicable to the Permittee’s hazardous waste

management activities, notwithstanding the conditions of this Permit.

This Permit is based upon the administrative record, as required by 40 C.F.R. § 124.9. The Permittee's failure in the application or during the Permit issuance process to fully disclose all relevant facts, or the Permittee's misrepresentation of any relevant facts at any time, shall be grounds for the termination or modification of this Permit and/or initiation of an enforcement action, including criminal proceedings. The Permittee shall inform the Administrator of noncompliance with any condition of the Permit or changes to the information provided in the Part B Permit Application that might affect the ability of the Permittee to comply with applicable regulations and permit conditions, or which alter any of the conditions of the Permit in any way.

This Permit includes the provisions of Section 206, 212, and 224 of the Hazardous and Solid Waste Amendments of 1984 (HSWA), which amended Sections 3004 and 3005 of RCRA, 42 U.S.C. §§ 6924 and 6925. In particular, Section 3004(u), 42 U.S.C. § 6924(u) requires corrective action for all releases of hazardous waste or constituents from any solid waste management unit at a treatment, storage, or disposal facility seeking a permit, regardless of the time at which waste was placed in such unit. Section 212 of HSWA provides that permits shall be for a fixed term not to exceed ten (10) years. Section 3005(c), 42 U.S.C. § 6925(c), provides the Administrator with authority to review and modify the Permit at any time. Under Section 6925(h) of RCRA, 42 U.S.C. § 6925(h), RCRA permits for hazardous waste management on the premises where the waste was generated must require the Permittee to certify efforts taken to minimize the amount and toxicity of hazardous waste.

At this time, the State of Alaska does not have an authorized RCRA program pursuant to Section 3006 of RCRA, 42 U.S.C. § 6926. Therefore, this RCRA Permit is issued by EPA since EPA has primacy under RCRA to enforce it.

DEFINITIONS

For purposes of this Permit, the following definitions shall apply:

a. All definitions contained in 40 C.F.R. Parts 124 and 260-270 are hereby incorporated by reference into this Permit.

   Where terms are not defined in the regulations or the permit, the meaning associated with such terms shall be the standard dictionary definition, or their generally accepted scientific or industrial meaning.

b. Unless otherwise noted, all schedules refer to calendar time; i.e. thirty (30) days means thirty (30) calendar days.

c. **"Administrator"** shall mean the Region 10 Regional Administrator of the U.S. Environmental Protection Agency (EPA) or a designated representative. The Director, Office of Air, Waste and Toxics, EPA Region 10, (with the address as specified on page one of this Permit), is a duly authorized and designated representative of the Administrator for purposes of this Permit.

d. **"Agency"** shall mean the U.S. Environmental Protection Agency, Region 10 (with the address as specified on page one of this Permit).

e. **"Elements"** (in the context of "Corrective Action Elements") shall refer to individual components of the remedy such as a landfill cap or an air sparging/soil vapor extraction (AS/SVE) system

f. **"Facility"** shall mean the property owned by the U.S. Coast Guard, Base Kodiak, to include all contiguous land, and structures, other appurtenances, and improvements on the land, used for treatment, storing, or disposing of hazardous waste, or for managing hazardous secondary materials prior to reclamation.

g. **"Hazardous constituent"** means any constituent identified in Appendix VIII of 40 C.F.R. Part 261, or any constituent identified in Appendix IX of 40 C.F.R. Part 264.

h. **"Permit"** shall mean the Permit issued by the Environmental Protection Agency, Region 10 pursuant to 42 U.S.C. Section 3251 eq seq., 40 C.F.R. Parts 124 and 270.

i. **"Permittee"** means the USCG.

j. **"Release"** means any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of hazardous waste (including hazardous constituents) into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing hazardous wastes or hazardous constituents).

k. **"Solid waste management unit"** means any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which hazardous wastes or hazardous constituents have been routinely and systematically released.

l. **“Work”** shall mean any activity the Permittee is required to perform under the permit.

PART I - STANDARD CONDITIONS

I.A. EFFECT OF PERMIT

I.A.1. The Permittee is allowed to store hazardous waste and to conduct post-closure care and corrective action in accordance with the conditions of this Permit. Any storage of hazardous waste governed by 40 C.F.R. 264 or 265 not authorized in this Permit is prohibited. Compliance with this Permit during its effective term constitutes compliance, for purposes of enforcement, with 40 C.F.R. Parts 264 and 270, for the hazardous waste activities identified and included in this Permit, except for any self-implementing provisions and related regulations pursuant to HSWA. All other requirements of RCRA, including the generator requirements of 40 C.F.R. Part 262 and 268, remain applicable to this facility and are not replaced or affected by this Permit.

I.A.2. Compliance with the terms of this Permit does not constitute a defense to any order issued or any action brought under any other federal or state law providing for protection of public health or the environment, including but not limited to, Section 3013 or 7003 of RCRA, 42 U.S.C. § 6934 or 6973, or any section of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9601 et seq. [40 C.F.R. § 270.4]

I.B. PERMIT ACTIONS AND MODIFICATIONS

I.B.1. This Permit may be modified, revoked and reissued, or terminated for cause, as specified in 40 C.F.R. §§ 270.41, 270.42, and 270.43.

I.B.2. Filing a request for a permit modification, revocation and reissuance, or termination, or filing a notification of planned changes or anticipated noncompliance on the part of the Permittee does not stay the applicability or enforceability of any permit condition.

I.B.3. Except as provided by specific language in this Permit, any modification or change in a hazardous waste management practice covered by this Permit must be accomplished in accordance with 40 C.F.R. §§ 270.41 or 270.42.

I.B.3.a. A written request must be submitted at least sixty (60) days prior to the proposed change in facility design or operation, or not later than sixty (60) days after an unexpected event has occurred which has affected the permit. The Administrator will approve, disapprove, or modify this request, in accordance with the procedures in 40 C.F.R. Parts 124 and 270.

I.B.3.b. If the Permittee determines that the corrective action or groundwater monitoring programs required by this Permit no longer satisfy the requirements of the regulations, the Permittee must, within ninety (90) days, submit a written request for a permit modification to make those changes deemed necessary to satisfy the regulations.

I.C. SEVERABILITY

I.C.1. The provisions of this Permit are severable. If any provision of this Permit, or the application of any provision of this Permit to any circumstances, is held invalid, the application of such provision to other circumstances and the remainder of this Permit shall not be affected thereby. Invalidation of any state or federal statutory or regulatory provision, which forms the basis for any condition of this Permit, does not affect the validity of any other state or federal statutory or regulatory basis for said condition. [40 C.F.R. § 124.16(a)(2)].

I.C.2. In the event that a condition of this Permit is stayed for any reason, the Permittee shall continue to comply with the conditions of the existing permit which correspond to the stayed conditions until final resolution of the stayed condition unless the Agency determines that compliance with the existing conditions would be technologically incompatible with compliance with other conditions of this Permit which have not been stayed.

I.D. PERSONAL AND PROPERTY RIGHTS

I.D.1. The Permittee shall hold harmless and indemnify the Agency, and its officers, employees, and agents from any claim, suit, or action arising from the activities of

the Permittee or its contractors, agents, or employees under this Permit.

I.D.2. Issuance of this Permit does not convey any property rights or any exclusive privilege, nor does issuance of the Permit authorize any injury to persons or property, any invasion of other private rights, or any infringement of federal, state or local laws or regulations. [40 C.F.R. § 270.30(g)]

I.E. DUTY TO COMPLY

I.E.1. The Permittee shall comply with all conditions of this Permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit issued in accordance with 40 C.F.R. § 270.61. Any permit noncompliance, other than noncompliance authorized by an emergency permit, constitutes a violation of RCRA and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; and/or for denial of a permit renewal application. [40 C.F.R. § 270.30(a)]

I.E.2. Compliance with the terms of this Permit does not constitute a defense to any action brought under Sections 3007, 3008, 3013, and 7003 of RCRA (42 U.S.C. §§ 6927, 6928, 6934, and 6973); CERCLA (42 U.S.C. § 9601 et. seq.); or any other federal or state law governing protection of public health or the environment.

I.F. DUTY TO REAPPLY

If the Permittee wishes to continue an activity allowed by this Permit after the expiration date of this Permit, or if the Permittee is required to conduct post-closure care, or if the Permittee is required to continue corrective action for releases from solid waste management units, the Permittee must reapply for and obtain a new permit, in accordance with 40 C.F.R. §§ 270.10(h), 270.30(b).

The corrective action obligations contained in this Permit will continue regardless of whether the facility continues to operate or ceases operation and closes. The facility is obligated to complete facility-wide corrective action regardless of the operational status of the facility.

I.G. CONTINUATION OF EXPIRING PERMIT

This Permit and all conditions herein will remain in effect beyond the permit's expiration date if the Permittee has submitted a timely, complete application (40 C.F.R. §§ 270.10, 270.13 through 270.29); and, through no fault of the Permittee, the Administrator has not issued or denied the new permit, as set forth in 40 C.F.R. § 270.51.

This Permit may be modified or revoked and reissued, and in accordance with 40 C.F.R. § 270.41 and/or 40 C.F.R. § 270.42.

I.H. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE

It shall not be a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit. [40 C.F.R. § 270.30(c)]

I.I. DUTY TO MITIGATE

In the event of noncompliance with this Permit, the Permittee shall take all reasonable steps to minimize releases to the environment and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment.

Such mitigation shall not be a defense to enforcement action. [40 C.F.R. § 270.30(d)]

I.J. PROPER OPERATION AND MAINTENANCE

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this Permit.

Proper operation and maintenance include effective performance adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance/quality control procedures.

This provision requires the operation of back-up or auxiliary facilities or similar systems to maintain compliance with the conditions of this Permit. No provision of this Permit shall be interpreted to require the Permittee to obligate funds in violation of the Anti-Deficiency Act, 31 U.S.C. Section 1341. [40 C.F.R. § 270.30(e)]

I.K. DUTY TO PROVIDE INFORMATION

The Permittee shall furnish to the Administrator, within a reasonable time, any relevant information which the Administrator may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit, or to determine compliance with this Permit. The Permittee shall also furnish to the Administrator, upon request, copies of records required to be kept by this Permit. [40 C.F.R. §§ 264.74(a), and 270.30(h)]

I.L. INSPECTION AND ENTRY

Pursuant to 40 C.F.R. § 270.30(i), the Permittee shall allow the Administrator, or authorized representatives, upon the presentation of credentials and other documents as may be required by law to:

I.L.1. Enter at reasonable times upon the Permittee's premises where a regulated facility or hazardous waste management activity or corrective action activity is located or conducted, or where records must be kept under the conditions of this Permit;

I.L.2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;

I.L.3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and

I.L.4. Sample or monitor, at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by RCRA, any substances or parameters at any location.

I.M. MONITORING AND RECORDS

I.M.1. Samples and measurements taken by the Permittee for the purpose of monitoring shall be representative of the monitored activity.

The method used to obtain a representative sample of the waste to be analyzed must be the most recent appropriate method from Appendix I of 40 C.F.R. Part 261.

The Permittee shall use techniques and procedures consistent with the most recent EPA guidance when collecting, preserving, shipping, analyzing, tracking, and controlling samples. [40 C.F.R. § 270.30(j)(1)]

I.M.2. Except as specifically required elsewhere (i.e. Permit Condition I.Y), the Permittee shall retain at the facility, records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports and records required by this Permit, certification required by 40 C.F.R. § 264.73(b)(9), and records of all data used to complete the application for this Permit for a period of at least thirty-six (36) months from the date of the sample, measurement, report, record, certification, or application.

This period may be extended by the Administrator at any time by notification, in writing, to the Permittee and is automatically extended during the course of any unresolved enforcement action regarding the Permit until the successful conclusion of any enforcement action. [40 C.F.R. § 270.30(j)(2)]

I.M.3. Pursuant to 40 C.F.R. § 270.30(j)(3), records of groundwater and air monitoring information, specific to post-closure and corrective action, shall specify:

I.M.3.a. The dates, exact place, and times of sampling or measurements;

I.M.3.b. The name, title and affiliation of the individual(s) who performed the sampling or measurements;

I.M.3.c. The dates the analyses were performed;

I.M.3.d. The name, title and affiliation of the individual(s) who performed the analyses;

I.M.3.e. The analytical techniques or methods used; and

I.M.3.f. The results of such analyses, including the Quality Assurance/Quality Control (QA/QC) summary.

I.M.4. The Permittee may substitute analytical methods which are equivalent to those specifically approved for use in this Permit in accordance with the following:

I.M.4.a. The Permittee submits to the Administrator a request for substitution of an analytical method(s) which is equivalent to the method(s) specifically approved for use in this Permit.

The request shall provide information demonstrating that the proposed method(s) is equal or superior to the approved analytical method(s) in terms of sensitivity, accuracy, and precision (i.e. reproducibility); and,

I.M.4.b. The Administrator notifies the Permittee in writing, that the substitution of the analytical method(s) is approved. Such approval shall not require a permit modification.

I.N. REPORTING PLANNED CHANGES

The Permittee shall give notice to the Administrator as soon as possible of any planned physical alterations or additions to RCRA regulated hazardous waste management units at U.S. Coast Guard, Base Kodiak, or of any activity which will physically alter or add to the permitted hazardous waste management units, or would result in noncompliance with permit requirements. [40 C.F.R. § 270.30(l)(1)]

I.O. REPORTING ANTICIPATED NONCOMPLIANCE

The Permittee shall give advance notice, in writing, to the Administrator of any planned change(s) in the permitted facility or any activity which may result in noncompliance with permit requirements. If advance notice is not possible, then the Permittee shall give notice within twenty-four (24) hours of the time the

Permittee becomes aware of the anticipated noncompliance. Such notice does not authorize any noncompliance with this Permit or modification of this Permit. [40 C.F.R. § 270.30(l)(2)]

I.P. TRANSFER OF PERMITS

This Permit may be transferred to a new owner or operator only if it is modified or revoked and reissued pursuant to 40 C.F.R. §§ 270.40(b), 270.41(b)(2) and 270.42.

Before transferring ownership or operation of the facility during its operating life, the Permittee shall notify the new owner or operator in writing of the requirements of 40 C.F.R. Parts 264 and 270 and this Permit. [40 C.F.R. §§ 264.12 and 270.30(l)(3)]

I.Q. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Permit shall be submitted no later than fourteen (14) days following each schedule date.

The Permittee shall follow the compliance schedules contained in Part V of this Permit. [40 C.F.R. § 270.30(l)(5)]

I.R. TWENTY-FOUR HOUR REPORTING

I.R.1. The Permittee shall report to the Administrator any noncompliance with the Permit which may endanger human health or the environment.

Any such information shall be reported orally within twenty-four (24) hours from the time the Permittee becomes aware of the circumstances/non-compliance.

The report shall include the following:

I.R.1.a. Information concerning release of any hazardous waste that may cause an endangerment to public drinking water supplies.

I.R.1.b. Any information of a release or discharge of hazardous waste or a fire or explosion relating to hazardous waste management at U.S. Coast Guard,

Base Kodiak, which could threaten the environment or human health.

I.R.2. The description in the oral report of the occurrence and its cause shall include:

I.R.2.a. Name, address, and telephone number of the owner or operator;

I.R.2.b. Name, address, and telephone number of the facility;

I.R.2.c. Date, time, and type of incident;

I.R.2.d. Name and quantity of material(s) involved;

I.R.2.e. The extent of injuries, if any;

I.R.2.f. An assessment of actual or potential hazards to the environment and human health, where this is applicable;

I.R.2.g. Estimated quantity and disposition of recovered material that resulted from the incident; and

I.R.2.h. A qualitative review of actions taken, intended responses, and remedial actions.

I.R.3. A written submission shall also be provided within five (5) days of the time the Permittee becomes aware of the circumstances/non-compliance. The written submission shall contain a description of the noncompliance, its extent, and its cause; the period(s) of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; corrective measures taken to mitigate the situation and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

The Director may waive the five (5) day written notice requirement in favor of a written report within fifteen (15) days. [40 C.F.R. § 270.30(l)(6)]

I.S. OTHER NONCOMPLIANCE

The Permittee shall report to the Administrator all other instances of noncompliance not otherwise required

to be reported in the monitoring reports, compliance schedules, and twenty-four (24) hour reports above, at the time monitoring reports are submitted.

The reports shall contain the information listed in Permit Condition I.R. [40 C.F.R. § 270.30(l)(10)]

I.T. OTHER INFORMATION

Whenever the Permittee becomes aware that it failed to submit any relevant facts in the permit application or submitted incorrect information in a permit application or in any report to the Administrator, the Permittee shall promptly submit such facts or information to the Administrator. [40 C.F.R. § 270.30(l)(11)]

I.U. BIENNIAL REPORT

The Permittee shall comply with Biennial Report requirements of 40 C.F.R. § 264.75.

I.V. SIGNATURE AND CERTIFICATION

Failure to submit the information required in this Permit, or falsification of any submitted information, is grounds for termination of this Permit, in accordance with 40 C.F.R. § 270.43.

The Permittee shall ensure that all plans, reports, notifications, and other submissions to the Administrator, required in this Permit, are signed and certified, in accordance with 40 C.F.R. § 270.11.

I.W. REPORTS, NOTIFICATION AND SUBMISSIONS

All reports, notifications, or other submissions which are required by this Permit to be sent or given to the Administrator must be sent by email, electronic file transfer, certified mail, or given directly to:

EPA RCRA Project Manager (MS-15-H04)
Division of Land, Chemicals, and Redevelopment
U.S. EPA, Region 10
1200 Sixth Avenue, Suite 155
Seattle, Washington 98101-3140
Telephone number: (206) 553-6702

Note: This is the current address and phone number and may change without modification of the Permit.

I.X. CONFIDENTIAL INFORMATION

The Permittee may claim confidential any information required to be submitted by this Permit, in accordance with 40 C.F.R. §§ 260.2 and 270.12.

I.Y. DOCUMENTS TO BE MAINTAINED AT THE FACILITY

The Permittee shall maintain at the facility until closure is completed and certified by an independent registered professional engineer, and have readily available for inspection, the following documents and amendments, revisions and modifications to these documents:

I.Y.1. Waste Analysis Plan (Attachment 2 of this Permit), and monitoring, testing or analytical data from monitoring activities, as required by 40 C.F.R. § 264.13 and this Permit.

I.Y.2. Records and results of each waste analysis performed in accordance with this Permit.

I.Y.3. Personnel training documents, certifications, and records, as outlined in Attachment 3 of this Permit, as required by 40 C.F.R. § 264.16(d) and this Permit.

I.Y.4. Contingency Plan, as required by 40 C.F.R. § 264.53(a) and this Permit.

I.Y.5. Closure and Post-Closure Plans (Attachments 4A and 4B of this Permit), as required by 40 C.F.R. § 264.112(a) and this Permit.

I.Y.6. Operating record, containing the documents required by 40 C.F.R. § 264.73 and this Permit.

I.Y.7. Inspection schedule(s), as required by 40 C.F.R. § 264.15(b)(2) and this Permit.

I.Y.8. Hazardous Waste Management Facility Permit, including all attachments.

I.Y.9. RCRA Part B Permit Application, dated August 1, 2007, including all attachments.

I.Y.10. Summaries of all records of the corrective action, including any cessation of remediation activities and measures taken to mitigate and prevent further cessations.

I.Y.11. Assessment reports pursuant to Permit Condition II.I of all incidents that require implementation of the contingency plan.

I.Y.12. Record of spills and releases.

I.Y.13. Copies of all other environmental permits associated with the hazardous and solid waste management units.

I.Y.14. Well construction, maintenance and replacement records pursuant to Permit Condition VI.C.

PART II – GENERAL FACILITY CONDITIONS

II.A. DESIGN AND OPERATION OF FACILITY

The Permittee shall design, construct, maintain and operate the facility:

(1) to avoid, reduce, or eliminate waste that may be generated from accidental spills, mishandling of containers, and other such activity; and

(2) to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water, which could threaten human health or the environment, as required by 40 C.F.R. § 264.31.

II.B. REQUIRED NOTICE

II.B.1. When the Permittee is to receive hazardous waste from an off-site source, the Permittee must inform the generator in writing that the Permittee has the appropriate permit(s) for, and will accept the waste the generator is shipping.

The Permittee must keep a copy of this written notice for each generator as part of the operating record, in accordance with 40 C.F.R. § 264.12(b), 40 C.F.R. § 264.73(b)(7).

The Permittee shall notify each generator identified in Section 2.8 of Attachment 2 of this Permit within thirty (30) days of the effective date of this Permit, or prior to receipt of hazardous waste from such an off-site source, whichever is sooner, of the hazardous wastes it is permitted to receive and store.

The Permittee shall renotify each generator within one (1) week after any permit modification to the hazardous waste codes which the Permittee is permitted to receive and store.

II.B.2. The Permittee is prohibited from receiving hazardous waste from a foreign source except during a maritime emergency involving a vessel under a foreign flag.

II.C. GENERAL WASTE ANALYSIS

The Permittee shall comply with the Waste Analysis provisions of 40 C.F.R. § 264.13 and shall implement the procedures of the Waste Analysis Plan, Attachment 2 of this Permit.

II.D. SECURITY

The Permittee shall comply with the security provisions of 40 C.F.R. § 264.14 and shall implement the Security Plan, Attachment 6 of this Permit.

II.E. GENERAL INSPECTION REQUIREMENTS

The Permittee shall comply with the inspection provisions of 40 C.F.R. § 264.15 and shall implement the inspection plan in Attachment 6 of this Permit.

II.F. TRAINING FOR PERSONNEL INVOLVED WITH HAZARDOUS WASTE MANAGEMENT ACTIVITIES

The Permittee shall comply with the personnel training provisions of 40 C.F.R. § 264.16 and shall implement the training program outlined in Attachment 3 of this Permit.

II.G. GENERAL REQUIREMENTS FOR IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTES

The Permittee shall comply with the requirements of 40 C.F.R. § 264.17 and shall implement the procedures for ignitable, reactive or incompatible wastes in Section 4.1, Waste Analysis Plan, Attachment 2 of this Permit; Section 5.0, Procedures to Prevent Hazards, Attachment 6 of this Permit; and Section 5.8 of the facility Contingency Plan, maintained at the facility.

II.H. LOCATION STANDARDS

The Permittee shall comply with the location standards of 40 C.F.R. § 264.18.

II.I. PREPAREDNESS AND PREVENTION

The Permittee shall comply with the preparedness and prevention provisions of 40 C.F.R. 264 §§ 31 through 37 and as outlined in Attachments 4B and 7 of this Permit.

II.J. CONTINGENCY PLAN

The Permittee shall comply with the contingency planning requirements of 40 C.F.R. 264 §§ 50 – 56, and shall implement the Contingency Plan, maintained at the facility in accordance with 40 C.F.R. § 264.52(b).

II.K. MANIFEST SYSTEM

The Permittee shall comply with the manifest requirements for the use of a manifest system, manifest discrepancies, and un-manifested waste reporting, in accordance with 40 C.F.R. §§ 264.71, 264.72, and 264.76.

II.L. RECORD KEEPING AND REPORTING

In addition to the record keeping and reporting requirements specified elsewhere in this Permit, the Permittee shall maintain a written operating record at the facility in accordance with 40 C.F.R. § 264.73. The Permittee is exempt from 40 C.F.R. § 264.73(b)(8) for closure cost estimates, in accordance with 40 C.F.R. § 264.140.

II.M. CLOSURE AND POST-CLOSURE

II.M.1. Performance Standard:
The Permittee shall close the storage unit, as required by 40 C.F.R. § 264.111 and in accordance with the Closure Plan, Attachment 4B of this Permit.

II.M.2. Amendment to Closure Plan:
The Permittee shall modify the Closure Plan in writing, in accordance with 40 C.F.R. § 264.112(c), whenever new information would more accurately characterize the manner in which the Permittee intends to close the hazardous waste storage unit. The Administrator may determine that cause exists to modify the Closure Plan at any time, in accordance with 40 C.F.R. § 270.41.

II.M.3. Notification of Closure:
The Permittee shall notify the Administrator in writing at least forty-five (45) days prior to the date on which the Permittee expects to begin closure as required by 40 C.F.R. § 264.112(d).

II.M.4. Time Allowed For Closure:
After receiving the final volume of hazardous waste, the Permittee shall remove from storage all hazardous waste and shall complete closure activities, in accordance with 40 C.F.R. § 264.113; and the Closure Plan, Attachment 4B of this Permit.

II.M.5. Disposal or Decontamination of Equipment, Structures, and Soils:
The Permittee shall decontaminate and/or remove and dispose of all contaminated equipment, structures, and soils, as required by 40 C.F.R. § 264.114, 40 C.F.R. § 264.178, and the Closure Plan, Attachment 4B of this Permit.

II.M.6. Certification of Closure:
The Permittee shall certify that the hazardous waste storage unit has been closed, in accordance with the specification in the Closure Plan, as required by 40 C.F.R. § 264.115 and 40 C.F.R. § 264.77(b).

II.N. POLLUTION PREVENTION PROGRAM

The Permittee shall comply with the pollution prevention requirements of 40 C.F.R. § 264.73(b)(9).

II.O. EQUIVALENT MATERIALS

Except as required in Permit Condition I.M.4 of this Permit, if certain equipment, materials, procedures, and/or administrative information (such as names, telephone numbers, or addresses) are specified in this Permit, the Permittee is allowed to use an equivalent or superior item. Use of such equivalent or superior items shall not be considered a modification of the permit, but the Permittee shall place a notation of such a revision in the operating record, accompanied by a narrative explanation and the date the revision became effective.

The Administrator may judge the soundness of the revision during inspections of the facility and may require the Permittee to reinstate the equipment, materials, procedures, or administrative information specified in the permit. The format of tables, forms and figures are not subject to the requirements of this Permit and may be revised according to the Permittee's discretion.

II.P. ORGANIC AIR EMISSION REQUIREMENTS

II.P.1. On December 6, 1994, EPA published the final rule for Phase II Organic Air Emissions Standards (40 C.F.R. Parts 264 and 265, Subpart CC) for hazardous waste treatment, storage, and disposal facilities, including certain hazardous waste generators accumulating waste on-site in RCRA permit-exempt (90-day) tanks and containers.

In general, under these standards air emissions controls must be used for tanks, surface impoundments, containers and miscellaneous units which contact hazardous waste containing an average organic concentration greater than 500 parts per million by weight (ppmw) at the point of origination determined by the procedures outlined in 40 C.F.R. §264.1083(a), except as specifically exempted under 40 C.F.R. §264.1080 and § 264.1082.

II.P.2. Prior to installing or using any additional equipment subject to the requirements of 40 C.F.R. Part 264 Subpart CC, the Permittee shall apply for a permit modification under 40 C.F.R. §270.42 and provide specific Part B information required pursuant to 40 C.F.R. § 270.27, as applicable, with the modification request.

II.P.3. The Permittee shall control air emissions from the Hazardous Waste Container Storage Unit in accordance with provisions of 40 C.F.R. §264.1082 and 40 C.F.R. § 264.1086.

This page intentionally blank

PART III – STORAGE IN CONTAINERS

III.A. WASTE IDENTIFICATION

III.A.1. The Permittee may store the following RCRA hazardous wastes in containers at Base Kodiak, subject to the terms of this Permit:

Location: Building N-48.

Description: [See Attachment 1]

Batteries: lithium, nickel-cadmium, zinc-air primary
Paint slops and waste paints, coatings and thinners
Chlorinated and non-chlorinated solvents

Emergency Escape Breathing Device (EEBD) cartridges
Waste fuel and waste oil, and solids contaminated with these materials

Solids and liquids from spill cleanups

Wastes from historical operations at Base Kodiak
Discarded commercial chemical products identified in Part A

Permitted RCRA Waste Codes:
See Part A Application, Attachment 1 of this Permit.

III.A.2. The Permittee may store other discarded commercial chemical products, off-specification species, container residues, and spill residues, as listed in 40 C.F.R. § 261.33 that are not identified in Permit Condition III.A.1, upon satisfying the Permit modification request procedure and receiving approval from the Administrator, as set forth in 40 C.F.R. § 270.42.

The storage of different wastes in containers that require additional or different management practices from those authorized in the Permit shall be considered a Class 3 modification.

The storage of different wastes in containers that do not require additional or different management practices from those authorized in the Permit shall be considered a Class 2 modification.

III.A.3. The Permittee shall manage newly listed or identified wastes in accordance with 40 C.F.R. § 270.42(g).

III.B. CONDITION OF CONTAINERS

III.B.1. If a container holding hazardous waste is not in good condition (e.g. corrosion, apparent structural defects, creases or dents), or if it begins to leak, the Permittee shall transfer the hazardous waste to a container that is in good condition or manage the waste in some other way that complies with the requirements of 40 C.F.R. Part 264.

III.B.2. The Permittee shall maintain at all times a sufficient number of empty containers, overpack drums, and drip pans at the hazardous waste storage units to comply with Permit Condition III.B.1.

The number of containers are specified in Attachment 5 of this Permit.

III.C. COMPATIBILITY OF WASTE WITH CONTAINERS

The Permittee must use a container made of or lined with materials which will not react with, and are otherwise compatible with, the hazardous waste to be stored, so that the ability of the container to contain the waste is not impaired, as required in 40 C.F.R. § 264.172.

III.D. MANAGEMENT OF CONTAINERS

III.D.1. The Permittee shall always have containers holding hazardous waste closed during storage, except when it is necessary to add or remove waste, as required in 40 C.F.R. § 264.173(a).

III.D.2. The Permittee shall not open, handle, or store hazardous waste in a manner which may rupture a container or cause it to leak, as required in 40 C.F.R. § 264.173(b).

III.D.3. At any time, the Permittee may store a maximum volume of 256 55-gallon (or other sized) drums, or their volumetric equivalent (in gallons) in other sized containers, at the Container Storage Unit identified in Permit Condition III.A.1. This requirement applies regardless of whether the containers hold hazardous waste, non-hazardous waste, or are empty.

III.E. INSPECTION OF CONTAINERS AND CONTAINMENT SYSTEM

III.E.1. The Permittee shall inspect, at least once every seven (7) days, areas where containers are stored, looking for leaking containers and for deterioration of containers and the containment system caused by corrosion, temperature, and/or other factors, as required in 40 C.F.R. § 264.174.

III.E.2. The Permittee shall document the inspections by maintaining the Inspection Log, as required by 40 C.F.R. § 264.15 and described in Attachment 6 of this Permit.

III.E.3. The Permittee shall inspect each container for its integrity prior to handling or moving, as required in 40 C.F.R. § 264.31.

III.F. CONTAINMENT

III.F.1. The Permittee shall maintain and operate the container storage containment system, as designed and described in the attached plans and specifications, Attachment 5 of this Permit, as required in 40 C.F.R. § 264.175.

III.F.2. The Permittee shall operate and maintain the containment system such that the base underlying the containers is free of cracks or gaps and is sufficiently impervious to contain leaks and spills and accumulated precipitation until the collected material is detected and removed, as required in 40 C.F.R. § 264.175(b).

III.F.3. The containment system must have sufficient capacity to contain 10 percent (10%) of the storage capacity of the facility (14,080 gallons) or the capacity of the largest container, whichever is greater, as required in 40 C.F.R. § 264.175(b)(3).

III.F.4. The Permittee shall remove spilled or leaked waste and accumulated precipitation from the sump or collection area in a manner as is necessary to prevent overflow of the collection system and in a manner to keep the containers from contact with the liquids/material in the collection area. The Permittee shall manage the collected material, in accordance with 40 C.F.R. § 264.175(b)(5). If the collected material is a hazardous waste under 40 C.F.R. Part 261, it must be managed in accordance with all applicable requirements of 40 C.F.R. Parts 262 through 266.

III.G. SPECIAL REQUIREMENTS FOR INCOMPATIBLE WASTE

III.G.1. The Permittee shall separate containers of incompatible wastes, as required by 40 C.F.R. § 264.177 and as described in Section 4.1 of the Waste Analysis Plan, Attachment 2 of this Permit; Section 5.0 of Procedures to Prevent Hazards, Attachment 6 of this Permit; and Section 5.8 of the facility Contingency Plan, maintained at the facility.

III.G.2. Notwithstanding Permit Condition III.G.1, the Permittee shall not place incompatible wastes or incompatible wastes and materials in the same container, nor place hazardous waste in an unwashed container that previously held an incompatible waste or material, as required in 40 C.F.R. § 264.177.

III.G.3. Notwithstanding Permit Condition III.G.1, the Permittee shall separate, or otherwise protect any storage container holding hazardous waste from any incompatible wastes or materials by means of a dike, berm, wall, or other appropriate device, such as an overpack drum, salvage drum, or drip pan, as required in 40 C.F.R. § 264.177.

III.G.4. Notwithstanding Permit Conditions III.A, the Permittee shall not place incompatible wastes, or incompatible wastes and materials in the same bay, unless the Permittee complies with 40 C.F.R. § 264.17(a)-(c) and Permit Conditions II.G.

III.H. PROHIBITIONS OF STORAGE OF RESTRICTED WASTES

III.H.1. The Permittee is prohibited from receiving or storing hazardous wastes restricted from land disposal, unless the conditions required in 40 C.F.R. § 268.50 are met.

III.H.2. The Permittee shall store land disposal restriction (LDR) hazardous waste in tanks or containers on-site solely for the purpose of the accumulation of such quantities of hazardous waste to facilitate proper recovery, treatment, or disposal and each container shall be clearly marked to identify its contents and the date each period of accumulation begins, as required by 40 C.F.R. § 268.50(a)(2).

The Permittee shall not store hazardous waste to circumvent or forestall the treatment requirements of 40 C.F.R. Part 268.

III.H.3. The Permittee shall store LDR wastes for no more than three hundred sixty-five (365) days, unless the Permittee can demonstrate to the satisfaction of the Administrator that such storage is/was solely for the purpose of accumulation of such quantities of hazardous waste as are necessary to facilitate proper recovery, treatment, or disposal, as required in 40 C.F.R. § 268.50(b)&(c).

The Permittee shall provide a written demonstration if the waste has been stored for greater than three-hundred sixty-five (365) days and in accordance with Permit Condition III.H.2.

This three-hundred sixty-five (365) day limitation does not apply to wastes subject to an approved petition, a nationwide variance, or an approved extension, nor to a waste that meets the treatment standard.

III.H.4. The Permittee shall not dilute a land disposal restricted waste, in any manner, in accordance with 40 C.F.R. § 268.3.

III.H.5. The Permittee shall receive from the generator all necessary notices, notifications, and certifications that are required to determine if a waste is restricted from land disposal, in accordance with 40 C.F.R. § 268.7.

III.H.6. The Permittee shall comply with the notice, notification, and certification requirements under 40 C.F.R. § 268.7 when sending waste or treatment residue off-site, in accordance with 40 C.F.R. § 268.7(b)(6).

III.H.7. The Permittee shall keep all copies of each applicable generator's demonstration and certification in the Permittee's operating record when the waste received is subject to a valid certification in accordance with 40 C.F.R. § 264.73(b).

III.H.8. It is the duty of the Permittee to request a modification of this Permit in the event that the Permittee believes any permit condition in Permit Condition III.H prevents the ability of the Permittee to comply with 40 C.F.R. Part 268, in accordance with 40 C.F.R. § 270.4(a), and 40 C.F.R. § 270.41(a).

This page intentionally blank

PART IV – POST-CLOSURE

IV.A. The permittee shall comply with requirements in 40 C.F.R. §§ 264.228(b), and 264.117 through 264.120 by performing activities included in the Post-Closure Plan, Attachment 4A of this Permit.

IV.B. The period of post-closure care for the regulated units, Sites 3, 6A and 7A, shall be a minimum of thirty (30) years. The post-closure care period extends thirty (30) years from the effective date of this Permit. The Agency will extend the post-closure care period, if necessary, to protect human health or the environment

IV.C. Use of the closed regulated units, located as designated on Figure 1 of this permit, shall not disturb the long-term integrity of the cover or any other components of the containment system, or the function of the facility's monitoring systems, unless the administrator finds that the disturbance:

IV.C.1. Is necessary to the proposed use of the property, and will not increase the potential hazard to human health or the environment; or,

IV.C.2. Is necessary to reduce a threat to human health or the environment.

IV.D. No later than sixty (60) days after completion of the established post-closure care period, the permittee shall submit to the administrator, by email, electronic file transfer, or certified mail, a certification that the post-closure care was performed in accordance with the specifications in the approved post-closure care plan. The certification must be signed by the permittee and an independent registered professional engineer.

This page intentionally blank

PART V – CORRECTIVE ACTION FOR CONTAMINATED GROUNDWATER

V.A. CORRECTIVE ACTION PROGRAM

V.A.1. The Permittee shall establish, operate and maintain a corrective action program to remediate groundwater contaminated as a result of releases from Sites 3 and 7A, in accordance with Permit Conditions V.A through V.F and as specified in Attachment 4A of this Permit.

The corrective action program shall consist of an asphalt cap and long-term monitoring of groundwater. An AS/SVE and treatment systems are not operated as part of the corrective action but are kept in a state of readiness to be reactivated if increasing contaminant concentration trends are observed in groundwater.

V.A.2. The Permittee may implement corrective measures in addition to those specified in Attachment 4A of this Permit to facilitate corrective action provided that compliance with the performance standards in Permit Condition V.F.1 are maintained and that the Agency has been notified and given opportunity for comment on and approval of the additional measures prior to implementation. If the Agency comments on the additional measures, the Permittee shall revise the measures to address those comments.

Implementation of additional corrective measures shall not be considered a modification of this Permit, and is subject to the dispute resolution procedures in Permit Condition V.N.

The Permittee shall place a notation of such additional corrective measures, accompanied by a narrative explanation and a copy of the Agency’s comments on the measures, in the operating record.

V.B. AIR SPARGING/VAPOR EXTRACTION SYSTEM

The Permittee shall maintain the AS/SVE systems at Sites 3 and 7A as described in Attachment 4A. Though these systems are not operating as part of the Corrective Action, they are maintained operational in a readiness state. If long-term monitoring exhibits an increasing trend in contaminant concentrations in groundwater, the

systems shall be operated to achieve the performance standards in Permit Condition VI.F.

During operational periods, data shall be collected to demonstrate compliance with Permit Condition V.F.1 and as specified by Permit Condition VI.E.

V.B.1. If EPA determines that reactivation of the AS/SVE systems is appropriate, except as provided by Permit Condition V.B.2, operation of the AS/SVE systems and treatment of groundwater shall operate seasonally, from July through September, on pulsed cycles until the Permittee can demonstrate that it is in compliance with the requirements of Permit Condition VI.E.4 of this Permit.

For the purpose of this Permit Condition, the term “operation” shall include seasonal pulsing of the extraction system.

A three (3) day readiness demonstration, consisting of successfully operating the extraction and treatment system, shall be conducted by the Permittee on an annual basis. The readiness demonstration shall not be conducted within seven (7) days of any groundwater sampling event.

V.B.2. The AS/SVE and/or treatment systems may be shut down for prearranged maintenance and repair, and for emergencies, or as approved by EPA in accordance with Permit Conditions V.O through V.R. The Permittee shall notify the Administrator if the systems are shut down for more than seven (7) days.

The Permittee shall provide, in the operating record and the next quarterly report, information including the repairs made and the reasons for those repairs.

V.B.3. Minor deviations from the designs or specifications in Attachment 4A of this Permit deemed necessary by the Permittee to facilitate proper operation of the AS/SVE and treatment systems shall not be considered a modification of this Permit.

The Permittee shall place a notation of such a deviation, accompanied by a narrative explanation, in the operating record, and shall notify EPA in the next Quarterly Progress Report. The Administrator may judge the soundness of this determination during inspections of

the facility and may determine that the change was inappropriate and require compliance with designs or specifications in Attachment 4A of this Permit. Such a determination is subject to the dispute resolution procedures in Permit Condition V.N.

V.C. TREATMENT SYSTEM

V.C.1. If EPA determines that reactivation of either AS/SVE system is appropriate, the Permittee shall conduct vapor treatment as specified by Attachment 4A.

The Permittee may implement modifications to these designs and specifications to ensure adequate capacity and flexibility to treat the effluent from the AS/SVE system specified in Permit Condition V.B. Such modifications shall be subject to the equivalent materials procedure specified in Permit Condition II.O.

V.C.2. All contaminated groundwater from the monitoring wells which exceeds the levels specified in Table 4 of this Permit shall be managed as a hazardous waste. Constituents removed from the groundwater shall be managed in accordance with 40 C.F.R. Part 262 after removal from the treatment system.

Disposal of contaminated groundwater shall conform to all applicable local, State, and Federal regulatory requirements.

V.D. MONITORING AND MAINTENANCE

V.D.1. The Permittee shall maintain the asphalt cap, well network, and AS/SVE and treatment system operations (in a readiness state), making timely repairs so that the groundwater corrective action program is not hindered or delayed. The Permittee shall maintain an adequate supply of replacement parts and repair equipment to ensure compliance with Permit Conditions V.F.1.a, V.F.1.b, and V.B.2.

V.D.2. The Permittee shall follow the procedures in Attachment 4A of this Permit for routine inspection of the AS/SVE and treatment systems.

V.D.2.a. If a monitoring or AS/SVE well must be decommissioned and replaced for any reason during the term of this Permit, it shall be replaced within

sixty (60) days of the date of being taken out of service.

The Permittee may request that the well be replaced within ninety (90) days during inclement or severe winter weather.

Prior to decommissioning, the Permittee shall apprise the Administrator of the rationale for the decision.

V.D.2.b. Construction of any new or replacement monitoring or AS/SVE well shall be performed as specified by condition VI.C of this Permit.

The replacement well shall be installed as close as practicable to the well being replaced. The Permittee shall provide information regarding the new well in the operating record and to the Agency as specified by Permit Conditions VI.C.4 and VI.C.5.

V.D.2.c. The Permittee shall close each well being replaced no later than ninety (90) days after installation of the replacement well.

Wells shall be decommissioned in accordance with the “Well Decommissioning Plan,” Attachment 9 of this Permit.

V.D.3.a. The Permittee shall conduct all sampling and analysis required by this Permit in accordance with procedures specified in Attachment 4A, Appendices A and B, of this Permit.

V.D.3.b. The Permittee shall respond to EPA comments, dated January 27, 2021, on Attachment 4A, Appendix B of this Permit, the Quality Assurance Project Plan (QAPP), and submit a revised QAPP which addresses the EPA comments, within one-hundred eighty (180) days of the effective date of this Permit.

V.E. QUARTERLY REPORTS

V.E.1. During operation of the groundwater corrective action elements, the Permittee shall submit Quarterly Reports to the Agency. Based upon information contained in the Quarterly Reports, the Agency may direct the Permittee

to take appropriate actions. These actions may include modifications to the corrective action elements if the Agency determines that the corrective action is not achieving adequate progress toward meeting the Groundwater Protection Standards as defined in Permit Condition V.F.1.

The Quarterly Reports shall at a minimum include:

V.E.1.a. A discussion and summary of all groundwater corrective-measures-related activities undertaken during the time period at hazardous waste management units during the post-closure period;

V.E.1.b. Reports of the results of all sampling and monitoring completed pursuant to this Permit; and,

V.E.1.c. A discussion, based on activities and sampling results described in V.E.1.a and V.E.1.b above, of changes in: the locations and levels of contamination at the post- closure units; identified migration pathways (or potential pathways); and impacts (or potential impacts) on human health and the environment since the last reporting period; and

V.E.1.d. Any recommendations for changes to the corrective action elements, based upon the semi-annual evaluation of the system's effectiveness in achieving adequate progress toward meeting the Groundwater Protection Standards as defined in Permit Condition V.F.1.

V.E.2. The Quarterly Reports which fall on the quarters identified in Permit Condition V.F.1 shall also contain the semi-annual demonstrations required by Permit Condition V.F.1, the calculations and contour maps showing the rate and direction of groundwater flow in the aquifer system underlying the post-closure units required by Permit Condition VI.D.1, and the progress reports required by Permit Condition IX.B.

V.E.3. The Quarterly Report following the October sampling event shall also include the results of triennial analyses on selected groundwater samples for all 40 C.F.R. Part 264 Appendix IX constituents as specified in

Permit Condition VI.D.4. These constituents are presented in Attachment 4A, Appendix B.

V.F. SEMI-ANNUAL REPORTS

V.F.1. In the next April or October quarterly report (whichever comes first) after the effective date of this Permit, and every six (6) months thereafter, according to the schedule in Table 3, the Permittee shall submit to the Agency a report demonstrating the effectiveness of the corrective action program. Effective performance shall be demonstrated by meeting the following performance standards:

V.F.1.a. A demonstration that monitoring wells specified in Tables 3(a) and 3(b), located as designated on Figures 2, 3 and 4 of this Permit, continue to be in compliance with the Groundwater Protection Standards specified in Table 4 of this Permit.

V.F.1.b. A groundwater contaminant concentration trend analysis as specified in Attachment 4A of this Permit.

V.F.1.c. If an AS/SVE system is reactivated, a demonstration that the AS/SVE is removing contaminants, through measurement of volatile organic compound (VOC) mass removal as specified in Attachment 4A of this Permit.

V.F.2. If the Permittee cannot demonstrate that the performance standards specified in Permit Condition V.F.1 are being met, the Permittee shall submit to the Administrator a plan for modification of the groundwater corrective action program to more effectively meet these standards, and a schedule for implementing this plan.

This modification plan and implementation schedule shall be submitted within ninety (90) days of the date of submission of the semi-annual report which fails to demonstrate effective performance pursuant to Permit Condition V.F.1 or within ninety (90) days of the Permittee's receipt of a written request from the Administrator, whichever comes first.

V.F.3. [Note: The performance standards specified in Permit Condition V.F.1 have been established based on the

monitoring and investigations performed prior to issuance of this Permit.]

If it is judged by the Administrator, or the Permittee, based on the semi-annual demonstrations submitted pursuant to Permit Condition V.F.1 and/or the groundwater monitoring data submitted pursuant to Part VI of this Permit, that the performance standards specified in Permit Condition V.F.1 are not appropriate criteria for determining the effectiveness of the groundwater corrective action program, the Administrator, or the Permittee, may propose modification of these standards.

If the Permittee proposes modification to the performance standards, then the Permittee shall follow procedures specified in 40 C.F.R. § 270.42.

V.G. CLOSURE OF CORRECTIVE ACTION SYSTEMS

V.G.1. The corrective action elements shall be maintained in operational readiness at least until the end of the three (3) year demonstration period cited in Permit Condition VI.E.4.

V.G.2. The Permittee shall submit to the Administrator a closure plan for the corrective action elements within thirty (30) days of the time when all wells are clean in accordance with Permit Condition VI.E.4. This plan shall include detailed procedures and a schedule for the disposal or decontamination of all elements of these systems.

V.H. ACCESS

To the extent that work required by this Permit must be done on property not owned or controlled by the Permittee, the Permittee shall use its best efforts to obtain site access agreements from the owner(s) of such property within thirty (30) days of the date that the need for access became known to the Permittee, or of approval of any Work Plan for which site access is required, whichever is earlier.

For the purposes of this Permit Condition, the term "best efforts" shall mean, at a minimum, a certified letter from the Permittee to the property owner(s) requesting

access to such property and, if a reply is received from the property owner, follow-up letters from the Permittee, as appropriate, to clarify the work contemplated and address the owner's reasonable concerns.

In the event that the Permittee cannot obtain the necessary access agreements, the Permittee shall notify the Administrator in writing within ten (10) days thereafter regarding both the efforts undertaken to obtain access and the failure to obtain such agreements.

The Administrator may, consistent with his/her legal authority, assist the Permittee in obtaining such agreements.

V.I. OTHER PERMITS AND APPROVALS

To the extent that the work required by this Permit must be done under permits or approvals pursuant to other federal, state, or local regulatory authorities, the Permittee shall use its best efforts to obtain such permits.

For the purposes of this Permit Condition, the term "best efforts" shall mean submittal of a complete and timely application for the permits or approvals.

V.J. SCHEDULE EXTENSIONS

To the extent that the activities required by Part V of this Permit are not completed in accordance with the schedules contained therein, and the Permittee can demonstrate to the Agency's satisfaction that the Permittee used its best efforts to accomplish the activity within the required schedule, the Administrator may grant the Permittee an extension to the applicable schedule.

For the purposes of this Permit Condition, successful demonstration of "best efforts" shall be achieved by meeting the following conditions: performance of all activities necessary to award contracts to outside contractors sufficiently in advance to comply with any aspect of this Permit; adequate planning, funding, operator staffing, laboratory and process controls; and operation of backup or auxiliary facility or similar

systems by the Permittee when necessary to meet the required schedules.

The Permittee shall notify the Administrator in writing no later than fifteen (15) days after the Permittee determines that such schedules will not be met. This notification must occur in advance of the scheduled deadline. The Permittee shall include with such notification all information supporting its claim that it has used best efforts to meet the required schedules and minimize delay.

If the Administrator determines that the Permittee has made best efforts to meet such schedules, the Administrator shall notify the Permittee in writing that the Permittee has been granted an extension and provide the Permittee with a revised schedule reflecting this extension. Such revisions to schedules shall not require a permit modification.

Copies of all correspondence pursuant to this Permit Condition shall be kept in the facility operating record.

V.K. CHANGES IN CORRECTIVE ACTIONS

Within one hundred twenty (120) days of a written request by the Agency, the Permittee shall submit a written proposal for a permit modification to alter any interim measures or long-term corrective action elements, based on analytical results and data evaluation obtained pursuant to this Permit.

V.L. AGENCY APPROVAL OF SUBMITTALS

With the exception of Quarterly Reports and as otherwise specified in this Permit, the Agency will review all submittals required by this Permit, and will provide written approval where approval is required, or disapproval with comments and/or modifications to be made by the Permittee. The Agency may also modify any Submittal and approve it as modified.

If the Agency provides comments or modifications to the Permittee on any Submittal, all comments or modifications must be incorporated into a revised

Submittal to the Agency within thirty (30) days of receipt of Agency comments or modifications.

Agency comments or modifications are subject to the dispute resolution provisions of Permit Condition V.N.

V.M. INCORPORATION OF DOCUMENTS INTO PERMIT

All plans, reports, and schedules, required by the terms of this Permit and where work is required, are, upon approval by the Agency where approval is required, incorporated into this Permit as fully enforceable permit conditions.

Any noncompliance with such approved plans, reports, and schedules shall be deemed noncompliance with this Permit.

In the event of conflict between any permit condition and any provisions in the approved plans, reports and schedules submitted in compliance with the terms of this Permit, the permit condition shall prevail.

V.N. DISPUTE RESOLUTION

V.N.1. In the event the Administrator rejects or modifies, in whole or in part, any submission required by this Permit where dispute resolution procedures are expressly identified as applicable, the following procedures shall apply:

V.N.1.a. The Permittee will be notified in writing (the Notice) of either a rejection with comments of a submission or modification of a submission. To the extent appropriate, such Notice will:

i. Identify problems with the submission and any modifications to be made;

ii. Provide an explanation and documentation or data to support the complete or partial rejection of, and any modification to, the submission;

iii. Identify a date by which either objections to the Notice or a document revised in accordance with comments that includes any required modifications must be received from the Permittee. Such date

shall not be less than thirty (30) days from the date the Permittee receives the Notice under Permit Condition V.N.1.a.

V.N.1.b. If the Permittee submits objections to the Notice, the Permittee and the Agency staff person(s) responsible for reviewing the submission (the "permitting staff") will attempt to resolve any disputes over the submission informally. If requested by the Permittee, a meeting will take place between the permitting staff and the Permittee to discuss the submission. Unless otherwise agreed to by the permitting staff, the meeting will be held at EPA Region 10's office in Seattle, Washington.

V.N.1.c. If agreement is not reached between the Permittee and the permitting staff within fourteen (14) days of the date the permitting staff receives the Permittee's objections to the Notice (the "informal dispute resolution period"), the Permittee must submit either written arguments and evidence to the Agency official authorized to make final permit decisions (the Decision Maker) or a document revised in accordance with comments that includes any required modifications. The written arguments and evidence or revised document shall be submitted to the Decision Maker within thirty (30) days of the end of the informal dispute resolution period.

V.N.1.d. If written arguments and evidence are submitted by the Permittee to the Decision Maker, the Decision Maker will promptly resolve the dispute. The Decision Maker's resolution of the dispute will include a written response to the evidence and arguments submitted by the Permittee.

The Permittee shall comply with the Decision Maker's decision regardless of whether the Permittee agrees with the decision. The Decision Maker's resolution of the dispute is not subject to administrative or judicial appeal.

V.N.2. Unless otherwise agreed to by the Administrator, the invocation of dispute resolution by the Permittee shall not extend, postpone or affect in any way any obligation

of the Permittee under this Permit not directly in dispute.

V.O. SUPPLEMENTAL RFI/CMS FOR REVISED CORRECTIVE ACTION AT SITE 3

V.O.1. The Permittee shall submit to EPA a Work Plan and schedule for implementation of a Supplemental RCRA Facility Investigation and Corrective Measures Study (RFI/CMS) for Site 3.

The Work Plan shall be developed in accordance with Permit Condition IX.E below. This Work Plan shall also address EPA's comments, dated February 27, 2020, on the Coast Guard's Site 3 Draft Pilot Treatment Study Report.

V.O.2. After the Permittee has received written approval from the Administrator for the Supplemental RFI/CMS Work Plan for Site 3, the Permittee shall begin implementation of the Supplemental RFI/CMS according to the schedules specified in the approved Work Plan.

Pursuant to Permit Condition IX.A.4, the RFI/CMS shall be conducted in accordance with the approved RFI/CMS Work Plan.

V.O.3. After the completion of the Supplemental RFI/CMS and receipt of validated data, the Permittee shall submit a Supplemental RFI/CMS Report to the Administrator.

The Supplemental RFI/CMS Report shall describe the procedures, methods, and results of all facility investigations of Site 3 and the associated releases, including information on the type and extent of contamination at Site 3, sources and migration pathways, and actual or potential receptors. Additionally, the Supplemental RFI/CMS Report shall include an evaluation of each remedial alternative, and a proposal for corrective measures implementation.

The Supplemental RFI/CMS Report shall present all information to support further corrective action decisions at Site 3 and to support the Administrator in the remedy selection decision making process, described under Permit Condition V.R of the permit. The Supplemental RFI/CMS Report shall be consistent with EPA guidance and Attachment 8 of this Permit.

V.O.4. Based on the results and conclusions of the Supplemental RFI/CMS, the Administrator may require the Permittee to evaluate additional remedies or particular elements of one or more proposed remedies and modify the RFI/CMS Report accordingly, within a timeframe specified by the Agency. Modifications to the RFI/CMS Report are subject to the dispute resolution procedures of Permit Condition V.N.

V.P. INTERIM MEASURES AT SITE 3

The Permittee shall conduct interim corrective measures at Site 3 if the Administrator determines that a release or potential release of hazardous waste or hazardous constituents from Site 3 pose a threat to human health and the environment. Such interim corrective measures shall follow the requirements of Permit Condition IX.G.

V.Q. REVISED REMEDY SELECTION FOR SITE 3

Based on the results of the Supplemental RFI/CMS Report and any further evaluations of additional remedies under this study, the Administrator may select a remedy from the remedial alternatives evaluated in the RFI/CMS that will:

(1) be protective of human health and the environment;

(2) meet the concentration levels of hazardous constituents in each medium that the remedy must achieve to be protective of human health and the environment;

(3) control the source(s) of release(s) so as to reduce or eliminate, to the maximum extent practicable, further releases that might pose a threat to human health and the environment; and

(4) meet all applicable waste management requirements.

V.R. PERMIT MODIFICATION FOR REVISED REMEDY AT SITE 3

V.R.1. Based on information the Permittee submits in the Supplemental RFI/CMS Final Report and other information, the Administrator may select a remedy and initiate a permit modification to this Permit, pursuant to 40 C.F.R. § 270.41. This modification will also revise Attachment 4A of the Permit to incorporate additional EPA-approved corrective measures, and revise Tables 1,

2, and 3 and Figures 2 and 3 of the Permit to incorporate the EPA-approved revised monitoring program for Site 3 into the Permit.

PART VI – CORRECTIVE ACTION FOR CONTAMINATED GROUNDWATER

VI.A. IMPLEMENTATION OF GROUNDWATER MONITORING PROGRAM

The Permittee shall implement a corrective action groundwater monitoring program for Sites 3 and 7A in accordance with Permit Conditions VI.B through VI.E. The Permittee shall commence this corrective action groundwater monitoring program within ninety (90) days of the effective date of this Permit.

VI.B. DESIGNATION OF MONITORING LOCATIONS

The Permittee shall include all monitoring wells specified in Table 1 of this Permit and located as designated on Figures 2 and 3 of this Permit in the corrective action monitoring program, except as provided in Permit Condition VI.B.1 below.

VI.B.1. Monitoring Locations for Site 3

The Permittee shall include all monitoring wells specified in Table 1 of this Permit and located as designated on Figure 2 of this Permit in the corrective action monitoring program for Site 3 until EPA determines that the requirements of Permit Conditions V.O through V.R above have been completed.

VI.C. WELL CONSTRUCTION, MAINTENANCE, AND REPLACEMENT

VI.C.1. The Permittee shall maintain all monitoring wells in good working order, making necessary repairs in a timely manner so that the sampling program is not hindered or delayed.

The Permittee shall maintain an adequate supply of replacement parts and repair equipment to ensure that each sampling event proceeds on schedule.

VI.C.2. The Permittee shall follow the procedures in the Post-Closure Care Plan, Attachment 4A of this Permit, for routine inspection of the monitoring wells. Visual evidence of damage to or deterioration of wells, and complete records of all well maintenance activities, must be noted in the operating record.

VI.C.2.a. The Permittee shall maintain borehole integrity of each monitoring well included in the corrective action monitoring program, as required by 40 C.F.R. §264.97(c), using the method designated in Permit Conditions VI.C.2.b.

VI.C.2.b. The monitoring wells shall be sounded on an annual basis. If a monitoring well exhibits buildup of one (1.0) foot or more of sediment at the bottom, the monitoring well shall be redeveloped and the sediment removed. Wells designated as “Gauge Only” in Attachment 4A may be redeveloped if sediment buildup is suspected to cover the screened interval.

VI.C.3. If a monitoring well must be decommissioned and replaced for any reason during the term of this Permit, it shall be replaced prior to the next scheduled sampling event.

The Permittee may request that the well be replaced within ninety (90) days of determination of the need for replacement during inclement or severe winter weather.

Prior to decommissioning, the Permittee shall apprise the Administrator of the rationale for the decision.

The replacement well shall be installed as close as practicable to the well being replaced. The Permittee shall provide information regarding the new well in the operating record and to the Administrator as specified by Permit Conditions VI.C.4 and VI.C.5.

The Permittee shall close each well being replaced no later than ninety (90) days after installation of the replacement well. Wells shall be decommissioned in accordance with the “Well Decommissioning Plan,” Attachment 9 of this Permit.

VI.C.4. Inspection of drilling and well construction of any new or replacement monitoring well shall be performed by a qualified geologist or geological engineer. The qualified professional shall construct and maintain a detailed log of each well describing the geologic strata encountered during drilling. The logs and descriptions shall include:

(1) Date and time of construction;

(2) Drilling method and any fluid used;

(3) Well location (surveyed to within 0.5 feet);

(4) Borehole diameter and well casing diameter;

(5) Well depth (to within 0.1 feet);

(6) Drilling logs and lithologic logs, including a description of soil or rock types, color, petrology, weathering, texture, structure, and fractures;

(7) Casing materials;

(8) Screen material and design, including screen length and slot size;

(9) Casing and screen joint type;

(10) Filter pack material, including size and placement method and approximate volume;

(11) Composition and approximate volume of sealant material and method of placement;

(12) Surface seal design and construction;

(13) Well development procedures;

(14) Ground surface elevation (to within 0.01 feet);

(15) Top of casing elevation (to within 0.01 feet); and,

(16) Detailed drawing of well, including dimensions.

VI.C.5. The Permittee shall submit the logs and descriptions obtained pursuant to Permit Condition VI.C.4, as-built drawings, revisions to Figures 2 and 3 of this Permit reflecting the location of the new well, and revisions to Table 1 of this Permit, if necessary due to renaming of the well, to include the new monitoring wells, to the Administrator within ninety (90) days after completion of the well. Incorporation of such revised figures and tables shall not be considered a modification of the permit.

VI.C.6. The installation of new monitoring wells shall be consistent with guidance contained in Alaska Department of Environmental Conservation’s (ADEC) Monitoring Well Guidance, dated September 2013.

VI.D. PROGRAM OPERATION

VI.D.1. The Permittee shall obtain water level elevation measurements from each monitoring well specified in Table 1 of this Permit, located as designated on Figures 2 and 3 of this Permit, at the frequencies designated in Table 1 of this Permit, in accordance with the procedures in Attachment 4A of this Permit.

Measurements for each monitoring well shall be obtained prior to purging of the well. In order to minimize the potential for error caused by temporal variations, the Permittee shall obtain all water level elevation measurements within as short a time as practicable. Barometric pressure shall be recorded for each sampling event.

The Permittee shall use these data to determine the rate and direction of groundwater flow semi-annually, for the periods of high and low water table elevation. The Permittee shall construct water table elevation contour maps semi-annually. The contour maps and flow rates shall be submitted to the Administrator in the semi-annual reports.

The Permittee shall submit, with the contour maps, a written review of the adequacy of the groundwater monitoring system relative to observed groundwater flow directions.

VI.D.2. The Permittee shall obtain water quality samples from each monitoring point specified in Table 1 of this Permit and located as designated on Figures 2 and 3 of this Permit at the frequencies designated in Table 1 of this Permit in accordance with the procedures in Attachment 4A of this Permit.

VI.D.3. Analysis and reporting of groundwater quality shall include the following:

VI.D.3.a. The Permittee shall analyze all groundwater samples obtained under Permit Condition VI.D.2 for laboratory standard list VOCs (Sites 3 and 7A) and chlorinated pesticides (Site 7A only) and shall report the detected concentrations of the parameters listed in Table 4 of this Permit, according to the schedule in Table 1 of this Permit, using procedures specified by Attachment 4A

of this Permit. Crosstab summary tables of all analytical results shall be appended to the reports, and all laboratory data shall be provided to the Administrator upon request.

VI.D.3.b. Quality assured results of these analyses, including laboratory detection limits achieved for each constituent, shall be submitted to the Administrator in the next Quarterly Report following the Permittee's receipt of results from the laboratory. In no case shall the period between the date of sampling and the date of submission of analytical results exceed one hundred twenty (120) days unless an extension is granted by the Administrator.

VI.D.4. The Permittee shall, every three (3) years (2021, 2024, etc.), during the October sampling event, analyze a groundwater sample from designated monitoring wells MW-03-013 at Site 3, and MW-7A-013 at Site 7A, for all 40 C.F.R. Part 264, Appendix IX, constituents. These constituents are presented in Attachment 4A, Appendix B.

If the designated wells have insufficient yield, the Permittee shall sample the well with the next highest contamination concentrations observed in the previous sampling event. If any Appendix IX constituents not identified in Table 4 of this Permit are detected, the Permittee shall report the concentrations of these detected constituents to the Administrator in the next Quarterly Report following the Permittee's receipt of results from the laboratory. In no case shall the period between the date of sampling and the date of submission of analytical results exceed one hundred twenty (120) days unless an extension is granted by the Administrator.

VI.D.5. For any constituent(s) detected under Permit Condition VI.D.4 that is not included in the quarterly monitoring program as described in Table 1, the Permittee shall, within forty-five (45) days of receipt of results from the laboratory:

VI.D.5.a. Add the newly detected constituent(s) to the list of monitoring constituents, and provide the Administrator with a copy of the revised list for inclusion into the permit Such modification to the

constituent monitoring list will not require a permit modification; or

VI.D.5.b. Submit a report justifying why the detected constituent(s) should not be included in the monitoring program. If the Administrator does not accept the Permittee's justification, the Permittee shall add the constituent to the monitoring list in accordance with VI.D.5.a. If the Administrator accepts the justification, the constituent does not have to be added to the list of monitoring constituents; or,

VI.D.5.c. Submit a notice that the Permittee has resampled and is repeating the analysis for the newly detected constituent(s). Within thirty (30) days of the Permittee's receipt of results of the second analysis, the Permittee shall submit the results of the second analysis and either add the newly detected constituent(s) to the list of monitoring constituents pursuant to VI.D.5.a, or submit a report justifying why the detected constituent(s) should not be included in the monitoring program pursuant to VI.D.5.b.

VI.D.6. If a constituent is detected that must be added to the monitoring list in accordance with VI.D.5, the Agency shall initiate a permit modification to add a groundwater protection standard for that constituent to Table 4, using the procedures in 40 C.F.R. §270.41.

VI.D.7. If, based on new information, the Permittee concludes that different wells are more appropriate for purposes of Appendix IX monitoring, new wells must be proposed in a Quarterly Report prior to the annual sampling. The wells proposed by the Permittee require approval of the Administrator. Selection and approval of the monitoring wells identified for Appendix IX monitoring shall be based on location and the numbers and levels of contaminants detected at the proposed well location and must be at least equally effective in detecting new releases or degradation products. This selection and approval of new Appendix IX monitoring wells shall not require a permit modification and is subject to the dispute resolution procedures in Permit Condition V.N.

VI.D.8. The Permittee shall enter all monitoring, testing, and analytical data obtained pursuant to Permit Conditions VI.D.1, VI.D.2, and VI.D.4 in the operating record as required by Permit Condition I.Y. These results shall be submitted to the Agency within fifteen (15) days of the Permittee's receipt of a written request from the Administrator, provided that the data has been received from the laboratory.

VI.E. DATA EVALUATION

VI.E.1. The results of the analyses obtained pursuant to Permit Condition VI.D.3.a shall be compared to Table 4 of this Permit, the Groundwater Protection Standards. Any constituent concentration equal to or above the Standard contained in Table 4 will be considered an indication of contamination. Any constituent concentration less than the Standard in Table 4 will be considered to be in compliance with that Standard.

VI.E.2. For any monitoring well specified in Table 1 of this Permit that has been in compliance with the Groundwater Protection Standards specified in Table 4 of this Permit for three (3) consecutive years, the Permittee may reduce the required water quality sampling frequency for that well from quarterly to annually. Written notice shall be provided to the Agency before monitoring frequency is reduced.

VI.E.3. Upon detection of constituents exceeding the Groundwater Protection Standards specified in Table 4 of this Permit in any monitoring well subject to Permit Condition VI.E.2, the Permittee shall:

VI.E.3.a. Notify the Administrator of this finding, in writing, in the next Quarterly Report following the detection; and,

VI.E.3.b. Resume the corrective action monitoring program as specified in Table 1 of this Permit for all wells and, within ninety (90) days of notification required in VI.E.3.a, submit an application for modification of the corrective action program to effectively remediate the source of the contamination; or within ninety (90) days of notification required in VI.E.3.a, submit a report to the Agency which identifies the source of the

contamination, including all supporting documentation, the extent of the contamination, and an application for a modification of the corrective action program to effectively remediate the source of the contamination and a revised corrective action monitoring program; or

VI.E.3.c. Submit to the Administrator, in the next Quarterly Report following the detection, notice that the Permittee intends to demonstrate that an off-site source caused the increase, or that the increase resulted from an error in sampling, analysis, or evaluation. A report of this demonstration shall be made within ninety (90) days of notice of intention to make this demonstration. If necessary, an application for a permit modification to make any appropriate changes to the corrective action monitoring program shall be submitted with the report.

VI.E.3.d. If, as determined by the Administrator, the report submitted in accordance with Permit Condition VI.E.3.c fails to identify any off-site source of contamination or an error in sampling, analysis, or evaluation, then the Permittee shall comply with Permit Condition VI.E.3.b. within sixty (60) days of written notification by the Administrator. If the Administrator approves the notice, then the Permittee shall resume monitoring in accordance with the monitoring program specified in Permit Condition VI.E.2.

VI.E.4. The Permittee may discontinue the Corrective Action Monitoring Program for a post-closure unit and implement the Compliance Monitoring Program for that unit, as specified by Part VII of this Permit, at such a time when the Permittee has submitted and demonstrated the following:

VI.E.4.a. The Permittee has demonstrated that the Groundwater Protection Standards, as specified in Table 4, have been met; and

VI.E.4.b. Has submitted an evaluation of the health and environmental risk due to the cumulative effects of the mixture of all parameters remaining in the

groundwater, performed in accordance with applicable Agency guidelines and regulations; and

VI.E.4.c. The Agency has determined that the cumulative health and environmental risk does not exceed standards based on applicable Agency guidelines and regulations.

The Permittee may ask the Agency at any time, after groundwater protection standards have been met, to make this determination. This Agency determination is subject to the dispute resolution procedures in Permit Condition V.N.

VI.E.4.d. The Permittee or the Agency may determine that the Groundwater Protection Standards are no longer appropriate for the post-closure unit prior to an evaluation made under Permit Condition VI.E.4.a. In such a situation, the Permittee shall request a permit modification, in accordance with condition VI.F.1 of this Permit and 40 C.F.R. § 270.42, to revise the Groundwater Protection Standards set forth in Table 4, based on applicable Agency guidelines and regulations. Upon approval of the permit modification, the Permittee shall continue the Corrective Action Monitoring Program until the conditions in part VI.E.4.a through VI.E.4.c of this Permit are met.

VI.E.4.e. For three (3) years after the demonstration is made under Permit Condition VI.E.4.a through VI.E.4.c, the Permittee shall continue to follow the approved Groundwater Corrective Action Monitoring Program and data evaluation and reporting under Permit Condition VI.D and VI.E. During this period, the AS/SVE and treatment systems shall be maintained in a readiness condition.

VI.E.5. If, during the Corrective Action Monitoring Program period covered under Permit Conditions VI.E.4, the health and environmental risk due to the cumulative effects of the mixture of parameters is found to exceed standards based on applicable Agency guidelines and regulations, then the Permittee shall notify the Administrator within thirty (30) days of such a finding. Under such conditions the Permittee shall implement renewed corrective actions or other procedures as

described in Permit Condition VI.E.3 to address the exceedances.

During this period, the Permittee shall continue to follow the approved Groundwater Corrective Action Monitoring Program until successfully achieving the conditions described in Permit Condition VI.E.4.

VI.E.6. Upon successful completion of Permit Condition VI.E.4, the Permittee will commence an approved Compliance Monitoring Program pursuant to Part VII.

VI.F. MODIFICATION OF STANDARDS AND MONITORING FREQUENCIES

VI.F.1. The Permittee may submit a request for a permit modification pursuant to 40 C.F.R. § 270.42 at any time during the life of this Permit for revisions of the standards specified in Table 4 of this Permit. Any such modification must be based on a demonstration that the revised standards are protective of human health and the environment, based on the analytical data obtained pursuant to this Permit.

VI.F.2. The Permittee may request a revision to the monitoring frequencies, monitoring point locations, and AS/SVE point locations, listed in Table 1 of this Permit and located as designated on Figures 2 and 3 of this Permit, based on submission to the Administrator of a demonstration that the revised monitoring frequencies, monitoring point locations, or AS/SVE point locations are as effective in ensuring effective performance of the corrective action program, based on the data obtained pursuant to this Permit.

Evaluation by the Administrator of request(s) for these revisions to the monitoring frequencies, monitoring point locations, or AS/SVE point locations shall be subject to the dispute resolution procedures specified in Permit Condition V.N.

PART VII – COMPLIANCE GROUNDWATER MONITORING

VII.A. IMPLEMENTATION OF GROUNDWATER MONITORING PROGRAM

The Permittee shall implement a groundwater compliance monitoring program for a post-closure unit in accordance with Permit Conditions VII.B through VII.E. The Permittee shall commence this compliance monitoring program as specified by Permit Condition VI.E.4.

VII.B. DESIGNATION OF MONITORING LOCATIONS

After the permit conditions specified in part VI.E.4 of this Permit have been met, all wells in Table 2 shall be monitored quarterly for all constituents in Table 4.

VII.C. WELL CONSTRUCTION, MAINTENANCE, AND REPLACEMENT

VII.C.1. The Permittee shall maintain all monitoring wells in good working order, making necessary repairs in a timely manner so that the sampling program is not hindered or delayed. The Permittee shall maintain an adequate supply of replacement parts and repair equipment to ensure that each sampling event proceeds on schedule.

VII.C.2. The Permittee shall follow the procedures in the Post-Closure Care Plan, Attachment 4A of this Permit, for routine inspection of the monitoring wells. Visual evidence of damage to or deterioration of wells, and complete records of all well maintenance activities, must be noted in the operating record.

VII.C.3. The Permittee shall maintain borehole integrity of each monitoring well, as required by 40 C.F.R. §264.97(c), using the method designated in Permit Conditions VI.C.2.b.

VII.C.4. If a monitoring well must be decommissioned and replaced for any reason during the term of this Permit, it shall be replaced prior to the next scheduled sampling event.

The Permittee may request that the well be replaced within ninety (90) days of determination of the need for replacement during inclement or severe winter weather. Prior to decommissioning, the Permittee shall apprise the Administrator of the rationale for the decision.

The replacement well shall be installed as close as practicable to the well being replaced. The Permittee shall provide information regarding the new well in the operating record and to the Administrator as specified by Permit Conditions VI.C.4 and VI.C.5.

The Permittee shall close each well being replaced no later than ninety (90) days after installation of the replacement well. Wells shall be decommissioned in accordance with the "Well Decommissioning Plan," Attachment 9 of this Permit.

VII.C.5. Inspection of drilling and well construction of any new or replacement monitoring well shall be performed by a qualified geologist or geological engineer. The qualified professional shall construct and maintain a detailed log of each well describing the geologic strata encountered during drilling. The logs and descriptions shall include:

(1) Date and time of construction;

(2) Drilling method and any fluid used;

(3) Well location (surveyed to within 0.5 feet);

(4) Borehole diameter and well casing diameter;

(5) Well depth (to within 0.1 feet);

(6) Drilling logs and lithologic logs, including a description of soil or rock types, color, petrology, weathering, texture, structure, and fractures;

(7) Casing materials;

(8) Screen material and design, including screen length and slot size;

(9) Casing and screen joint type;

(10) Filter pack material, including size and placement method and approximate volume;

(11) Composition and approximate volume of sealant material and method of placement;

(12) Surface seal design and construction;

(13) Well development procedures;

(14) Ground surface elevation (to within 0.01 feet);

(15) Top of casing elevation (to within 0.01 feet); and,

(16) Detailed drawing of well, including dimensions.

VII.C.6. The Permittee shall submit the logs and descriptions obtained pursuant to Permit Condition VII.C.5, as-built drawings, revisions to Figures 2 and 3 of this Permit reflecting the location of the new well, and revisions to Table 1 of this Permit, if necessary due to renaming of the well, to include the new monitoring wells, to the Administrator within ninety (90) days after completion of the well. Incorporation of such revised figures and tables shall not be considered a modification of the permit.

VII.C.7. The installation of new monitoring wells shall be consistent with guidance contained in the most recent edition of ADEC's Monitoring Well Guidance, dated September 2013.

VII.D. PROGRAM OPERATION

VII.D.1. The Permittee shall obtain water level elevation measurements from each monitoring well specified in Table 2 of this Permit, located as designated on Figures 2, 3 and 4 of this Permit, at the frequencies designated in Table 2 of this Permit, in accordance with the procedures in Attachment 4A of this Permit.

Measurements for each monitoring well shall be obtained prior to purging of the well. In order to minimize the potential for error caused by temporal variations, the Permittee shall obtain all water level elevation measurements within as short a time as practicable. Barometric pressure shall be recorded for each sampling event.

The Permittee shall use these data to determine the rate and direction of groundwater flow semi-annually, for the periods of high and low water table elevation. The Permittee shall construct water table elevation contour maps semi-annually. The contour maps and flow rates shall be submitted to the Administrator in the semi-annual reports. The Permittee shall submit, with the contour maps, a written review of the adequacy of the

groundwater monitoring system relative to observed groundwater flow directions.

VII.D.2. Upon successful completion of the requirements of Section VI.E.4, wells will be sampled as specified in Table 2 of this Permit, in accordance with the procedures in Attachment 4A of this Permit.

VII.D.3. Analysis and reporting of groundwater quality shall include the following:

VII.D.3.a. The Permittee shall analyze all groundwater samples obtained under Permit Condition VII.D.2 for the parameter list in Table 4 of this Permit quarterly, according to the schedule in Table 2 of this Permit, using procedures specified by Attachment 4A of this Permit.

VII.D.3.b. Quality assured results of these analyses, including laboratory detection limits achieved for each constituent, shall be submitted to the Administrator in the next Quarterly Report following the Permittee's receipt of results from the laboratory. In no case shall the period between the date of sampling and the date of submission of analytical results exceed one hundred twenty (120) days unless an extension is granted by the Administrator.

VII.D.4. The Permittee shall, every three (3) years (2021, 2024, etc.), during the October sampling event, analyze a groundwater sample from the designated wells identified in Permit Condition VI.D.4 for all 40 C.F.R. Part 264, Appendix IX, constituents. These constituents are presented in Attachment 4A, Appendix B.

If the designated wells have insufficient yield, the Permittee shall sample the well with the next highest contamination concentrations observed in the previous sampling event. If any Appendix IX constituents not identified in Table 4 of this Permit are detected, the Permittee shall report the concentrations of these detected constituents to the Administrator in the next quarterly report following the Permittee's receipt of results from the laboratory. In no case shall the period between the date of sampling and the date of submission of analytical results exceed one hundred twenty

(120) days unless an extension is granted by the Administrator.

VII.D.5. For any constituent(s) detected under Permit Condition VII.D.4 that is not included in the monitoring program currently in effect under the permit, the Permittee shall, within forty-five (45) days of receipt of results from the laboratory:

VII.D.5.a. Add the newly detected constituent(s) to the list of monitoring constituents, and provide the Administrator with a copy of the revised list for inclusion into the permit. Such modification to the constituent monitoring list will not require a permit modification; or

VII.D.5.b. Submit a report justifying why the detected constituent(s) should not be included in the monitoring program. If the Administrator does not accept the Permittee's justification, the Permittee shall add the constituent to the monitoring list in accordance with VII.D.5.a. If the Administrator accepts the justification, the constituent does not have to be added to the list of monitoring constituents; or,

VII.D.5.c. Submit a notice that the Permittee has resampled and is repeating the analysis for the newly detected constituent(s). Within thirty (30) days of the Permittee's receipt of results of the second analysis, the Permittee shall submit the results of the second analysis and either add the newly detected constituent(s) to the list of monitoring constituents pursuant to VII.D.5.a, or submit a report justifying why the detected constituent(s) should not be included in the monitoring program pursuant to VII.D.5.b.

VII.D.6. If, based on new information, the Permittee concludes that different wells are more appropriate for purposes of Appendix IX monitoring, new wells must be proposed in a Quarterly Report prior to the annual sampling. The wells proposed by the Permittee require approval of the Administrator. Selection and approval of the monitoring wells identified for Appendix IX monitoring shall be based on location and the numbers and levels of contaminants detected at the proposed well location.

This selection and approval of new Appendix IX monitoring wells shall not require a permit modification and is subject to the dispute resolution procedures in Permit Condition V.N.

VII.D.7. If a constituent is detected that must be added to the monitoring list in accordance with VII.D.5.a, the Agency shall initiate a permit modification to add a groundwater protection standard for that constituent to Table 4, using the procedures in 40 C.F.R. §270.41.

VII.D.8. The Permittee shall enter all monitoring, testing, and analytical data obtained pursuant to Permit Conditions VII.D.1, VII.D.3, and VII.D.4 in the operating record as required by Permit Condition I.Y. These results shall be submitted to the Agency within fifteen (15) days of the Permittee's receipt of a written request from the Administrator, provided the data has been received from the laboratory.

VII.E. DATA EVALUATION

VII.E.1. The results of the analyses obtained pursuant to Permit Condition VII.D.3 shall be compared to Table 4 of this Permit, the Groundwater Protection Standards. Any constituent above the Standards contained in Table 4 of this Permit will be considered an indication of contamination. Any constituent equal to or less than the Standard contained in Table 4 of this Permit will be considered to be in compliance with that Standard.

VII.E.2. Upon detection of constituents exceeding the Groundwater Protection Standards specified in Table 4 of this Permit in any well subject to Permit Condition VII.D.2, the Permittee shall:

VII.E.2.a. Notify the Administrator of this finding, in writing, in the next Quarterly Report following the detection, in accordance with 40 C.F.R. §264.99(I)(1); and,

VII.E.2.b. Immediately collect two (2) samples from any affected well(s), purging the well(s) between samples, and reanalyze both samples for all constituents specified in Table 4 of this Permit.

VII.E.3. If the results of the analyses show that:

VII.E.3.a. Neither verification sample described in Permit Condition VII.E.2.b confirm the detection of constituents above the Groundwater Protection Standards, the Permittee shall resume compliance monitoring according to the standard quarterly schedule and notify the Administrator that the compliance monitoring program is being resumed.

VII.E.3.b. Only one of the verification samples described in Permit Condition VII.E.2.b confirms the detection of constituents above the Groundwater Protection Standards, the Permittee shall repeat the verification procedure which begins in Permit Condition VII.E.2.b.

VII.E.3.c. Both verification samples described in Permit Condition VII.E.2.b confirm the detection of constituents above the Groundwater Protection Standards, the Permittee shall comply with Permit Condition VII.E.4.

VII.E.4. The Permittee shall either:

VII.E.4.a. Within ninety (90) days of the notice required by Permit Condition VII.E.2.a, implement the corrective action program as specified in Part V of this Permit and the corrective action monitoring program as specified in Part VI of this Permit; or,

VII.E.4.b. Submit, within ninety (90) days of the notice required by Permit Condition VII.E.2.a, for review and approval by the Agency, a proposal for a modified corrective action program and corrective action monitoring; or

VII.E.4.c. Submit to the Administrator, within fifteen (15) days of the notice required by Permit Condition VII.E.2.a, notice that the Permittee intends to demonstrate that an off-site source caused the increase, or that the increase resulted from an error in sampling, analysis, or evaluation. A report of this demonstration shall be made within ninety (90) days of the notice required by Permit Condition VII.E.2.a. If necessary to enhance the effectiveness of the monitoring in addressing the

new constituent or new source, an application for a permit modification to make any appropriate changes to the compliance monitoring program shall be submitted with the report; or

VII.E.4.d. Perform, and submit to the Agency for review and approval, an evaluation of the health and environmental risk due to the cumulative effects of the mixture of parameters, performed in accordance with applicable Agency and guidelines and regulations; and

VII.E.4.e. Continue to monitor in accordance with the compliance monitoring program.

VII.E.5. If, as determined by the Administrator, the report submitted in accordance with Permit Condition VII.E.4.c or VII.E.4.d fails to identify any off-site source of contamination or an error in sampling, analysis, or if the cumulative risk of the mixture of parameters exceeds applicable Agency guidelines and regulations, then the Permittee shall comply with Permit Condition VII.E.4.a or VII.E.4.b if the corrective action monitoring program has been approved by the Agency.

VII.E.6. Except as may be required by Permit Conditions VII.E.4 and VII.E.5, the Permittee shall continue operating the compliance monitoring program until the end of the post-closure care period, as required by Permit Condition IV.B.

PART VIII – DETECTION GROUNDWATER MONITORING

VIII.A. IMPLEMENTATION OF GROUNDWATER MONITORING PROGRAM

The Permittee shall implement an annual groundwater detection monitoring program for Site 6A (MOGAS) in accordance with Permit Conditions VIII.B through VIII.E. This detection monitoring program shall commence within ninety (90) days of the effective date of this Permit and shall continue to the end of the post-closure period.

VIII.B. DESIGNATION OF MONITORING LOCATIONS

The Permittee shall maintain a groundwater monitoring system which complies with the requirements of 40 C.F.R. §§ 264.95 and 264.97 as specified below at the locations specified in Table 3 of this Permit (locations depicted on Figure 4 of this Permit).

VIII.C. WELL CONSTRUCTION, MAINTENANCE AND REPLACEMENT

VIII.C.1. The Permittee shall maintain all monitoring wells in good working order, making necessary repairs in a timely manner so that the sampling program is not hindered or delayed. The Permittee shall maintain an adequate supply of replacement parts and repair equipment to ensure that each sampling event proceeds on schedule.

VIII.C.2. The Permittee shall follow the procedures in the Post-Closure Care Plan, Attachment 4A of this Permit, for routine inspection of the monitoring wells. Visual evidence of damage to or deterioration of wells, and complete records of all well maintenance activities, must be noted in the operating record.

VIII.C.3. The Permittee shall maintain borehole integrity of each monitoring well in the detection monitoring program, as required by 40 C.F.R. §264.97(c), using the method designated in Permit Conditions VI.C.2.b.

VIII.C.4. If a monitoring well must be decommissioned and replaced for any reason during the term of this Permit, it shall be replaced prior to the next scheduled sampling event. The Permittee may request that the well be replaced within ninety (90) days of determination of the need for replacement during inclement or severe winter weather.

Prior to decommissioning, the Permittee shall apprise the Administrator of the rationale for the decision.

The replacement well shall be installed as close as practicable to the well being replaced. The Permittee shall provide information regarding the new well in the operating record and to the Administrator as specified by Permit Conditions VI.C.4 and VI.C.5.

The Permittee shall close each well being replaced no later than ninety (90) days after installation of the replacement well. Wells shall be decommissioned in accordance with the "Well Decommissioning Plan," Attachment 9 of this Permit.

VIII.C.5. Inspection of drilling and well construction of any new or replacement monitoring well shall be performed by a qualified geologist or geological engineer. The qualified professional shall construct and maintain a detailed log of each well describing the geologic strata encountered during drilling. The logs and descriptions shall include:

(1) Date and time of construction;

(2) Drilling method and any fluid used;

(3) Well location (surveyed to within 0.5 feet);

(4) Borehole diameter and well casing diameter;

(5) Well depth (to within 0.1 feet);

(6) Drilling logs and lithologic logs, including a description of soil or rock types, color, petrology, weathering, texture, structure, and fractures;

(7) Casing materials;

(8) Screen material and design, including screen length and slot size;

(9) Casing and screen joint type;

(10) Filter pack material, including size and placement method and approximate volume;

(11) Composition and approximate volume of sealant material and method of placement;

(12) Surface seal design and construction;

(13) Well development procedures;

(14) Ground surface elevation (to within 0.01 feet);

(15) Top of casing elevation (to within 0.01 feet); and,

(16) Detailed drawing of well, including dimensions.

VIII.C.6. The Permittee shall submit the logs and descriptions obtained pursuant to Permit Condition VIII.C.5, as-built drawings, revisions to Figure 4 of this Permit reflecting the location of the new well, and revisions to Table 3 of this Permit, if necessary due to renaming of the well, to include the new monitoring wells, to the Administrator within ninety (90) days after completion of the well.

Incorporation of such revised figures and tables shall not be considered a modification of the permit.

VIII.C.7. The installation of new monitoring wells shall be consistent with guidance contained in the most recent ADEC Monitoring Well Guidance, dated September 2013.

VIII.D. PROGRAM OPERATION

VIII.D.1. The Permittee shall obtain water level elevation measurements from each monitoring well specified in Table 3 of this Permit (locations depicted on Figure 4 of this Permit) at the frequencies designated in Table 3 of this Permit, in accordance with the procedures in Attachment 4A of this Permit.

Measurements for each monitoring well shall be obtained prior to purging of the well. In order to minimize the potential for error caused by temporal variations, the Permittee shall obtain all water level elevation measurements within as short a time as practicable. Barometric pressure shall be recorded for each sampling event.

The Permittee shall use these data to determine the rate and direction of groundwater flow annually, for the periods of high and low water table elevation. The Permittee shall construct water table elevation contour maps annually. The contour maps and flow rates shall be submitted to the Administrator annually, in the second of the two semi-annual reports. The Permittee shall submit, with the contour maps, a written review of the

adequacy of the groundwater monitoring system relative to observed groundwater flow directions.

VIII.D.2. The Permittee shall obtain water quality samples from each monitoring point specified in Table 3 of this Permit (locations depicted on Figure 4) of this Permit at the frequencies designated in Table 3 of this Permit in accordance with the procedures in Attachment 4A of this Permit.

VIII.D.3. Analysis and reporting of groundwater quality shall include the following:

VIII.D.3.a. The Permittee shall analyze all groundwater samples obtained under Permit Condition VIII.D.2 for the parameter list in Table 4 of this Permit annually, using procedures specified by Attachment 4A of this Permit.

VIII.D.3.b. Quality assured results of these analyses, including laboratory detection limits achieved for each constituent, shall be submitted to the Administrator in the next Quarterly Report following the Permittee's receipt of results from the laboratory.

In no case shall the period between the date of sampling and the date of submission of analytical results exceed one hundred twenty (120) days unless an extension is granted by the Administrator.

VIII.D.4. The Permittee shall enter all monitoring, testing, and analytical data obtained pursuant to Permit Conditions VIII.D.1, VIII.D.2, and VIII.D.3 in the operating record as required by Permit Condition I.Y. Upon written request by the Agency, these results shall be submitted within fifteen (15) days of the Permittee's receipt of the request, provided the data has been received from the laboratory.

VIII.E. DATA EVALUATION

VIII.E.1. The results of the analyses obtained pursuant to Permit Condition VIII.D.3 shall be compared to Table 4 of this Permit, the Groundwater Protection Standards, or to the modifications made to this Table pursuant to Permit Condition VI.E.4.d. Any constituent concentration above the Standards contained in Table 4 of this Permit will

be considered an indication of contamination. Any constituent concentration equal to or less than the Standard contained in Table 4 of this Permit will be considered to be in compliance with that Standard.

VIII.E.2. Upon detection of constituents in any monitoring well exceeding the Groundwater Protection Standards specified in Table 4 of this Permit, the Permittee shall:

VIII.E.2.a. Notify the Administrator of this finding, in writing, in the next Quarterly Report following the detection, in accordance with 40 C.F.R. §264.99(I)(1); and,

VIII.E.2.b. Immediately collect two (2) samples from any affected well(s), purging the well(s) between samples, and reanalyze both samples for all constituents specified in Table 4 of this Permit.

VIII.E.3. If the results from the analyses show that:

VIII.E.3.a. Neither verification sample described in Permit Condition VIII.E.2.b confirm the detection of constituents above the Groundwater Protection Standards, the Permittee shall resume detection monitoring according to the standard annual schedule and notify the Administrator that the detection monitoring program is being resumed.

VIII.E.3.b. Only one of the verification samples described in Permit Condition VIII.E.2.b confirms the detection of constituents above the Groundwater Protection Standards, the Permittee shall repeat the verification procedure which begins in Permit Condition VIII.E.2.b.

VIII.E.3.c. Both verification samples described in Permit Condition VIII.E.2.b confirm the detection of constituents above the Groundwater Protection Standards, the Permittee shall comply with Permit Condition VIII.E.4.

VIII.E.4. The Permittee shall sample the affected well(s) within fourteen (14) days of receipt of analytical data obtained in Permit Condition VIII.E.3.c, and analyze for the constituents identified in 40 C.F.R. Part 264 Appendix IX. These constituents are presented in

Attachment 4A, Appendix B. Within ninety (90) days of receipt of the Appendix IX results, the Permittee shall submit to the Administrator either of the following:

VIII.E.4.a. An application for a permit modification to establish compliance monitoring and corrective action programs as specified in 40 C.F.R. § 264.98(g)(4) and (5); or,

VIII.E.4.b. A report demonstrating that an off-site source caused the increase, or that the increase resulted from an error in sampling, analysis, or evaluation, and in addition, when required by 40 C.F.R. § 264.98(h), an application for a permit modification to make any appropriate changes to the detection monitoring program.

VIII.E.5. If, as determined by the Administrator, the report submitted in accordance with Permit Condition VIII.E.4.b fails to identify any off-site source of contamination or an error in sampling, analysis, then the Permittee shall:

VIII.E.5.a. Immediately sample and analyze all point of compliance wells, as specified in Table 3 and located on Figure 4 of this Permit for Appendix IX constituents; and,

VIII.E.5.b. Establish background concentrations of all Appendix IX constituents identified at the point of compliance, as specified in Table 3 and located on Figure 4 of this Permit as specified by 40 C.F.R. 264.97(h); and

VIII.E.5.c. Submit an application for a permit modification within ninety (90) days to establish compliance monitoring and corrective actions programs as specified in 40 C.F.R. § 264.98(h)(4) and (5).

PART IX – CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS

IX.A. STANDARD CONDITIONS

IX.A.1. The Permittee must take corrective action to protect human health and the environment from all releases of hazardous waste or constituents from any solid waste management unit at the facility, regardless of the time at which waste was placed in such unit, in accordance with Section 3004(u) of RCRA, 42 U.S.C. § 6924(u), 40 C.F.R. § 264.264.90(a), and 40 C.F.R. § 264.101.

IX.A.2. The Permittee must take corrective action beyond the facility property boundary, where necessary to protect human health and the environment, in accordance with Section 3004(v) of RCRA, 42 U.S.C. § 6924(v), and 40 C.F.R. § 264.101. The Permittee must exhaust all options to implement corrective action beyond the facility property boundary, including but not limited to purchasing affected property by eminent domain, relocating affected populations to new housing, and offering to finance and construct satisfactory water supply utilities to affected properties before making a demonstration, in accordance with 40 C.F.R. § 264.101.

IX.A.3. All plans and schedules required by the conditions of this Permit are, upon approval of the Administrator, incorporated into this Permit by reference and become an enforceable part of this Permit. Any noncompliance with such approved plans and schedules shall be termed noncompliance with this Permit. Extensions of the due dates for submittal may be granted by the Administrator, in accordance with the permit modification processes under 40 C.F.R. § 270.41.

IX.A.4. If the Administrator determines that further corrective actions beyond those provided in this Permit, or changes to that which is stated herein, are warranted, then the Administrator shall modify this Permit according to the permit modification processes under 40 C.F.R. § 270.41.

IX.A.5. All raw data, such as laboratory reports, geological and hydrogeological investigations, bench-scale or pilot-scale data, and other supporting information gathered or generated during activities undertaken pursuant to this

Permit, including any reissued permits, shall be provided at the request of the Agency.

IX.B. REPORTING REQUIREMENTS

IX.B.1. In the next April or October quarterly report (whichever comes first) following the effective date of this Permit, and every six (6) months thereafter, as part of the semi-annual reports referenced in Permit Condition V.F, the Permittee shall submit to the Administrator signed semi-annual corrective measures progress reports which shall contain:

IX.B.1.a. A discussion and summary of all corrective measures-related activities undertaken during the time period;

IX.B.1.b. Summaries of all problems or potential problems encountered during the reporting period and actions taken to rectify problems; and

IX.B.1.c. Projected work for the next reporting period.

IX.B.2. The Permittee shall maintain copies of other reports (e.g., inspection reports), geological and hydrogeological investigations, records of groundwater monitoring wells and associated groundwater surface elevations, and laboratory data, for the active life (including the post-closure period) of the facility, and shall make them available to the Administrator upon request.

IX.B.3. The Administrator may require the Permittee to conduct new or more extensive assessments, investigations, or studies, as needed, based on information provided in these progress reports or other supporting information.

IX.C. NEWLY-IDENTIFIED OR NEWLY-CREATED SOLID WASTE MANAGEMENT UNITS

IX.C.1. The Permittee shall notify the Administrator in writing of any newly-identified or newly-created SWMU(s) that are not covered by this Permit, as set out in Attachment 7 of this Permit. This notice shall be provided no later than fifteen (15) days after discovery of the newly identified or created SWMU(s).

IX.C.2. Within ninety (90) days after the notification provided in accordance with Permit Condition IX.C.1, the Permittee shall prepare a SWMU Assessment Report. At a minimum, the Report shall provide the following information for each newly- identified or newly-created SWMU:

IX.C.2.a. The location of each newly-identified SWMU in relation to other SWMUs, building numbers, or other descriptive landmarks;

IX.C.2.b. The type and function of the unit;

IX.C.2.c. The general dimensions, capacities, and structural description of the unit (supply any available drawings);

IX.C.2.d. The period during which the unit was operated;

IX.C.2.e. The specifics on all wastes that have been or are being managed at the SWMU, to the extent available; and

IX.C.2.f. A description of any release (or suspected release) of hazardous constituents originating from the unit, including planned or unplanned releases to the air. Include information on the date of release, type of hazardous waste or hazardous constituents, quantity released, nature of the release, extent of release migration, and cause of release (e.g. overflow, broken pipe, tank leak, etc.). Also provide any available data which would quantify the nature and extent of environmental contamination, including the results of soil and/or groundwater sampling and analysis efforts. Likewise, submit any existing monitoring information that indicates release of hazardous waste or hazardous constituents has not occurred or is not occurring.

IX.C.3. Based on the results of this Report, the Administrator shall determine the need for further investigations at specific unit(s) covered in the SWMU Assessment Report. If the Administrator determines that such investigations are needed, the Administrator may require the Permittee to prepare a RFI Work Plan and/or RFI report within a specified time and consistent with EPA guidance. The RFI

Work Plan and/or report is subject to the dispute resolution procedures of Permit Condition V.N. If the Administrator determines that corrective measures are required, the Permittee shall submit a request for a permit modification to implement corrective measures.

IX.D. NEWLY-DISCOVERED RELEASES AT SOLID WASTE MANAGEMENT UNITS

IX.D.1. The Permittee shall notify the Administrator, in writing, of any release(s) of hazardous waste or hazardous constituents from any SWMU. Such newly-discovered releases may be from newly-identified SWMUs, from SWMUs at which the Administrator had previously determined that no further investigation was necessary, or from SWMUs investigated as part of this Permit. This notification shall be submitted in two parts:

IX.D.1.a. First, within fifteen (15) days of discovery of the release the Permittee shall submit in writing an initial notification report of the discovery. This notification shall alert the Agency to the magnitude of the threat.

IX.D.1.b. Second, within sixty (60) days of such a discovery the Permittee must submit a written report. The report shall discuss the Permittee's efforts to investigate and/or remediate the discovered release and shall specifically include:

i. the concentrations and estimated quantities of any hazardous wastes or hazardous constituents released;

ii. the known, or expected, pathway(s) through which the contamination is migrating (or may migrate), and the extent, rate, and direction of that migration;

iii. the projected fate and transport of the release;

iv. the likely exposure pathway(s) for potential receptors, and the consequences of exposure to these receptors; and,

v. an outline of proposed Interim Measures to arrest the release, as well as a schedule for implementing

the Interim Measures. The schedule should be justified by a discussion of possible consequences arising from any delay in implementing Interim Measures.

IX.D.2. If, based either on information submitted in Permit Condition IX.C.1 or IX.D.1 above, or on information obtained during the investigation or monitoring of the facility, the Agency determines at any time that a threat to human health or the environment may result from a release at the facility, the Permittee will be directed by a notification from the Agency to implement interim corrective measures designed to minimize the threat to human health and the environment, subject to review and approval by the Agency. Interim corrective measures are subject to the dispute resolution procedures in Permit Condition V.N. Implementation by the Permittee of treatment or containment activities taken during immediate response to a discharge of hazardous waste, an imminent and substantial threat of a discharge of hazardous waste, or a discharge of material which, when discharged, becomes a hazardous waste, is not subject to this Permit. [40 C.F.R. § 270.1(c)(3)]

IX.D.3. Within ninety (90) days of discovery of a release, the Permittee shall submit a Report describing the interim corrective measures activities taken to date. This Report shall include the reporting requirements specified in Permit Condition IX.B. If the Administrator determines that additional investigation or corrective measures are required, the Permittee shall submit a request for a permit modification to investigate and perform additional corrective measures, or the Agency may initiate a permit modification.

IX.E. RCRA FACILITY INVESTIGATION WORK PLAN

IX.E.1. If the Administrator determines that a RFI is necessary for any newly discovered or newly created SWMU or for a newly discovered release under Permit Conditions IX.C or IX.D, or if needed to further investigate an existing SWMU, the Permittee shall submit an RFI Work Plan to the Administrator. Such Work Plans must address those applicable SWMU's, releases of hazardous waste including hazardous constituents, and media of concern which, based on the permit, require corrective action, based upon new information or new releases. The RFI Work Plan

shall be consistent with the U.S. Environmental Protection Agency document RFI Guidance, OSWER Directive 9502.00- 6C, dated May, 1989, and with EPA corrective action guidance, Attachment 8 of this Permit.

IX.E.1.a. The RFI Work Plan shall describe the objectives of the investigation and the overall technical and analytical approach to completing all actions necessary to characterize the nature, direction, rate, movement, and concentration of releases of hazardous waste, including hazardous constituents from specific SWMUs or groups of SWMUs, and their actual or potential receptors. The RFI Work Plan shall detail all proposed activities and procedures to be conducted at the unit, the schedule for implementing and completing such investigations, and the overall management of the RFI. The RFI Work Plan shall include action levels consistent with EPA health and ecological based guidance effective at the time of implementation.

IX.E.1.b. In addition, the RFI Work Plan shall discuss sampling and data collection quality assurance and data management procedures, including formats for documenting and tracking data and other results of investigations, and health and safety procedures.

IX.E.2. After the Permittee submits the RFI Work Plan, the Administrator may either approve or disapprove the RFI Work Plan in writing. If the Administrator disapproves the RFI Work Plan, the Administrator shall either:

(1) notify the Permittee in writing of the deficiencies in the RFI Work Plan and specify a due date for submittal of a revised RFI Work Plan; or

(2) revise and approve with modification the RFI Work Plan and notify the Permittee of the revisions. Submittals required by this permit condition do not require a permit modification, and are subject to the dispute resolution procedures in Permit Condition V.N.

IX.E.3. The Administrator may review for approval as part of the RFI Work Plan any plans developed pursuant to Permit Condition IX.C.3., addressing further investigations of newly-identified SWMUs, or Permit Condition IX.D, addressing new releases from previously-identified

SWMUs. The Administrator may modify this Permit according to the permit modification procedures under 40 C.F.R. § 270.41, to incorporate these SWMUs and releases into the RFI Work Plan.

IX.E.4. After the Permittee has received written approval from the Administrator for the RFI Work Plan, the Permittee shall begin implementation of the RCRA Facility Investigation according to the schedules specified in the approved RFI Work Plan. Pursuant to Permit Condition IX.A.4, the RFI shall be conducted in accordance with the approved RFI Work Plan.

IX.F. RCRA FACILITY INVESTIGATION REPORT

IX.F.1. The Permittee is to develop and submit a RCRA Facility Investigation Report consistent with the U.S. Environmental Protection Agency document RFI Guidance, OSWER Directive 9502.00-6C, dated May, 1989, and with EPA Corrective Action Guidance, Attachment 8 of this Permit.

IX.F.2. Within ninety (90) days after the completion of the RFI and receipt of validated data, the Permittee shall submit an RFI Final Report to the Administrator. The RFI Report shall describe the procedures, methods, and results of all facility investigations of SWMUs and their releases, including information on the type and extent of contamination at the facility, sources and migration pathways, and actual or potential receptors. The RFI Final Report shall present all information to support further corrective action decisions at the unit.

IX.G. INTERIM CORRECTIVE MEASURES

IX.G.1. If during the course of any activity initiated under this Permit, the Administrator determines that a release or potential release of hazardous waste, including hazardous constituents, from a SWMU, poses a threat to human health and the environment, the Permittee will be directed by a notification from the Agency to implement interim corrective measures designed to minimize the threat to human health and the environment, subject to review and approval by the Agency. Interim corrective measures are subject to the dispute resolution procedures in Permit Condition V.N. Implementation by the Permittee of treatment or containment activities

taken during immediate response to a discharge of hazardous waste, an imminent and substantial threat of a discharge of hazardous waste, or a discharge of material which, when discharged, becomes a hazardous waste, is not subject to this Permit. [40 C.F.R. § 270.1(c)(3)]

IX.G.2. The following factors may be considered by the Administrator in determining the need for additional interim corrective measures:

IX.G.2.a. Time required to develop and implement a final remedy;

IX.G.2.b. Actual and potential exposure of human and environmental receptors;

IX.G.2.c. Actual and potential contamination of drinking water supplies and sensitive ecosystems;

IX.G.2.d. The potential for further degradation of the medium absent interim measures;

IX.G.2.e. Presence of hazardous waste in containers or tanks that may pose a threat of release;

IX.G.2.f. Presence and concentration of hazardous waste including hazardous constituents in soils that have the potential to migrate to groundwater or surface water;

IX.G.2.g. Weather conditions that may affect the current levels of contamination;

IX.G.2.h. Risks of fire, explosion, or accident; and

IX.G.2.i. Other situations that may pose threats to human health and the environment.

IX.H. DETERMINATION OF CORRECTIVE ACTION COMPLETE WITHOUT CONTROLS

IX.H.1. Based on the results of the RFI and other relevant information, the Permittee may submit an application to the Administrator for a Class 3 permit modification under 40 C.F.R. § 270.42 to terminate all or parts of the corrective action requirements in this Permit. This

Permit modification application must contain information demonstrating that there are no releases of hazardous waste, including hazardous constituents from SWMUs at the facility, that pose a threat to human health and the environment, as well as information required in 40 C.F.R. § 270.42(c), which incorporates by reference 40 C.F.R. §§ 270.13 through 270.21, 270.62, and 270.63.

If, based upon review of the Permittee's request for a permit modification, the results of the RFI, and other information, including comments received during the sixty (60) day public comment period required for a Class 3 permit modification, the Administrator determines that releases or suspected releases, which were investigated, either are non-existent or do not pose a threat to human health and the environment, the Administrator will grant the requested modification for the identified SWMU or SWMUs.

IX.H.2. A determination of corrective action complete without controls shall not preclude the Administrator from requiring continued or periodic monitoring of air, soil, groundwater, or surface water, when site- specific circumstances indicate that releases of hazardous wastes, including hazardous constituents, are likely to occur, if necessary to protect human health and the environment.

IX.H.3. A determination of corrective action complete without controls shall not preclude the Administrator from requiring further investigations, studies, or remediation at a later date, if new information or subsequent analysis indicates a release or likelihood of a release from a SWMU at the facility that is likely to pose a threat to human health or the environment. In such a case, the Administrator may initiate a permit modification according to 40 C.F.R. § 270.41, to rescind the determination made in accordance with Permit Condition IX.H.1.

IX.I. CORRECTIVE MEASURES STUDY

IX.I.1. If the Administrator has reason to believe that a SWMU has released concentrations of hazardous constituents in excess of the current EPA health and ecological based levels, or if the Administrator determines that contaminants present at levels below the current EPA

health based levels pose a threat to human health and the environment given site-specific exposure conditions, the Administrator may require a CMS and shall notify the Permittee in writing. This notice shall identify the hazardous constituents(s) which have exceeded action levels as well as those which have been determined to threaten human health and the environment given site-specific exposure conditions.

IX.I.2. No later than sixty (60) days after the Permittee has received notification from the Administrator, under Permit Condition IX.I.1, of the need for a CMS, the Permittee shall submit to the Agency a schedule for conducting a CMS. Upon EPA approval of the schedule, the Permittee shall implement the Corrective Measures Study according to the approved schedule. The CMS shall be consistent with EPA guidance, Attachment 8 of this Permit.

IX.I.3. The Permittee shall submit a CMS Report according to the schedule in Attachment 7 of this Permit. The CMS Report shall summarize the results of the investigations for each remedy, and of any bench-scale or pilot tests conducted. The CMS Report must include an evaluation of each remedial alternative, and a proposal for corrective measures implementation. The report shall contain adequate information to support the Administrator in the remedy selection decision making process, described under Permit Condition IX.J of the permit.

IX.I.4. Based on preliminary results and the CMS Report, the Administrator may require the Permittee to evaluate additional remedies or particular elements of one or more proposed remedies and modify the CMS Report accordingly, within a timeframe specified by the Agency. Modifications to the CMS Report are subject to the dispute resolution procedures of Permit Condition V.N.

IX.J. REMEDY SELECTION

Based on the results of the RFI Report, CMS Report, or any further evaluations of additional remedies, the Administrator will select a remedy that will:

(1) be protective of human health and the environment;

(2) meet the concentration levels of hazardous constituents in each medium that the remedy must achieve to be protective of human health and the environment;

(3) control the source(s) of release(s) so as to reduce or eliminate, to the maximum extent practicable, further releases that might pose a threat to human health and the environment; and

(4) meet all applicable waste management requirements.

IX.K. PERMIT MODIFICATION FOR REMEDY

Based on information the Permittee submits in the RFI Final Report, the CMS Final Report, or other information, the Administrator will initiate a modification to this Permit for selection and implementation of the remedy, pursuant to 40 C.F.R. § 270.41.

IX.L. CORRECTIVE MEASURES IMPLEMENTATION FOR SWMUS 1, 10/11, 18, 28 AND 33A

The Permittee shall implement the Corrective Measures selected by EPA described in Attachment 11 of this Permit in accordance with all EPA-approved Submittals, including the site-specific CMI Work Plans as reviewed and approved by EPA.

Development of CMI Work Plans shall be consistent with Attachment 8 of this Permit and shall detail the design, construction, operation, maintenance, and monitoring of the performance of the Corrective Measures selected by EPA to protect human health and the environment, and shall include a schedule for all activities, including Submittals. The Permittee shall design the Corrective Measures so that the established media cleanup standards will be achieved.

This page intentionally blank

Table 1 Corrective Action Monitoring Program

WELL ID	WATER QUALITY SAMPLING	WATER LEVEL ELEVATION
Site 3 – Laundry		
MW-03-003	Semi-annual	Semi-annual
MW-03-013	Quarterly	Quarterly
MW-03-018	Semi-annual	Semi-annual
MW-03-022	Quarterly	Quarterly
MW-03-025	Semi-annual	Semi-annual
MW-03-107S	Semi-annual	Semi-annual
MW-03-202	Quarterly	Quarterly
MW-03-401	Semi-annual	Semi-annual
MW-03-402D	Quarterly	Quarterly
MW-03-402M	Semi-annual	Semi-annual
MW-03-407D	Semi-annual	Semi-annual
MW-03-502M	Quarterly	Quarterly
MW-03-503D	Semi-annual	Semi-annual
Site 7A – Barrel Storage Area No. 1		
MW-7A-003	Quarterly	Quarterly
MW-7A-004	Quarterly	Quarterly
MW-7A-007	Semi-annual	Semi-annual
MW-7A-011	Quarterly	Quarterly
MW-7A-012	Semi-annual	Semi-annual
MW-7A-013	Quarterly	Quarterly
MW-7A-018	Quarterly	Quarterly
MW-7A-023	Semi-annual	Semi-annual
MW-7A-024	Semi-annual	Semi-annual

Table 2 Compliance Monitoring Program

WELL ID	WATER QUALITY SAMPLING	WATER LEVEL ELEVATION
Site 3 – Laundry		
MW-03-013	Quarterly	Quarterly
MW-03-022	Quarterly	Quarterly
MW-03-107S	Semi-annual	Semi-annual
MW-03-202	Quarterly	Quarterly
MW-03-402D	Quarterly	Quarterly
Site 7A – Barrel Storage Area No. 1		
MW-7A-011	Quarterly	Quarterly

Table 3 Effectiveness Monitoring Program

WELL ID	WATER QUALITY SAMPLING	WATER LEVEL ELEVATION
Site 3 – Laundry		
MW-03-003	Semi-annual	Semi-annual
MW-03-018	Semi-annual	Semi-annual
MW-03-025	Semi-annual	Semi-annual
MW-03-407D	Semi-annual	Semi-annual
Site 7A – Barrel Storage Area No. 1		
MW-7A-007	Semi-annual	Semi-annual
MW-7A-012	Semi-annual	Semi-annual
MW-7A-023	Semi-annual	Semi-annual
MW-7A-024	Semi-annual	Semi-annual
Site 6A – MOGAS		
MW-6A-107	Annually	Annually
MW-6A-108	Annually	Annually
MW-6A-116	Annually	Annually
MW-6A-117	Annually	Annually
MW-6A-120	Annually	Annually
MW-6A-121	Annually	Annually
MW-6A-122	Annually	Annually

Table 4 Groundwater Protection Standards

HAZARDOUS CONSTITUENT	GROUNDWATER PROTECTION STANDARD[1] [mg/L]
Site 3 – Laundry	
Tetrachloroethylene	0.005
Trichloroethylene	0.005
cis-1,2-Dichloroethylene	0.07
trans-1,2-Dichloroethylene	0.1
Vinyl Chloride	0.002
Chloroform	0.080
Site 7A – Barrel Storage Area No. 1	
Tetrachloroethylene	0.005
Trichloroethylene	0.005
cis-1,2-Dichloroethylene	0.07
trans-1,2-Dichloroethylene	0.1
Vinyl Chloride	0.002
Carbon Tetrachloride	0.005
Dieldrin[2]	1.8
beta-BHC[2]	0.25
TPH (RRO)[3]	1.1
Site 6A – MOGAS	
Benzene	0.005
Ethylbenzene	0.7
Toluene	1.0
Xylenes (total)	10
2-Methylnaphthalene[2]	0.036
2,4-Dimethylphenol[2]	0.36
Naphthalene[2]	0.00012
Methyl ethyl ketone[2]	5.6

Notes:

[1] Groundwater Protection Standards reflect the EPA MCLs.

[2] No EPA MCL established for this constituent; Groundwater Protection Standard reflects the EPA Human Health RSL (TR=1E-06, THQ=1.0).

[3] No EPA MCL or RSL for this constituent; Groundwater Protection Standard reflects the 18 AAC 75 Table C cleanup level.

AAC = Alaska Administrative Code
EPA = U.S. Environmental Protection Agency
MCL = Maximum Contaminant Level
mg/L = milligrams per liter
RSL = Regional Screening Level
THQ = target hazard quotients
TR = target cancer risk

RCRA Permit No. AK9690330742 Record of Modification (From 2019 Update)

DATE	DESCRIPTION	REMOVE PAGES	INSERT PAGES

Requested 10/2020	Permit Text
	Minor editorial modifications:
	• Moved "List of Attachments" to follow TOC
	  ○ Revised document hierarchy as follows: Permit > Attachment > Appendix > Exhibit
	• Updated and corrected permit outline formatting/numbering
	• Rearranged "Definitions" section to be alphabetical
	• Revised corrective actions for Sites 3 & 7A
	  ○ AS/SVE operated as contingency-only
	  ○ Reassigned Appendix IX wells to reflect wells within plume area
	• Incorporated Appendix IX analytes as Table 5
		--	--

Requested 10/2020	Attachment 1: Part A Application: • Reinserted Part A Application (removed during 2019 update) • Updated contact information • Updated Waste Codes Facility Description: • Updated Facility Description and History • Updated climate data • Incorporated 2017 tsunami inundation scenario study	--	Part A Application
Requested 10/2020	Attachment 2: Waste Analysis Plan: • Minor editorial updates (formatting, etc.) to text • Updates to waste types and management • Revised procedural flow charts Attachment 2, Appendix A: Example Waste Profile: • Updated Hazardous Waste Profile Sheet Attachment 2, Appendix B: Sampling Standard Operating Procedures: • No change Attachment 2, Appendix C: Field Verification Checklist: • Minor editorial updates (formatting, etc.)	Entire Attachment Entire Attachment Cover Page Entire Attachment	Entire Attachment Entire Attachment Cover Page Entire Attachment

RCRA Permit No. AK9690330742 Record of Modification (From 2019 Update)

DATE	DESCRIPTION	REMOVE PAGES	INSERT PAGES
Requested 10/2020	Attachment 3: Personnel Training Outline: • Minor editorial updates (formatting, etc.) • No USCG edits received	Entire Attachment	Entire Attachment
Requested 10/2020	Attachment 4A: Consolidated Post-Closure Plan – Sites 3, 6A, 7A: • Reinserted Figures (removed during 2019 update) • Revised corrective actions to reflect AS/SVE contingency-only operation • Revised analytical methods • Revised designated Appendix IX wells	Entire Attachment	Entire Attachment
	Attachment 4A, Appendix A: RCRA Quarterly Sampling and Analysis Plan: • Minor editorial updates (formatting, etc.) to text. • Minor updates to tables, standard operating procedures, and field forms. ○ Turbidity stability parameters edited to allow stability at 3 consecutive readings under 10 NTU • Edits to reduce redundancies with the QAPP • Moved "Health and Safety" to *Consolidated Post-Closure Plan*	Entire Attachment	Entire Attachment
	Attachment 4A, Appendix B: Post-Closure Groundwater Monitoring Quality Assurance Project Plan: • Significant updates (analytical methods, data validation [e.g. application of data flags], etc.) to align with industry standards and updates to permit text. • Table updates to consolidate and clarify information presentation • Edits to reduce redundancies with the SAP • Moved "Organization and Responsibilities" to *Consolidated Post-Closure Plan*	Entire Attachment	Entire Attachment
Requested 10/2020	Attachment 4B: Closure Plan for the Hazardous Waste Storage Building (Building N-48): • Minor editorial and formatting updates • No USCG edits received	Entire Attachment	Entire Attachment

RCRA Permit No. AK9690330742 Record of Modification (From 2019 Update)

DATE	DESCRIPTION	REMOVE PAGES	INSERT PAGES
Requested 10/2020	Attachment 5: Container Storage Area Plans and Specification Process Information: • Minor editorial and formatting updates • Updates and clarification to descriptions • Updates to HWSB layout and maximum storage configuration	Entire Attachment	Entire Attachment
Requested 10/2020	Attachment 6: Procedures to Prevent Hazards: • Minor editorial and formatting updates • Minor updates to inspection text	Entire Attachment	Entire Attachment
Requested 10/2020	Attachment 7: Solid Waste Management Units and Schedule of Compliance: • Minor editorial and formatting updates • Significant updates to sites and dates based on historical activities and current status	Entire Attachment	Entire Attachment
Requested 10/2020	Attachment 8: RCRA Corrective Action Plan: • Minor editorial and formatting updates • No changes to content	Cover Page	Cover Page
Requested 10/2020	Attachment 9: Well Decommissioning Plan: • Minor editorial and formatting updates • No substantive changes to content	Entire Attachment	Entire Attachment
Requested 10/2020	Attachment 10: Land Use Control Assurance Plan for Environmental Cleanup Activities: • Minor editorial and formatting updates Attachment 10, Appendix A: List of Sites Requiring Land Use Control Measures: • Minor editorial and formatting updates • Added Site 9 – AVGAS Hill Attachment 10, Appendix B: General Services Administration Memo, October 16, 1998: • No changes to content Attachment 10, Appendix C: Agency Contacts: • No changes to content	Entire Attachment Entire Attachment Cover Page Cover Page	Entire Attachment Entire Attachment Cover Page Cover Page

RCRA Permit No. AK9690330742 Record of Modification (From 2019 Update)

DATE	DESCRIPTION	REMOVE PAGES	INSERT PAGES
	Attachment 10, Appendix D: Five Year Review Criteria: • No changes to content	Cover Page	Cover Page
	Attachment 10, Appendix E: Land Use Control Implementation Plans: • Minor editorial and formatting updates and edits to mirror layout and organization • Updated narratives for each Site to reflect recent historical activities and latest pertinent references • Added Site 9 – AVGAS Hill • Added Site 22 – AKDOT Maintenance Area	Entire Attachment	Entire Attachment
Requested 10/2020	Attachment 11: Summaries of Selected Remedies: • Minor editorial and formatting updates • Draft or Final CMI plans (where available / complete) incorporated as appendices	Entire Attachment	Entire Attachment

RCRA SUBTITLE C ACTIVITIES FORMS

United States Environmental Protection Agency
RCRA SUBTITLE C SITE IDENTIFICATION FORM

1. Reason for Submittal (Select only one.)

☐	Obtaining or updating an EPA ID number for an on-going regulated activity that will continue for a period of time. (Includes HSM activity)
☐	Submitting as a component of the Hazardous Waste Report for _____ (Reporting Year)
	☐ Site was a TSD facility and/or generator of ≥ 1,000 kg of non-acute hazardous waste, > 1 kg of acute hazardous waste, or > 100 kg of acute hazardous waste spill cleanup in **one or more months of the reporting year** (or State equivalent LQG regulations)
☐	Notifying that regulated activity is no longer occurring at this Site
☐	Obtaining or updating an EPA ID number for conducting Electronic Manifest Broker activities
☑	Submitting a new or revised Part A Form

2. Site EPA ID Number

A	K	9	6	9	0	3	3	0	7	4	2

3. Site Name

USDHS USCG Base Kodiak

4. Site Location Address

Street Address **Anton Larson Bay Road and Rezanof Highway**		
City, Town, or Village **Kodiak**		County **Kodiak Island**
State **Alaska**	Country **USA**	Zip Code **99619**

5. Site Mailing Address

☐ Same as Location Address

Street Address **PO Box 195025**		
City, Town, or Village **Kodiak**		
State **Alaska**	Country **USA**	Zip Code **99619**

6. Site Land Type

☐ Private ☐ County ☐ District ☑ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

7. North American Industry Classification System (NAICS) Code(s) for the Site (at least 5-digit codes)

A. (Primary)	**922190**	C.	
B.	**928110**	D.	

8. Site Contact Information

☐ Same as Location Address

First Name **Scott**	MI	Last Name **Griffin**
Title **Environmental Protection Specialist**		
Street Address **HWSB Building N48 Storis Drive**		
City, Town, or Village **Kodiak**		
State **Alaska**	Country **USA**	Zip Code **99619**
Email **scott.e.griffin@uscg.mil**		
Phone **907.487.5588**	Ext	Fax

9. Legal Owner and Operator of the Site

A. Name of Site's Legal Owner

☐ Same as Location Address

Full Name **United States Coast Guard**	Date Became Owner (mm/dd/yyyy) **1/1/1972**

Owner Type

☐ Private ☐ County ☐ District ☑ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

Street Address **HWSB Building N48 Storis Drive**		
City, Town, or Village **Kodiak**		
State **Alaska**	Country **USA**	Zip Code **99619**
Email		
Phone	Ext	Fax
Comments		

B. Name of Site's Legal Operator

☐ Same as Location Address

Full Name **United States Coast Guard**	Date Became Operator (mm/dd/yyyy) **1/1/1972**

Operator Type

☐ Private ☐ County ☐ District ☑ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

Street Address **HWSB Building N48 Storis Drive**		
City, Town, or Village **Kodiak**		
State **Alaska**	Country **USA**	Zip Code **99619**
Email		
Phone	Ext	Fax
Comments		

10. Type of Regulated Waste Activity (at your site)

Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

☑ Y ☐ N	1. Generator of Hazardous Waste—If "Yes", mark only one of the following—a, b, c	
☑	a. LQG	-Generates, in any calendar month (includes quantities imported by importer site) 1,000 kg/mo (2,200 lb/mo) or more of non-acute hazardous waste; or - Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or - Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.
☐	b. SQG	100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.
☐	c. VSQG	Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.
☐ Y ☑ N	2. Short-Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section. *Note: If "Yes", you MUST indicate that you are a Generator of Hazardous Waste in Item 10.A.1 above.*	
☑ Y ☐ N	3. Treater, Storer or Disposer of Hazardous Waste—Note: Part B of a hazardous waste permit is required for these activities.	
☑ Y ☐ N	4. Receives Hazardous Waste from Off-site	
☐ Y ☑ N	5 Recycler of Hazardous Waste	
☐	a. Recycler who stores prior to recycling	
☐	b. Recycler who does not store prior to recycling	
☐ Y ☑ N	6. Exempt Boiler and/or Industrial Furnace—If "Yes", mark all that apply.	
☐	a. Small Quantity On-site Burner Exemption	
☐	b. Smelting, Melting, and Refining Furnace Exemption	

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

D001	D006	D011	D029	F001	F027	U002
D002	D007	D013	D035	F002	F039	U043
D003	D008	D018	D039	F003	P001	U044
D004	D009	D021	D040	F004	P042	U080
D005	D010	D022	D043	F005	P106	U112

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

11. Additional Regulated Waste Activities (NOTE: Refer to your State regulations to determine if a separate permit is required.)

A. Other Waste Activities

☑ Y ☐ N	1. Transporter of Hazardous Waste—If "Yes", mark all that apply.
☑	a. Transporter
☑	b. Transfer Facility (at your site)
☐ Y ☑ N	2. Underground Injection Control
☐ Y ☑ N	3. United States Importer of Hazardous Waste
☐ Y ☑ N	4. Recognized Trader—If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter
☐ Y ☑ N	5. Importer/Exporter of Spent Lead-Acid Batteries (SLABs) under 40 CFR 266 Subpart G—If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter

B. Universal Waste Activities

☑ Y ☐ N	1. Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more) - If "Yes" mark all that apply. Note: Refer to your State regulations to determine what is regulated.
☑	a. Batteries
☑	b. Pesticides
☑	c. Mercury containing equipment
☑	d. Lamps
☑	e. Other (specify) _Aerosols_____
☐	f. Other (specify) _____
☐	g. Other (specify) _____
☐ Y ☑ N	2. Destination Facility for Universal Waste Note: A hazardous waste permit may be required for this activity.

C. Used Oil Activities

☑ Y ☐ N	1. Used Oil Transporter—If "Yes", mark all that apply.
☑	a. Transporter
☐	b. Transfer Facility (at your site)
☑ Y ☐ N	2. Used Oil Processor and/or Re-refiner—If "Yes", mark all that apply.
☑	a. Processor
☐	b. Re-refiner
☐ Y ☑ N	3. Off-Specification Used Oil Burner
☑ Y ☐ N	4. Used Oil Fuel Marketer—If "Yes", mark all that apply.
☐	a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner
☑	b. Marketer Who First Claims the Used Oil Meets the Specifications

D. Pharmaceutical Activities

☑ Y ☐ N	1. Operating under 40 CFR 266 Subpart P for the management of hazardous waste pharmaceuticals—if "Yes", mark only one. Note: See the item-by-item instructions for definitions of healthcare facility and reverse distributor.
☐	a. Healthcare Facility
☑	b. Reverse Distributor
☐ Y ☑ N	2. Withdrawing from operating under 40 CFR 266 Subpart P for the management of hazardous waste pharmaceuticals. Note: You may only withdraw if you are a healthcare facility that is no longer an LQG or SQG.

12. Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR 262 Subpart K.

☐ Y ☑ N	A. Opting into or currently operating under 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories— If "Yes", mark all that apply. Note: See the item-by-item instructions for definitions of types of eligible academic entities.
☐	1. College or University
☐	2. Teaching Hospital that is owned by or has a formal written affiliation with a college or university
☐	3. Non-profit Institute that is owned by or has a formal written affiliation with a college or university
☐ Y ☑ N	B. Withdrawing from 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories.

13. Episodic Generation

☐ Y ☑ N	Are you an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves you to a higher generator category. If "Yes", you must fill out the Addendum for Episodic Generator?

14. LQG Consolidation of VSQG Hazardous Waste

☐ Y ☑ N	Are you an LQG notifying of consolidating VSQG Hazardous Waste Under the Control of the Same Person pursuant to 40 CFR 262.17(f)? If "Yes", you must fill out the Addendum for LQG Consolidation of VSQGs hazardous waste.

15. Notification of LQG Site Closure for a Central Accumulation Area (CAA) (optional) OR Entire Facility (required)

☐ Y ☑ N	LQG Site Closure of a Central Accumulation Area (CAA) or Entire Facility.
	A. ☐ Central Accumulation Area (CAA) or ☐ Entire Facility
	B. Expected closure date: _____ mm/dd/yyyy
	C. Requesting new closure date: _____ mm/dd/yyyy
	D. Date closed : _____ mm/dd/yyyy ☐ 1. In compliance with the closure performance standards 40 CFR 262.17(a)(8) ☐ 2. Not in compliance with the closure performance standards 40 CFR 262.17(a)(8)

16. Notification of Hazardous Secondary Material (HSM) Activity

☐ Y ☑ N	Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 260.30, 40 CFR 261.4(a)(23), (24), (25), or (27)? If "Yes", you must fill out the Addendum to the Site Identification Form for Managing Hazardous Secondary Material.

17. Electronic Manifest Broker

☐ Y ☑ N	Are you notifying as a person, as defined in 40 CFR 260.10, electing to use the EPA electronic manifest system to obtain, complete, and transmit an electronic manifest under a contractual relationship with a hazardous waste generator?

18. Comments (include item number for each comment)

10B-Additional EPA waste codes: U114, U121, U122, U151, U154, U159, U161, U165, U188, U210, U220, U226, U227, U228, U239, U248, and U359

19. Certification I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations. **Note: For the RCRA Hazardous Waste Part A permit Application, all owners and operators must sign (see 40 CFR 270.10(b) and 270.11)**.

Signature of legal owner, operator or authorized representative	Date (mm/dd/yyyy)
Printed Name (First, Middle Initial Last) **Scott E Griffin**	Title **Environmental Protection Specialist**
Email **scott.e.griffin@uscg.mil**	

Signature of legal owner, operator or authorized representative	Date (mm/dd/yyyy)
Printed Name (First, Middle Initial Last)	Title
Email	

ADDENDUM TO THE SITE IDENTIFICATION FORM:
NOTIFICATION OF HAZARDOUS SECONDARY MATERIAL ACTIVITY

ONLY fill out this form if:

- You are located in a State that allows you to manage excluded hazardous secondary material (HSM) under 40 CFR 260.30, 261.4(a)(23), (24), (25), or (27) (or state equivalent; See https://www.epa.gov/epawaste/hazard/dsw/statespf.htm for a list of eligible states; AND
- You are or will be managing excluded HSM in compliance with 40 CFR 260.30, 261.4(a)(23), (24), (25), or (27) (or state equivalent) or have stopped managing excluded HSM in compliance with the exclusion(s) and do not expect to manage any amount of excluded HSM under the exclusion(s) for at least one year. Do not include any information regarding your hazardous waste activities in this section. Note: If your facility was granted a solid waste variance under 40 CFR 260.30 prior to July 13, 2015, your management of HSM under 40 CFR 260.30 is grandfathered under the previous regulations and you are not required to notify for the HSM management activity excluded under 40 CFR 260.30.

1. Reason for Notification (Include dates where requested)

☐ Facility will begin managing excluded HSM as of _____ (mm/dd/yyyy).

☐ Facility is still managing excluded HSM/re-notifying as required by March 1 of each even-numbered year.

☐ Facility has stopped managing excluded HSM as of _____ (mm/dd/yyyy) and is notifying as required.

2. Description of Excluded HSM Activity. Please list the appropriate codes (see Code List section of the instructions) and quantities, in short tons, to describe your excluded HSM activity ONLY (do not include any information regarding your hazardous wastes). Use additional pages if more space is needed.

A. Facility Code	B. Waste Code(s) for HSM	C. Estimate Short Tons of excluded HSM to be managed annually	D. Actual Short Tons of excluded HSM that was managed during the most recent odd-numbered year	E. Land-based Unit Code

ADDENDUM TO THE SITE IDENTIFICATION FORM: EPISODIC GENERATOR

ONLY fill out this form if:

- You are an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more then 60 days, that moves the generator to a higher generator category pursuant to 40 CFR 262 Subpart L. Note: Only one planned and one unplanned episodic event are allowed within one year; otherwise, you must follow the requirements of the higher generator category. Use additional pages if more space is needed.

Episodic Event	
1. Planned ☐ Excess chemical inventory removal ☐ Tank cleanouts ☐ Short-term construction or demolition ☐ Equipment maintenance during plant shutdowns ☐ Other _____	2. Unplanned ☐ Accidental spills ☐ Production process upsets ☐ Product recalls ☐ "Acts of nature" (Tornado, hurricane, flood, etc.) ☐ Other _____
3. Emergency Contact Phone	4. Emergency Contact Name
5. Beginning Date _____ (mm/dd/yyyy)	6. End Date _____ (mm/dd/yyyy)

Waste 1

7. Waste Description				8. Estimated Quantity (in pounds)	
9. Federal and/or State Hazardous Waste Codes					

Waste 2

7. Waste Description				8. Estimated Quantity (in pounds)	
9. Federal and/or State Hazardous Waste Codes					

Waste 3

7. Waste Description				8. Estimated Quantity (in pounds)	
9. Federal and/or State Hazardous Waste Codes					

ADDENDUM TO THE SITE IDENTIFICATION FORM: LQG CONSOLIDATION OF VSQG HAZARDOUS WASTE

ONLY fill out this form if:

- You are an LQG receiving hazardous waste from VSQGs under the control of the same person. Use additional pages if more space is needed.

VSQG 1		
1. EPA ID Number (if assigned)	2. Name	
3. Street Address		
4. City, Town, or Village	5. State	6. Zip Code
7. Contact Phone Number	8. Contact Name	
9. Email		

VSQG 2		
1. EPA ID Number (if assigned)	2. Name	
3. Street Address		
4. City, Town, or Village	5. State	6. Zip Code
7. Contact Phone Number	8. Contact Name	
9. Email		

VSQG 3		
1. EPA ID Number (if assigned)	2. Name	
3. Street Address		
4. City, Town, or Village	5. State	6. Zip Code
7. Contact Phone Number	8. Contact Name	
9. Email		

United States Environmental Protection Agency
HAZARDOUS WASTE REPORT _____ (reporting cycle)
WASTE GENERATION AND MANAGEMENT (GM) FORM

1. **Waste Characteristics**

A. Waste Description						
B. EPA Hazardous Waste Code(s)						
C. State Hazardous Waste Code(s)						

D. Source Code	Management Method (G25)	Country Code (G62)	
E. Form Code	F. Waste Minimization Code	G. Radioactive Mixed ☐ Y ☐ N	
H. Quantity	UOM	Density	☐ lbs/gal ☐ sg

2. **On-site Generation and Management of Hazardous Waste**

☐ Y ☐ N	Was any of this waste that was generated at this facility treated, disposed, and/or recycled on-site? If yes, continue to On-site Process System 1.	
Process System 1	Management Method Code	Quantity
Process System 2	Management Method Code	Quantity

3. **Off-site Shipment of Hazardous Waste**

☐ Y ☐ N	A. Was any of this waste that was generated at this facility shipped off-site for treatment, disposal, or recy-		
Site 1			
B. EPA ID of facility to which waste was shipped	C. Management Method Code	D. Total Quantity Shipped	
Site 2			
B. EPA ID of facility to which waste was shipped	C. Management Method Code	D. Total Quantity Shipped	
Site 3			
B. EPA ID of facility to which waste was shipped	C. Management Method Code	D. Total Quantity Shipped	

4. **Comments**

United States Environmental Protection Agency
HAZARDOUS WASTE REPORT _____ (reporting year)
WASTE RECEIVED FROM OFF-SITE (WR) FORM

1. Waste 1

A. Waste Description						
B. EPA Hazardous Waste Code(s)						
C. State Hazardous Waste Code(s)						
D. EPA ID Number		E. Form Code		F. Management Code		
G. Quantity	UOM	Density		☐ lbs/gal ☐ sg		

2. Waste 2

A. Waste Description						
B. EPA Hazardous Waste Code(s)						
C. State Hazardous Waste Code(s)						
D. EPA ID Number		E. Form Code		F. Management Code		
G. Quantity	UOM	Density		☐ lbs/gal ☐ sg		

3. Waste 3

A. Waste Description						
B. EPA Hazardous Waste Code(s)						
C. State Hazardous Waste Code(s)						
D. EPA ID Number		E. Form Code		F. Management Code		
G. Quantity	UOM	Density		☐ lbs/gal ☐ sg		

4. Comments

United States Environmental Protection Agency
HAZARDOUS WASTE REPORT
OFF-SITE IDENTIFICATION (OI) FORM

1. Site 1

A. EPA ID Number of Off-site Installation or Transporter		
B. Name of Off-site Installation or Transporter		
C. Handler Type (mark all that apply) ☐ Generator	☐ Transporter	☐ Receiving Facility
D. Address of Off-site Installation		
Street Address		
City, Town, or Village		
State	Zip Code	Country

2. Site 2

A. EPA ID Number of Off-site Installation or Transporter		
B. Name of Off-site Installation or Transporter		
C. Handler Type (mark all that apply) ☐ Generator	☐ Transporter	☐ Receiving Facility
D. Address of Off-site Installation		
Street Address		
City, Town, or Village		
State	Zip Code	Country

3. Site 3

A. EPA ID Number of Off-site Installation or Transporter		
B. Name of Off-site Installation or Transporter		
C. Handler Type (mark all that apply) ☐ Generator	☐ Transporter	☐ Receiving Facility
D. Address of Off-site Installation		
Street Address		
City, Town, or Village		
State	Zip Code	Country

4. **Comments**

United States Environmental Protection Agency

HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name	**Scott**	MI		Last Name	**Griffin**
Title	**Environmental Protection Specialist**				
Email					
Phone	**907.487.5588**	Ext		Fax	

2. Facility Permit Contact Mailing Address

Street Address	**HWSB Building N48 Storis Drive**		
City, Town, or Village	**Kodiak**		
State **Alaska**	Country **USA**	Zip Code **99619**	

3. Facility Existence Date (mm/dd/yyyy)

1/1/1972

4. Other Environmental Permits

A. Permit Type	B. Permit Number	C. Description
E	LAS 1140 8	Water Appropriation Permit
E	9825-DB00 1	Facility Wastewater Permit
E	ORL0000 9 3	Air Permit
E	Y012-SC00 8	Open Burn Permit
E	AKR05AG10	Stormwater Discharge Permit

5. Nature of Business

Coast Guard at Kodiak, Alaska includes eight (8) independent Coast Guard units with missions including search and rescue, maintenance of aids to navigation, enforcement of laws and treaties, and marine safety. Tenant activities are also located at Base Kodiak.

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity		C. Process Total Number of Units	D. Unit Name
					(1) Amount	(2) Unit of Measure		
	1	S	0	1	14080	G	001	

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes								
								(1) Process Codes								(2) Process Description (if code is not entered in 7.D1))
	1	D	0	0	1	54,000	P	S	0	1						
	2	D	0	0	2	19,000	P	S	0	1						
	3	D	0	0	3	600	P	S	0	1						
	4	D	0	0	4	100	P	S	0	1						
	5	D	0	0	5	2,000	P	S	0	1						
	6	D	0	0	6	3,000	P	S	0	1						
	7	D	0	0	7	1,500	P	S	0	1						
	8	D	0	0	8	5,500	P	S	0	1						
	9	D	0	0	9	500	P	S	0	1						
1	0	D	0	1	0	500	P	S	0	1						
																(Cont'd next page)

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity		C. Process Total Number of Units	D. Unit Name
					(1) Amount	(2) Unit of Measure		

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes								
								(1) Process Codes								(2) Process Description (if code is not entered in 7.D1))
1	1	D	0	1	1	500	P	S	0	1						
1	2	D	0	1	3	100	P	S	0	1						
1	3	D	0	1	8	500	P	S	0	1						
1	4	D	0	2	1	500	P	S	0	1						
1	5	D	0	2	2	100	P	S	0	1						
1	6	D	0	2	9	100	P	S	0	1						
1	7	D	0	3	5	500	P	S	0	1						
1	8	D	0	3	9	500	P	S	0	1						
1	9	D	0	4	0	500	P	S	0	1						
2	0	D	0	4	3	100	P	S	0	1						
																(Cont'd next page)

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity (1) Amount	B. Process Design Capacity (2) Unit of Measure	C. Process Total Number of Units	D. Unit Name

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes (1) Process Codes								D. Processes (2) Process Description (if code is not entered in 7.D1))
2	1	F	0	0	1	3,000	P	S	0	1						
2	2	F	0	0	2	2,000	P	S	0	1						
2	3	F	0	0	3	500	P	S	0	1						
2	4	F	0	0	4	100	P	S	0	1						
2	5	F	0	0	5	500	P	S	0	1						
2	6	F	0	2	7	100	P	S	0	1						
2	7	F	0	3	9	100	P	S	0	1						
2	8	P	0	0	1	200	P	S	0	1						
2	9	P	0	4	2	200	P	S	0	1						
3	0	P	1	0	6	1	P	S	0	1						
																(Cont'd next page)

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity (1) Amount	B. Process Design Capacity (2) Unit of Measure	C. Process Total Number of Units	D. Unit Name

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes (1) Process Codes								D. Processes (2) Process Description (if code is not entered in 7.D1))
3	1	U	0	0	2	500	P	S	0	1						
3	2	U	0	4	3	500	P	S	0	1						
3	3	U	0	4	4	500	P	S	0	1						
3	4	U	0	8	0	500	P	S	0	1						
3	5	U	1	1	2	500	P	S	0	1						
3	6	U	1	1	4	500	P	S	0	1						
3	7	U	1	2	1	500	P	S	0	1						
3	8	U	1	2	2	500	P	S	0	1						
3	9	U	1	5	1	500	P	S	0	1						
4	0	U	1	5	4	500	P	S	0	1						
																(Cont'd next page)

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity (1) Amount	B. Process Design Capacity (2) Unit of Measure	C. Process Total Number of Units	D. Unit Name

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes (1) Process Codes									D. Processes (2) Process Description (if code is not entered in 7.D1))
4	1	U	1	5	9	500	P	S	0	1							
4	2	U	1	6	1	500	P	S	0	1							
4	3	U	1	6	5	500	P	S	0	1							
4	4	U	1	8	8	100	P	S	0	1							
4	5	U	2	1	0	500	P	S	0	1							
4	6	U	2	2	0	500	P	S	0	1							
4	7	U	2	2	6	500	P	S	0	1							
4	8	U	2	2	7	500	P	S	0	1							
4	9	U	2	2	8	500	P	S	0	1							
5	0	U	2	3	9		P	S	0	1							

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity		C. Process Total Number of Units	D. Unit Name
					(1) Amount	(2) Unit of Measure		

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes								
								(1) Process Codes								(2) Process Description (if code is not entered in 7.D1))
5	1	U	2	4	8	200	P	S	0	1						
5	2	U	3	5	9	100	P	S	0	1						

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

Draft
Attachment 1
Hazardous Waste Storage Building N-48 Facility Description

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 GENERAL DESCRIPTION [40 CFR 270.14(B)(1)] **1**

1.1 Kodiak Island 1
1.2 Base Kodiak 2
1.3 HWSB (Building N-48) 5

2.0 TOPOGRAPHIC MAPS [40 CFR 270.14(B)(19)] **7**

2.1 Topographic Maps 7
2.2 Wind Rose 7
2.3 Injection and Withdrawal Wells 7
2.4 Surrounding Land Use 7
2.5 Access Control 8
2.6 Other Structures 8

3.0 LOCATION INFORMATION **9**

3.1 Seismic Standard [40 CFR 264.18(a) and 40 CFR 270.14(b)(11)(i-ii)] 9
3.2 Floodplain Standard [40 CFR 264.18(b) and 40 CFR 270.14(b)(11)(iii-iv)] 9
3.3 Effects of the 1964 Earthquake on Base Kodiak 10

4.0 TRAFFIC INFORMATION [40 CFR 270.14(B)(10)] **11**

4.1 Offsite Traffic 11
4.2 Onsite Traffic 11
4.3 HWSB Traffic 11

5.0 REFERENCES **13**

TABLES

Table 1 Base Kodiak Hazardous Waste Management Units Closed Under Interim Status 15
Table 2 Scenario-Based Maximum Water Depth at Base Kodiak Locations 16

FIGURES

Figure 1 General Location Map
Figure 2 Hazardous Waste Storage Building
Figure 3 Base Kodiak Topography
Figure 4 Boundaries of Base Kodiak and Surrounding Land Uses
Figure 5 Wind Rose
Figure 6 Location of Beach House Well and Buskin Lake Pump House
Figure 7 Base Kodiak Scenario-Based Tsunami Inundation Levels

This page intentionally blank

ACRONYMS AND ABBREVIATIONS

ADOT&PF	Alaska Department of Transportation and Public Facilities
AIRSTA	Air Station
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
COMMSTA	Communications Station
ELT	Enforcement of Laws and Treaties
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
HWMU	Hazardous Waste Management Unit
HWSB	Hazardous Waste Storage Building
km	kilometers
LORAN	Long-Range Aid to Navigation
MHHW	Mean Higher High Water
mph	miles per hour
M_w	moment magnitude
NOAA	National Oceanic and Atmospheric Administration
RCRA	Resource Conservation and Recovery Act
SAR	Search and Rescue
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey

This page intentionally blank

1.0 GENERAL DESCRIPTION [40 CFR 270.14(B)(1)]

This section provides a general description of the U.S. Coast Guard (USCG) Base Kodiak as required by Code of Federal Regulations (CFR) Title 40 Part 270.14(b). This attachment addresses hazardous waste management activities at the Hazardous Waste Storage Building (HWSB), Building N-48. Additional Hazardous Waste Management Units (HWMUs) have been operated at Base Kodiak in the past by the Navy and the USCG. Some of these units were closed under interim status. Units at Base Kodiak that were closed under interim status are listed in Table 1. These units will not be discussed further in this section.

A Resource Conservation and Recovery Act (RCRA) Facility Assessment was prepared by the U.S. Environmental Protection Agency (EPA) in March 1991 that identified solid waste management units and areas of concern. RCRA Facility Investigations and/or Corrective Measures Studies are now being conducted on sites at Base Kodiak. Attachment 7 of the Permit provides a compliance schedule for these investigations.

This Attachment 1 is organized as follows. Section 1.0 provides a general description of Base Kodiak and the HWSB. Section 2.0 discusses topographic maps, land use, and wind rose data for Base Kodiak, along with supporting discussion. Section 3.0 contains location information and describes how Base Kodiak complies with seismic and floodplain standards at the HWSB. Section 4.0 contains information on traffic volume and controls at Base Kodiak for both onsite and offsite traffic.

1.1 Kodiak Island

Base Kodiak is located approximately 8 miles south of the City of Kodiak in the eastern portion of Kodiak Island, Alaska (Figure 1). Kodiak Island covers 3,588 square miles, the second largest island in North America. It lies in the western half of the Gulf of Alaska, 300 miles south of Anchorage. It is separated from the Alaska Peninsula by Shelikof Strait. Kodiak Island is isolated and completely dependent on air and sea connections for the movement of people and goods. Major commercial air carriers and all military air operations use the Kodiak Airport located on USCG property adjacent to the Base Kodiak main complex. A portion of the airfield is leased by the USCG to the State of Alaska for operation of the Kodiak State Airport. Access to the outlying villages is by small aircraft, helicopter or boat. The Alaska Marine Highway system operates ferry service to the mainland and other islands. The terrain of the eastern part of Kodiak Island consists of mountains and fjords. Inland from Base Kodiak, the land rises steeply to the peaks of Old Womens Mountain - elevation 1,300 feet, Pyramid Mountain - elevation 2,400 feet, and Barometer Mountain - elevation 2,500 feet.

The flora of Kodiak Island includes grass, Sitka Spruce, balsam, poplar, cottonwood, willow and undergrowth shrubs including elderberry, blueberry, alder, salmonberry, and a variety of wildflowers. Fauna on Kodiak Island include the Kodiak brown bear, Roosevelt elk, Sitka black tail deer, caribou, fox, beaver, hare, mountain goats, river otter, marmot, parka squirrels, and weasels. Sea fauna include sea lions, sea otter, whales, dolphins, and a wide variety of invertebrates. Sea birds such as puffins, cormorants, kittiwakes, sea ducks and scores of other varieties can be found on Kodiak Island's shoreline.

The aquatic community surrounding Kodiak Island contains all five species of Pacific salmon: coho, chum, king, pink, and sockeye. Several bottom fish species are also present, such as ocean perch, cod, and halibut. In addition, the waters of Kodiak Island contain scallops, shrimp, crabs, octopus, sea anemones, butter and razor clams, chitons, tritons, sea urchins, segmented worms, jelly fish, limpits, snails, starfish, blue mussels, sea cucumbers, and barnacles.

Stratigraphic and geomorphic evidence suggests that three major glaciations occurred on Kodiak Island during middle to late Pleistocene time, separated by long periods of complete deglaciation. The present topography and surficial deposits are largely results of the last major glaciation.

Exposed bedrock covers much of the Kodiak Island, predominately in the higher elevations along the ridges of the mountain systems. The island has very little topsoil. In most places bedrock is only 3 to 10 feet below ground surface. Topsoil includes several layers of ash from volcanic eruptions on the Alaskan Peninsula. The mid and lower slopes are chiefly made up of well-drained, silty and find sandy-ash soils. Valley basins tend to consist of shallow loams.

There are no active volcanoes on Kodiak Island; however, several active volcanoes can be found across from the Kodiak Island group on the Shelikof Strait. These are composite volcanoes, termed "andesitic" due to the chemical composition of the magma, and are often violent and explosive by nature because of the viscous magma. Andesitic volcanoes do not pose serious problems for the Kodiak Island group. Eruptions are typically short in duration. Heavy ashfalls and acidic volcanic gases combined with precipitation produce corrosive rains. The ash and acidity of the atmosphere reduces or stops aircraft in the area but has little effect on the land.

Alaska's greatest recorded volcanic eruption was when the Novarupta Volcano erupted in 1912 covering the Shelikof Strait with an unbroken mass of pumice and volcanic ash reaching depths of 3 feet in isolated places on Kodiak Island. Ash varying in depth from 6 inches to 3 feet can be found at Base Kodiak. Mt. Augustine erupted in the winter of 1986 causing a heavy ashfall. Due to the distance of the volcano from Kodiak Island, the amount of ashfall received at Base Kodiak was very slight.

Kodiak Island is located approximately 190 miles northwest of an active zone of subduction along the Aleutian Trench. This is a major thrust zone experiencing frequent earthquake activity. The destructiveness of earthquakes is contingent on many variables, including magnitude, focal depth, distance from the epicenter, and local geological conditions. An earthquake that had a moment magnitude (M_w) of 9.2 struck the Prince William Sound region on March 27, 1964. It impacted many Alaska communities including Kodiak Island and the nearby islands. Substantial damage was caused by subsidence, seismic shaking, and seismic sea waves (tsunamis). Damage to residential, commercial, and USCG properties was estimated in 1964 to be more than $45,000,000. Section 3.3 of this Permit Attachment 1 contains a detailed discussion of the damage received by Base Kodiak during the 1964 earthquake and tsunami.

1.2 Base Kodiak

Base Kodiak is owned by the United States Government and operated by the USCG. Base Kodiak is utilized to provide a focus for North Pacific security, fisheries, and search and rescue activities. Base Kodiak employs approximately 2,500 individuals (military and civilian) and provides onsite housing for Base Kodiak personnel. The day- to-day conduct of many ancillary support functions at Base Kodiak involving non- military activities is contracted by the USCG to a Base Operating Support Service Contractor.

Base Kodiak is located on the northeastern coast of Kodiak Island, Alaska and covers an area of approximately 23,000 acres. Many of the buildings and structures at Base Kodiak are from the World War II era when the Department of Defense established a Naval Base on Kodiak Island to protect the approaches to the Gulf of Alaska and act as an intermediate point between other installations at Cold Bay and Sitka. As World War II came to an end, so did the need for the Naval Base. Between the years of 1947 and 1969, the U.S. Navy maintained activities on Kodiak Island; however, Navy activities on Kodiak Island were phased out and on July 1, 1972, the entire complex was turned over to USCG.

Base Kodiak is a Unit in District 17 under the Director of Operational Logistics. Base Kodiak's mission is strictly one of logistics and administrative support to a number of tenant and non-tenant Coast Guard units. USCG assets based at Base Kodiak include C-130 aircraft, helicopters, and homeported cutters whose missions are search and rescue, enforcement of laws and treaties, maintenance of navigational aids. Following is a more detailed description of the USCG operations based at Base Kodiak:

- Air Station Kodiak has aircraft for Search and Rescue (SAR), Aids to Navigation, maintenance support, maritime patrol, USCG logistics support, and Enforcement of Laws and Treaties (ELT).
- The Communications Station (COMMSTA) which provides support to all USCG missions and monitors distress radio traffic. Land dedicated to COMMSTA operations is used for antenna fields, a transmitter facility, a receiver site, and a network control facility.
- Sea-going buoy tenders that service aids to navigation and perform SAR and ELT from Kodiak to Adak and north to the Seward Peninsula. Medium endurance cutters that perform SAR and ELT patrols enforce fishery regulations in the same areas.
- Base Kodiak provides support to decommissioned Long-Range Aid to Navigation (LORAN) stations throughout District 17. Decommissioned LORAN stations are outside of the contiguous boundaries of Base Kodiak.
- Electronic Support Unit which provides repair support and technical assistance for Base Kodiak electronic equipment.
- A USCG Marine Safety Detachment unit whose primary responsibilities are commercial vessel safety, marine environmental protection and port security and safety. This unit also investigates chemical and oil pollution incidents, including pollution cleanup monitoring.
- Base Kodiak provides support to Forward Operations Locations that are seasonally operational throughout Alaska.

Additionally, cutters patrolling Alaska waters routinely schedule patrol breaks at Base Kodiak where they are provided with fuel and other services. Finally, Base Kodiak provides logistical support to decommissioned LORAN and ancillary facilities.

Maintenance and logistics support activities for USCG activities and units for which Base Kodiak provides support generate hazardous wastes. Typical waste streams from these activities include paint related waste, solvents and degreasers, and various batteries. Additionally, large volumes of fuel are stored at Base Kodiak. Occasional spills associated with fuel transfer and storage also results in the generation of hazardous waste. Hazardous waste is temporarily stored at the HWSB until such time that it is transported offsite to a RCRA facility for treatment, storage, or disposal. Some nonregulated hazardous material is also stored in the HWSB until such time it is sent offsite for recycling or disposal.

The majority of Base Kodiak operations occur in areas near the low-lying coastal areas along Womens Bay, and Nyman Peninsula. Nyman Peninsula is surrounded on three sides by Womens Bay, and therefore drains into Womens Bay. The only significant body of surface water on Nyman Peninsula is Peninsula Lake. Surface water at Base Kodiak consists of rivers and creeks, snowmelt, mountain and forest watershed runoff, and ground water seepage from bedrock outcrops onto Base Kodiak shores and beaches. Streams entering or on Base Kodiak include Devils Creek and the Buskin River. The Buskin River and its tributaries drain into St. Paul Harbor. Several freshwater lakes are also located on or near Base Kodiak including Lake Catherine, Lake Louise, Boy Scout Lake (Lake Genevieve), and Buskin Lake. Buskin Lake is the source of potable water for Base Kodiak. Figure 1 shows the location of surface waters with respect to Base Kodiak and the HWSB.

Most of Base Kodiak is characterized by a thin (less than 15 feet thick) sediment of glacial sediments, volcanic ash, organic soils, and fill materials overlying bedrock. Because of the low hydraulic conductivity and ineffective porosity of fractured bedrock, most ground water flow occurs in the overlying sediments. In areas of Base Kodiak with significant topographic expression, the water table follows topography, with recharge occurring along ridges and discharge in valleys to seeps, drainage ways, and the marine environment. Flow velocities and groundwater fluxes in these sediments are largely dependent on grain size, with sand and gravel fill and sandy matrix till providing preferential pathways for groundwater flow.

Geologic subsurface materials on Nyman Peninsula do not appear to be capable of yielding economic quantities of water. Nyman Peninsula borehole logs indicate an abundance of inconsistently stratified (heterogeneous) low permeability sediment overlying fractured bedrock and bedrock outcrops. Water levels are inconsistent across subsurface geologic materials; no one "unit" appears to be consistently saturated based on information gathered from borehole logs. Aquifer slug tests resulted in determination of low hydraulic conductivity, transmissivity, and storativity values indicating subsurface materials are low-yielding and of low permeability. Qualitative evaluations during well purging also indicate low well yields. These saturated materials, both sediments and bedrock, are not considered to be an aquifer per the regulatory definition, rather they are non-aquifer saturated zones.

Water levels in the vicinity of the HWSB were measured by the USCG in shallow and deep wells in 1988 and 1989. Measurements indicated that the surface of the water table is irregular with a water table high in the southeast portion of Nyman Peninsula. Water levels varied between 1 foot and 15 feet below ground surface depending on well location. Changes in groundwater elevation varied between approximately 0.5 feet and 3 feet with the highest water levels measured in October and the lowest values measured during February or March for most wells. Approximate water levels were recorded during drilling as well as subsequent static water levels. Although the difference between dynamic and static water levels ranges between 0.5 and 4 feet, the consistent rise in water level during equilibration to static conditions may be indicative of localized confined or semiconfined conditions. The water table indicates groundwater flow in the vicinity of the HWSB is northwest towards Womens Bay. Hydraulic conductivity tests to measure the rate of flow of water in the vicinity of the HWSB indicated flow in the range of 0.1 feet and 16 feet per day.

In addition to the USCG activities at Base Kodiak, property (land and buildings) within Base Kodiak boundaries is leased, granted, permitted, or otherwise encumbered to tenant organizations. A total of approximately 34,400 square feet of buildings on about 1,336 acres is currently leased to others by the USCG. The largest portion of leased property is 618 acres to the State of Alaska to operate the Kodiak State Airport. There are also leases for an Alaska State Park recreation site, Alaska Department of Transportation and Public Facilities (ADOT&PF) highway right-of- way, and power line rights-of-way with the Kodiak Electric Association. Because of on- going negotiations and constant changes, tenant organizations at Base Kodiak may vary. Following is a current listing of organizations who through leases, permits, or agreements maintain a physical presence at Base Kodiak:

- Federal Aviation Administration (FAA)
- National Oceanic and Atmospheric Administration (NOAA)
- U.S. Department of Health and Human Services - Peterson School (land only)
- National Marine Fisheries Service
- U.S. Navy
- Alaska State Airport, ADOT&PF
- Alaska Department of Fish and Game

- State Highway Right-of-Way, ADOT&PF
- Alaska State Parks
- Kodiak Electric Association
- FEDALASKA Credit Union
- NOAA, National Weather Service

Waste from Federal agencies which are tenant organizations at Base Kodiak is handled by the USCG. Other non-federal tenant organizations, including their sublessees that are hazardous waste generators are responsible for the management (treatment, storage, and disposal) of their own waste. The USCG takes no role in the management of hazardous waste generated by non-federal tenant organizations or their sublessees.

1.3 HWSB (Building N-48)

The HWSB is located in the northwestern portion of Nyman Peninsula, which extends southwest from the main portion of Base Kodiak into Womens Bay. The peninsula is approximately 1.5 miles long and 1,500 feet across, and is bordered along its northwest and southeast shores by Womens Bay. Figure 1 shows the location of the HWSB on Nyman Peninsula.

The HWSB is a one-story building constructed in 1988. It is 100 feet long and 28 feet wide. The building includes an entry area, an office (Room 102), a locker room (Room 103), a restroom, a shower room, a mechanical - storage room (Room 106), a waste handling and storage room (Room 107), a supply storage room (Room 108), and the waste handling and container storage area (Room 109). The storage room accounts for 1,792 square feet of the available floor space which provides a maximum storage capacity of 14,080 gallons. The remaining 1,008 square feet of floor space is occupied by the office area, the restroom and locker room, and the supply and storage rooms. Figure 2 shows the layout of the HWSB.

The container storage area is a 6-inch thick concrete slab surrounded by a 6-inch high concrete curb. The floor surface has been coated with a chemically resistant epoxy coating. The walls of the HWSB are wood coated with fire-retardant paint. An overhead door is located on the south side of the HWSB. The overhead door provides access into the container storage area during waste unloading and loading operations. The west end of the container storage area is the east wall of Room 107. Personnel and overhead doors in this wall provide access from the waste handling room (Room 107) to Room 109. The east wall of the container storage area is constructed of plywood. The design of the HWSB and the materials of construction are discussed in detail in Attachment 5 of the Permit.

This page intentionally blank

2.0 TOPOGRAPHIC MAPS [40 CFR 270.14(B)(19)]

This section presents topographic map information and supporting information on prevailing winds, withdrawal wells, surrounding land use, access controls, and other structures present.

2.1 Topographic Maps

A topographic map of the contiguous Base Kodiak is provided on Figure 3 and shows topographic contours, surface waters, streams, rivers, lakes, and the installation boundary. Only the portion of Base Kodiak north of Womens Bay is considered contiguous property, since the USCG does not control access to the waters of Womens Bay. Topographic maps of the three HWMUs on Base Kodiak are included in Attachment 4A of the RCRA Permit; these maps show features of the HWMUs, monitoring wells, and site features (EPA 2021). The boundaries of Base Kodiak, surrounding land uses, roads, and access controls are shown on Figure 4.

2.2 Wind Rose

A wind rose presented as an average by month for Base Kodiak is provided on Figure 5. It was generated using RStudio software with data collected from January 2010 through May 2020 at Station KDAA2-9457292 Kodiak Island, Alaska. The wind data was retrieved from NOAA's National Data Buoy Center (National Data Buoy Center 2020).

Prevailing winds at Base Kodiak are from the southwest for 7 months of the year; there is also a significant northeast wind most months. During April through August, prevailing winds blow from the northeast. The average wind speed depending on the month is between 3.5 and 6 knots, although the williwaw winds often blow from 60 to 100 knots.

2.3 Injection and Withdrawal Wells

There are no injection wells at Base Kodiak. Water supplies for Base Kodiak are provided from water treatment facilities located at the mouth of Buskin Lake, several miles north of the main residential and industrial area. Three water intakes are located near the source of the Buskin River, at the south end of Buskin Lake. Raw water is filtered and chlorinated at a nearby pump house before being piped to Base Kodiak. A dedicated well has been installed to provide water to a recreational "beach house" which is owned and operated by USCG and is located north of the mouth of the Buskin River. The well is over 100 feet in depth and is the only source of groundwater used by Base Kodiak. Figure 6 shows the beach house well and Buskin Lake Pump House locations.

2.4 Surrounding Land Use

The nearest populated areas to Base Kodiak are Bells Flats (approximately 4 miles south of Base Kodiak) and the City and Borough of Kodiak (approximately 8 miles north of Base Kodiak). The population of Kodiak Island and nearby islands according to a 1989 survey conducted by the Kodiak Island Convention and Visitors Bureau is 14,500. Commercial fishing is the backbone of Kodiak's economy. Major fishing activities include salmon, crab, halibut and other bottomfish, shrimp, and herring roe. Kodiak has traditionally been one of the largest U.S. ports in value of fish landed. The importance of the Kodiak fisheries has resulted in the growth of Kodiak as a regional center for state and federal agencies, primarily the USCG.

Most of the land surrounding Base Kodiak is classified as "native uncertified" in ownership. The Bureau of Land Management (BLM) is in the process of certifying it as native land through surveys, public and private ownership claims, appeal and distribution.

The largest neighbor to Base Kodiak is Koniag Incorporated - a native corporation. The corporation controls uncertified lands to the north and southwest of Base Kodiak and some certified land at Cliff Point north of the Holiday Beach site. The certified lands have been officially surveyed, title searched and publicly announced by the BLM. The titles for certified lands are conveyed to the corporation. Uncertified lands have not gone through this process. The BLM also owns a large area of property adjacent to Base Kodiak.

Two-thirds of Kodiak Island is dedicated as a National Wildlife Refuge. The area designated as the Refuge does not adjoin Base Kodiak; however, the LORAN Station at Narrow Cape is adjacent to the Refuge. Figure 4 shows the land use surrounding the contiguous Base Kodiak.

The federal government has leased its lands on Kodiak Island for open-range grazing of cattle, reindeer, and buffalo. Base Kodiak has no grazing requests or policies.

2.5 Access Control

Security at Base Kodiak is maintained by the following: (1) a 6-foot-high chain link fence surrounds the land side of the 23,000-acre area covered by Base Kodiak, (2) property warning signs, (3) surveillance patrols by USCG Military Police, 24 hours per day, 7 days per week, (4) security measures specific to the HWSB, such as warning signs and building security (administrative and physical controls). Access is further described in Attachment 6.

2.6 Other Structures

"Other structures" (in the regulations) refers to storm, sanitary and process sewerage systems; loading and unloading areas; fire control facilities; and intake/discharge structures. Sewerage systems, loading and unloading areas, and fire control facilities (fire department, fire hydrants, fire extinguisher, fire alarm systems, etc.) are described in detail in subsequent sections of this application.

3.0 LOCATION INFORMATION

3.1 Seismic Standard [40 CFR 264.18(a) and 40 CFR 270.14(b)(11)(i-ii)]

Base Kodiak is located in the Borough of Kodiak which is listed in 40 CFR 264 Appendix VI as being in a political jurisdiction which requires a demonstration of compliance with the location standard requirements found in 40 CFR 264.18(a) and 40 CFR 270.14(b)(11). In cooperation with the U.S. Geological Survey (USGS) Water Resources Division, several geologic studies were undertaken during 1988 by the Alaska Division of Geological and Geophysical Surveys to provide detailed information regarding bedrock and surficial deposits and seismic-refraction at Base Kodiak. Details of these studies have been published in *Bedrock Geology of U.S. Coast Guard Reservation, Kodiak, Alaska* (Solie and Reifenstuhl 1989) and *Shallow Seismic-Refraction Profiling of the U.S. Coast Guard Reservation, Kodiak, Alaska* (Allely 1989). These studies indicate fractures in bedrock outcrops and fractures which may also be faults; however, no faults which have had displacement in Holocene time are present, nor do lineations suggest the presence of a fault (which has displacement in Holocene time) within 3,000 feet of the HWSB.

3.2 Floodplain Standard [40 CFR 264.18(b) and 40 CFR 270.14(b)(11)(iii-iv)]

The major sources of flooding to the Nyman Peninsula would be from coastal waves caused by offshore storms and tsunamis. Tsunamis are traveling ocean waves whose origin is in deep water. Tsunamis occur as vertical columns of sea water which are displaced from submarine avalanches, displacement of sea floors, and vibrations from volcanic and seismic activities. Tsunamis usually occur as a series, gradually increasing in height, then gradually lessening. Tsunamis are, therefore, frequently observed as slightly higher tides or a fast rising tide and not as a single wave.

During the 1964 Alaska earthquake that struck in southcentral Alaska, Kodiak Island was severely impacted by tectonic subsidence and seismic sea waves. The former Kodiak Naval Station was affected by 5.6 feet of tectonic subsidence and at least 10 seismic waves that flooded low lying areas of Kodiak Island; the maximum sea wave height at the station was 25 feet above post-earthquake Mean Lower Low Water level (Kachadoorian and Plafker 1967). Following the 1964 earthquake, a 100-year tsunami elevation was established, and subsequent studies provided tsunami hazard maps for Kodiak. In 2017, the potential tsunami hazards to the communities of Kodiak, Womens Bay, and Base Kodiak were re-evaluated and presented in a report the updates the previously published reports (Suleimani et al. 2017). The potential hazards were evaluated with numerical modeling of inundation levels by tsunamis generated by hypothetical earthquakes. Updated tsunami inundation models were created from simulations using bathymetric and topographic data corresponding to Mean Higher High Water (MHHW) tide level and, as a conservative approach, assuming the tsunami waves reach the communities at high tide.

Figure 7 presents the scenario-based tsunami inundation levels for four scenarios modeled in the report. Scenario 1 is the inundation level from the rupture model of the 1964 M_w 9.2 earthquake. The maximum expected inundation level at Base Kodiak is presented by Scenario 6; it is a model of a M_w 9.1 earthquake rupturing near Kodiak Island on the Aleutian megathrust with an epicenter 15 to 25 kilometers (km) (approximately 9 to 15 miles) deep (Suleimani et al. 2017). The HWSB, located at an approximate elevation of 56 feet (17.1 meters), is not located in the area of probable inundation. However, a significant portion of Base Kodiak would be inundated by water in Scenario 6, the worst-case scenario. Table 2 presents descriptions of the 10 modeled scenarios as well as the maximum water depth per scenario at two Base Kodiak locations (both shown on Figure 7): USCG Hangars and the Kodiak Tide Gauge. The Kodiak Tide Gauge is located on Base Kodiak along Inner Womens Bay on the North Cargo Pier; the maximum

water depth above sea level in Scenario 6 (worst-case scenario) is 14.7 meters (48 feet) at this location. In the same scenario, the maximum water level above the ground surface on the tarmac is 10 meters (32 feet).

Coastal wave flooding occurs more frequently than tsunamis. The U.S. Army Corps of Engineers as part of a study for the Emergency Flooding Range Program for the City of Kodiak has determined the coastal storm wave height at 20.0 feet. The elevation of the HWSB is 56 feet; thus, it is not subject to coastal flooding.

The only significant body of surface water on Nyman Peninsula is Peninsula Lake. A floodplain study of Base Kodiak has not been conducted. However, a 1981 study by the U.S. Army Corps of Engineers indicated that river flooding was not a threat at Base Kodiak, and no flood insurance was required. There are no flood control or drainage barriers on Base Kodiak. All major buildings including the HWSB have floor levels at least 8 feet above mean sea level. The average annual rainfall on Kodiak Island is approximately 59.12 inches per year and snowfall is 63 inches per year (Western Regional Climate Center 2020).

3.3 Effects of the 1964 Earthquake on Base Kodiak

From 1939 through 1972 the Department of Defense operated a U.S. Navy base at what is today Base Kodiak. The base, the Kodiak Naval Station, was severely damaged by the earthquake that struck southcentral Alaska on March 27, 1964. The epicenter of the earthquake was about 280 miles southwest of the Station. Damage from the earthquake is described in a USGS publication, *Effects of the Earthquake of March 27, 1964, on the Communities of Kodiak and Nearby Islands* (Kachadoorian and Plafker 1967). The Station was inundated by at least 10 seismic sea waves (tsunamis) which reached a maximum height of 25 feet above post-earthquake mean lower low water. The first seismic wave that inundated the station did not do severe damage because it behaved much like a rapid rise of tide, but the subsequent and more violent waves destroyed most of the Station's docking facilities and several other shoreline structures. The waves struck the station from the southwest and from the east.

The shoreline structures that were not destroyed required rehabilitation because the 5.6 feet of tectonic subsidence put them under water during the highest tides. Additionally, the subsidence accelerated erosion during high tide of the soft unconsolidated sediments and fill in the low-lying areas of the station. Seismic shaking did little damage to the station housing facility, but it was responsible for compaction of sediments, lateral displacement of a seawall, and the development of fissures in the aircraft parking area. The compaction was due to seismic action and amounted to as much as 1 foot beneath Hangar 1. Compaction of fill also occurred under the asphalt aircraft ramp outside another hangar. Differential settlement or compaction occurred in other areas in the main complex of the naval station. The concrete deck of a supply building located between Cape Spencer and Cape Sarichef Street (formerly Fifth and Sixth Streets) settled about 6 inches; 3 to 4 inches of settlement of the supporting sediments also occurred in the floor of Building 22, a small structure near Cape Spencer Street, about 500 feet southwest of the supply building. A 1964 estimate indicated that the earthquake did $10,916,800 worth of damage to roads, equipment, structures and buildings at the Naval Station.

4.0 TRAFFIC INFORMATION [40 CFR 270.14(B)(10)]

The following sections describe the traffic pattern, the volume of traffic (number, types of vehicles), and the traffic controls at Base Kodiak.

4.1 Offsite Traffic

Base Kodiak is connected to the city of Kodiak by Rezanof Highway, which extends south from the Chiniak Highway and north to the Kodiak Highway, following the shoreline on the northeast side of the island. The Rezanof Highway ends at Narrow Cape, 40 miles to the south. Base Kodiak's main gate on Cape Sarichef Street is located approximately 100 feet off the Rezanof Highway. USCG has no vehicle counting equipment; however, in 1983 the ADOT&PF, which has the only permanent vehicle counter in the area, conducted a vehicle count on Rezanof Highway. The average daily traffic count was 5,193 vehicles.

Studies have indicated that 90 percent of the users of the road systems around Base Kodiak are USCG-related. Much of the highway traffic into and from the City of Kodiak also consists of USCG personnel. Except within the City of Kodiak, the road network on the northeastern portion of the island is a series of long dead ends totaling less than 150 miles.

4.2 Onsite Traffic

Base Kodiak has approximately 16.67 km (10 miles) of paved roads and 13.34 km (8 miles) of unpaved roads within its boundaries. There are no roads within the secure area of Base Kodiak which provide public-right-of-way.

A study of the average daily traffic entering Base Kodiak Main Gate was conducted in 1985. The Main Gate's annual average daily traffic was calculated to be 2,700 vehicles. These vehicles consisted of USCG private vehicles and government vehicles (USCG, U.S. Army Corps of Engineers, FAA, official federal government vehicles). The highest volume of traffic through the Main Gate of Base Kodiak occurs from 7:00 to 9:00 a.m. and from 4:00 to 5:00 p.m. Monday through Friday.

Waste shipments are transported from Base Kodiak waste accumulation areas to the HWSB by truck. The truck travels on two-lane roads within Base Kodiak boundaries on route to the HWSB. Roads within Base Kodiak boundaries have posted speed limits which do not exceed 25 miles per hour (mph). Traffic flow and control at Base Kodiak is maintained by conventional stop and yield signs.

4.3 HWSB Traffic

The Base Kodiak road leading directly to the HWSB is Seafarer Driver (formerly referred to as Avenue "A" and Avenue "B"). Seafarer Drive is two lanes with a posted speed limit of 25 mph or less. The portion of Seafarer Drive which provides access to the HWSB is gravel and has an H-20/S-16 load bearing capacity. Traffic in this area is relatively light - between 10 to 25 vehicles daily. There are no traffic control signs in the vicinity of the HWSB. Base Kodiak personnel and resident dependents have been warned by the USCG to avoid the HWSB and Fuel Farm areas. Entrances to the HWSB are posted with "DANGER - Unauthorized Personnel Keep Out" signs.

This page intentionally blank

5.0 REFERENCES

Allely, R.D. 1989. *Shallow Seismic-Refraction Profiling of the U.S. Coast Guard Reservation, Kodiak, Alaska.* Alaska Division of Geological and Geophysical Surveys Public Data File 89-8C. December 1989.

EPA. 2021. RCRA Permit. Base Kodiak No. AK9690330742. As amended March 2021.

Kachadoorian, R., and Plafker, G. 1967. Effects of the earthquake of March 27, 1964, on the communities of Kodiak and Nearby Islands: U.S. Geological Survey Professional Paper 542–F, 41 p., 1 sheet, scale ~1:1,000, https://pubs.usgs.gov/pp/0542f/.

National Data Buoy Center. 2020. Station KDAA2-9457292-Kodiak Island, Alaska. Retrieved from https://www.ndbc.noaa.gov/station_page.php?station=kdaa2. Accessed July 2020.

Solie, D.N. and Reifenstuhl, R.R. 1989. *Bedrock Geology of U.S. Coast Guard Reservation, Kodiak, Alaska.* Alaska Division of Geological and Geophysical Surveys Public Data File 89-8A. March 1989.

Suleimani, E.N., Nicolsky, D.J., and Koehler, R.D. 2017. Updated tsunami inundation maps of the Kodiak area, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2017-8, 38 p., 10 sheets. http://doi.org/10.14509/29740.

Western Regional Climate Center. 2020. Kodiak Navy Air STN, Alaska (504986). Retrieved from https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ak4986. Accessed August 2020.

This page intentionally blank

Table 1 Base Kodiak Hazardous Waste Management Units Closed Under Interim Status

UNIT NAME	LOCATION	SCHEDULED CLOSURE DATE
Advanced Underwater Weapons Building	Near Buskin River	Spring 1994
Battery Storage Area	Nyman Peninsula	March 1994
Barrel Storage Area No. 1	Nyman Peninsula	October 1996
Barrel Storage Area No. 2	Nyman Peninsula	March 1994
MOGAS Tank Farm	Nyman Peninsula	October 1995
Laundry Facility	Nyman Peninsula	April 1997
Navy Landfill Lead Waste Pile	Anton Larsen Bay Road	July 1994
Nyman Peninsula Lead Waste Pile	Nyman Peninsula	July 1994

Table 2 Scenario-Based Maximum Water Depth at Base Kodiak Locations

TECTONIC SCENARIO	SCENARIO	KODIAK TIDE GAUGE[1]	USCG HANGARS[2]
		Maximum Water Depth Above Sea Level[3] [meters (feet)]	Maximum Water Level Above Ground[3] [meters (feet)]
Rupture model of the 1964 M_w 9.2 earthquake	1	6 (19.7)	1.7 (5.6)
M_w 9.1 earthquake in the area of Kodiak Island, 10 km depth	2	8.4 (27.6)	4.0 (13.1)
M_w 9.0 earthquake in the area of Kodiak Island, 15 km depth	3	11.7 (38.4)	7.1 (23.3)
M_w 9.0 earthquake in the area of Kodiak Island, 20 km depth	4	14 (45.9)	9.3 (30.5)
M_w 9.0 earthquake in the area of Kodiak Island, 25 km depth	5	13.8 (45.3)	9.2 (30.2)
M_w 9.1 earthquake in the area of Kodiak Island, 15 to 25 km depth	6	14.7 (48.2)	10 (32.8)
M_w 9.1 earthquake in the area of Kodiak Island with a splay fault, 15 to 25 km depth	7	14 (45.9)	9.4 (30.8)
M_w 9.2 earthquake in the area of Kodiak Island with 44 meters of maximum slip	8	6.9 (22.6)	2.6 (8.5)
M_w 9.25 earthquake in the area of Kodiak Island with 50 meters of maximum slip	9	9.8 (32.2)	5.5 (18.0)
M_w 9.0 to 9.1 earthquake in the Cascadia subduction zone	10	2.7 (8.9)	0 (0)

Notes:

1 The Kodiak Tide Gauge is located on Base Kodiak along Inner Womens Bay on the North Cargo Pier.

2 The USCG Hangars are located on the tarmac between the two hangars and has a pre-earthquake elevation of 4.5 meters (14.9 feet).

3 The maximum water depth above sea level or water level above ground per scenario is presented in meters (feet in parentheses) above MHHW level.

Acronyms:

km = kilometers
MHHW = Mean Higher High Water
M_w = moment magnitude
USCG = U.S. Coast Guard

1 INCH

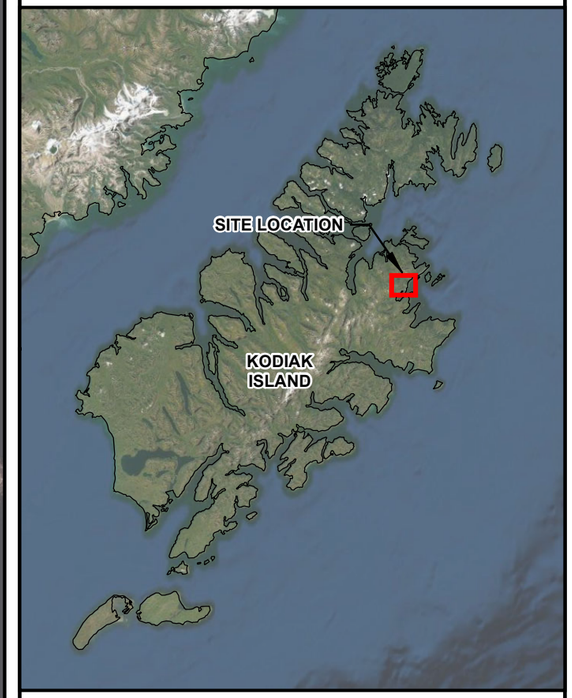
ANTON LARSEN BAY RD
BUSKIN LAKE
BUSKIN RIVER
LAKE CATHERINE
BOY SCOUT LAKE
LAKE LOUISE
TOM STILES RD
REZANOF HWY
KODIAK AIRPORT
MAIN GATE
DEVIL'S CREEK
ST. PAUL HARBOR
HAZARDOUS WASTE STORAGE BUILDING
WOMENS BAY (INNER BASIN)
WOMENS BAY (OUTER BASIN)
NYMAN PENINSULA
N

Document Path: G:_PROJECTS\BENG\USCGBase_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT1_F01.mxd

ATTACHMENT 1 PART A PERMIT APPLICATION AND FACILITY DESCRIPTION

USCG BASE KODIAK, KODIAK, ALASKA

GENERAL LOCATION MAP



Legend

- River/Creek
- Road Outlines
- Lake

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

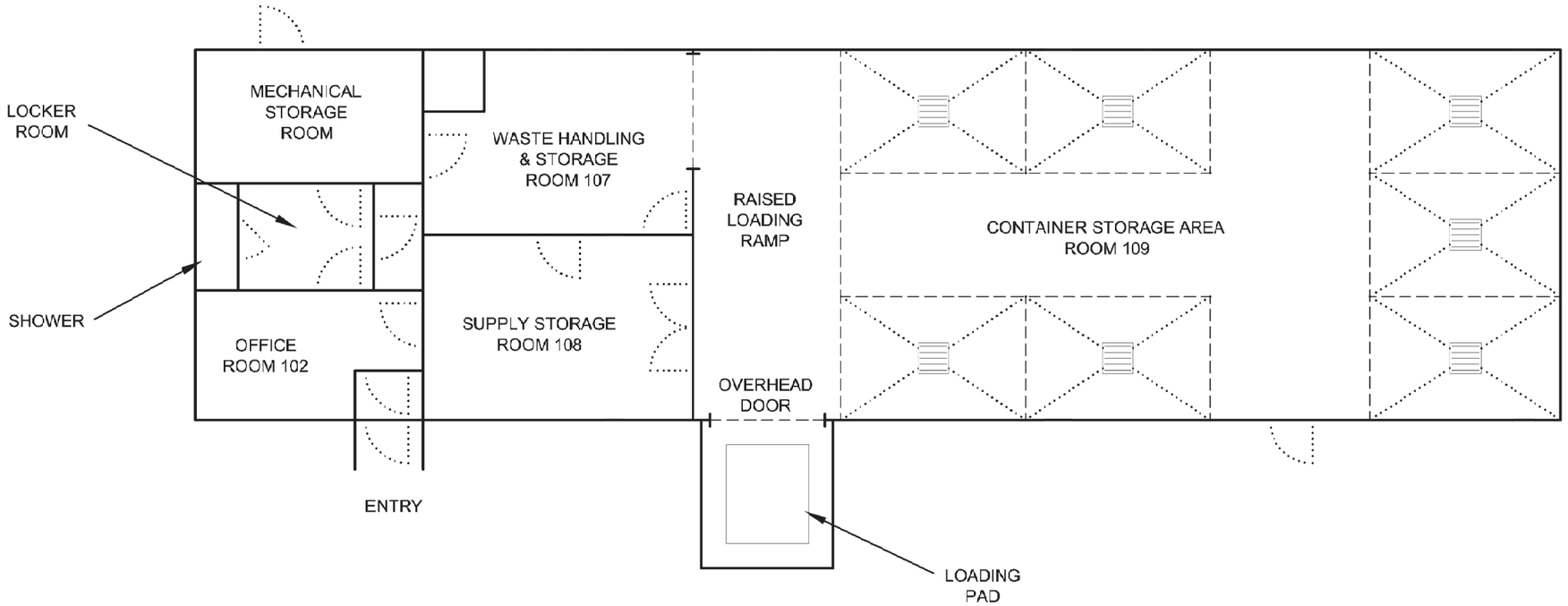
ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

0.5 0.25 0 0.5 1

SCALE IN MILES

PROJECT No.:	DATE:	FIGURE:
680411	8/19/2020	1
P.M.: CS	DRAWN: JC	

1 INCH



ATTACHMENT 1 PART A PERMIT APPLICATION AND FACILITY DESCRIPTION

USCG BASE KODIAK, KODIAK, ALASKA

HAZARDOUS WASTE STORAGE BUILDING LAYOUT

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

0.5 0.25 0 0.5 1

SCALE IN MILES

PROJECT No.:	DATE:	FIGURE:
680411	8/18/2020	2
P.M.: CS	DRAWN: JC	

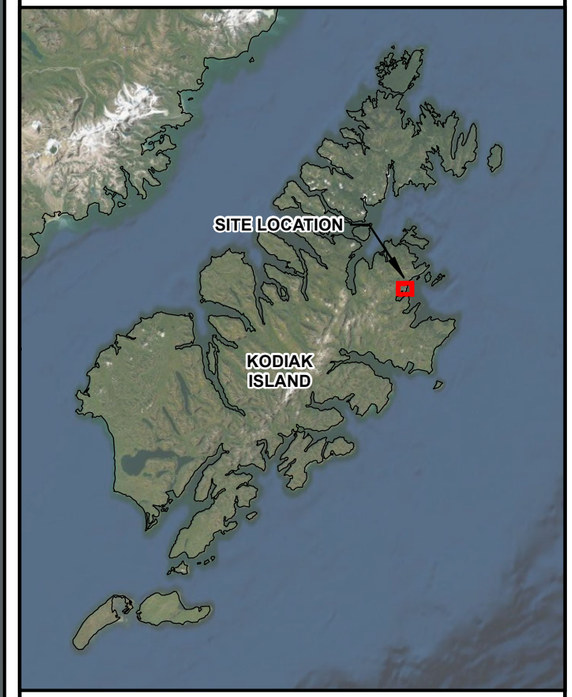
Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT1_F02.mxd

1 INCH

ATTACHMENT 1 PART A PERMIT APPLICATION AND FACILITY DESCRIPTION

USCG BASE KODIAK, KODIAK, ALASKA

BASE KODIAK TOPOGRAPHY



Legend

- USCG Approximate Property Boundary
- River/Creek
- Major Contour - 100'
- Minor Contour - 10'
- Road Outlines
- Lake

References

1. Imagery source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

0.25 0.125 0 0.25 0.5

SCALE IN MILES

PROJECT No.:	DATE:	FIGURE:
680411	8/19/2020	3
P.M.: CS	DRAWN: JC	

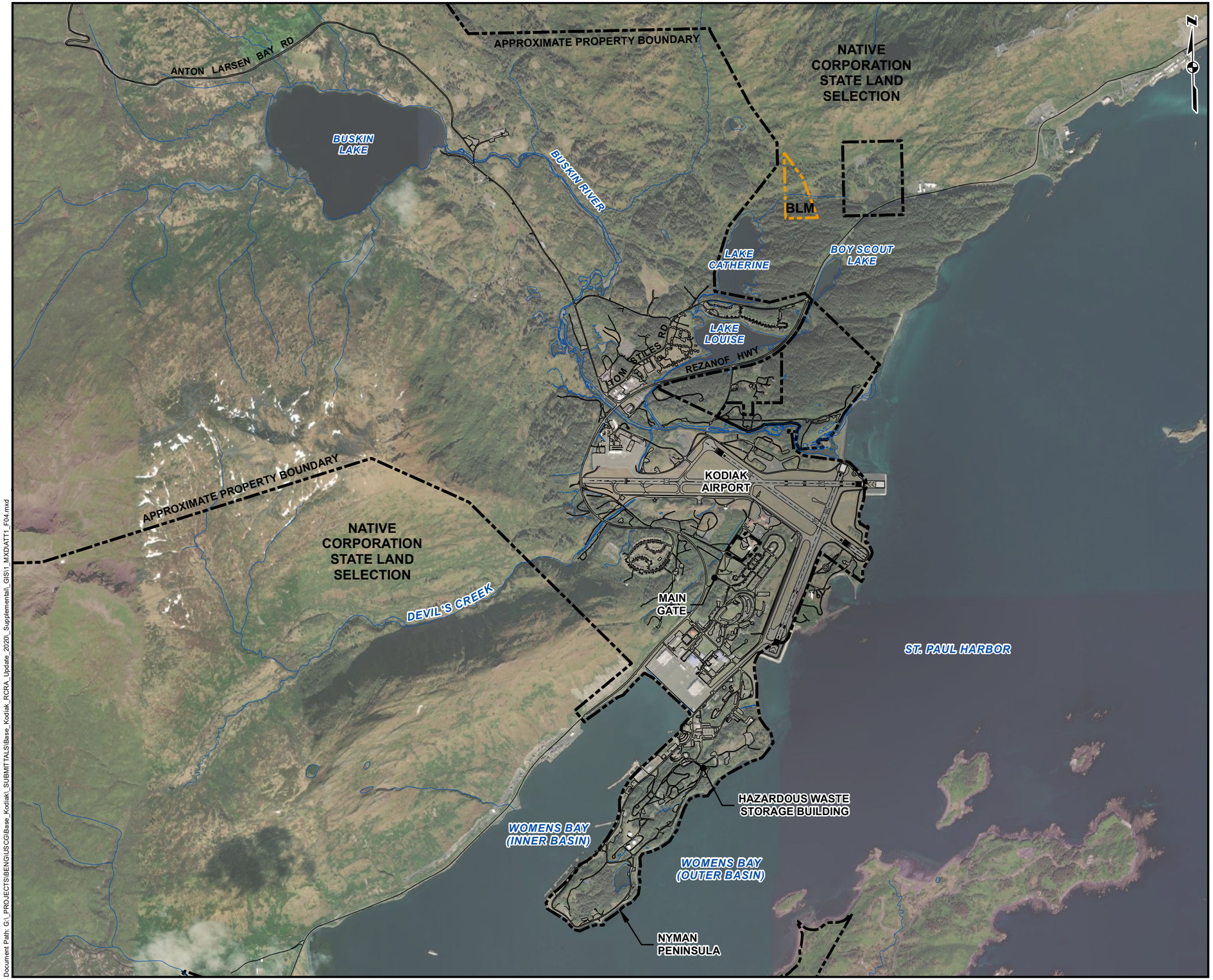
Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT1_F03.mxd

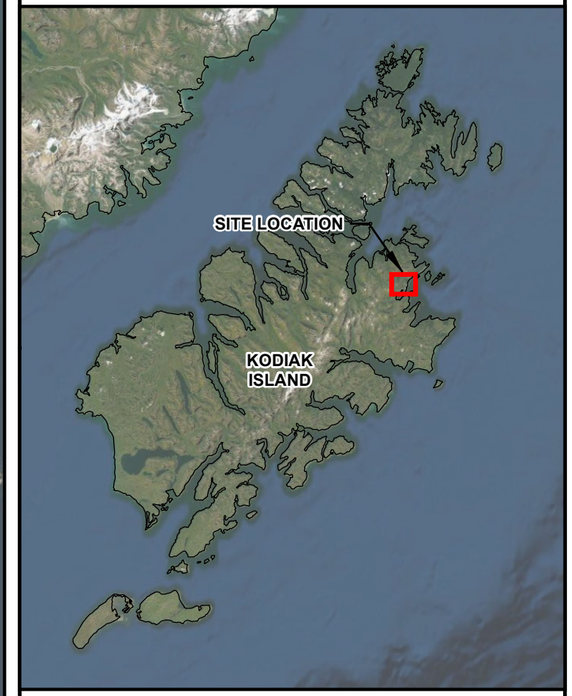
1 INCH

ATTACHMENT 1 PART A PERMIT APPLICATION AND FACILITY DESCRIPTION

USCG BASE KODIAK, KODIAK, ALASKA

BOUNDARIES OF BASE KODIAK AND SURROUNDING LAND USES





Legend

- River/Creek
- Road Outlines

LAST_NAME

- BLM Approximate Property Boundary
- USCG Approximate Property Boundary
- Lake

References

1. Imagery source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. USGS and BLM Property Boundary source:KIIB_Ownership feature service was published by the Kodiak Island Borough and accessed from ESRI Online on 07/011/2021.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

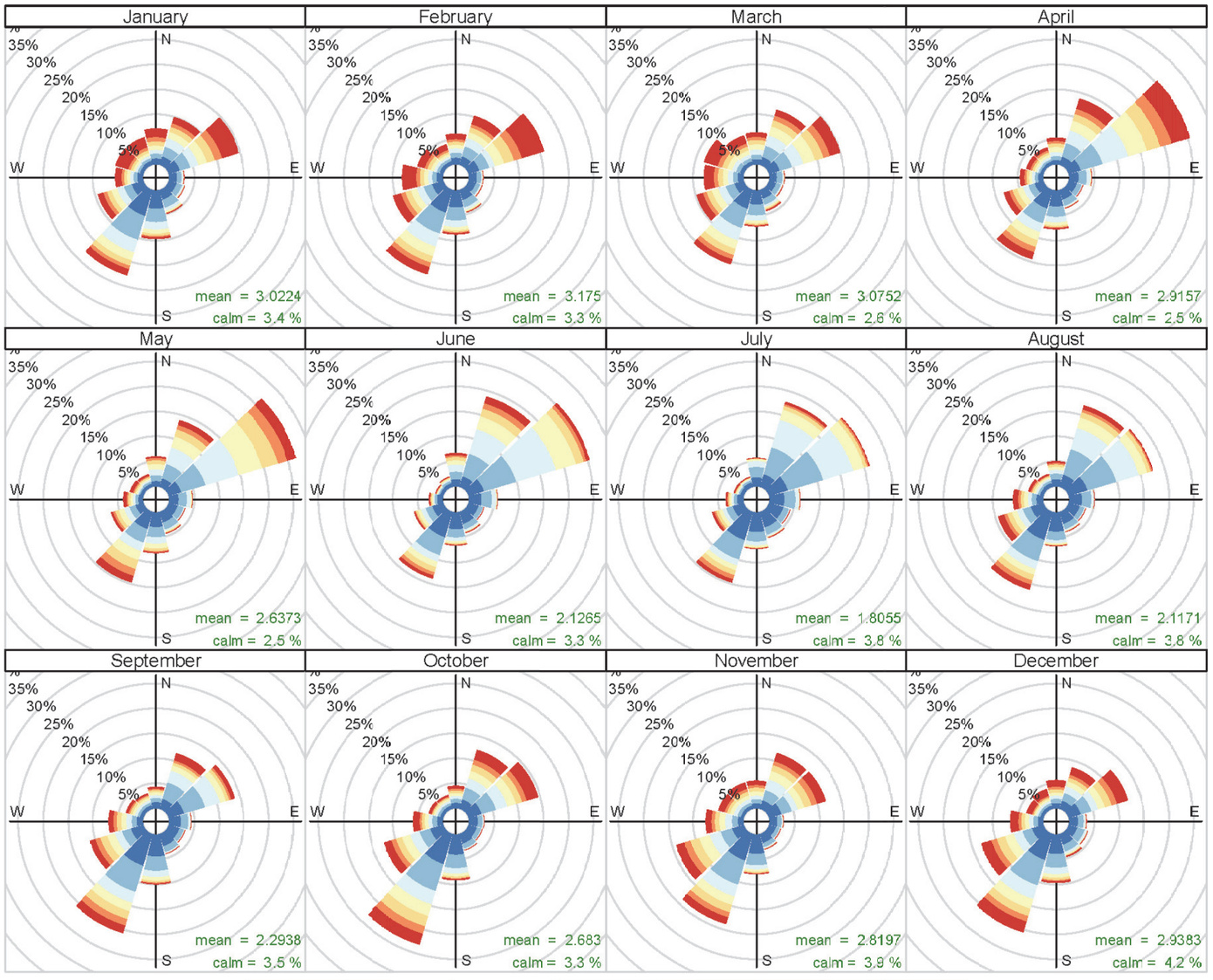
0.5 0.25 0 0.5 1

SCALE IN MILES

PROJECT No.:	DATE:	FIGURE:
680411	1/18/2021	4
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT1_F04.mxd

1 INCH



Frequency of counts by wind direction (%)

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT1_F05.mxd

ATTACHMENT 1 PART A PERMIT APPLICATION AND FACILITY DESCRIPTION

USCG BASE KODIAK, KODIAK, ALASKA

WIND ROSE

Notes

1. Wind Rose presented as an average by month of data collected from January 2010 through May 2020.
2. Wind Rose generated with RStudio software.

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Wind data retrieved from National Oceanic and Atmospheric Administration's National Data Buoy Center Station KDAA2-9457292-Kodiak Island, AK.

PROJECT No.:	DATE:	FIGURE:
680411	8/18/2020	5
P.M.: CS	DRAWN: JC	

1 INCH

ANTON LARSEN BAY RD

BUSKIN LAKE PUMP HOUSE

BUSKIN LAKE

BUSKIN RIVER

LAKE CATHERINE

BOY SCOUT LAKE

LAKE LOUISE

TOM STILES RD

REZANOF HWY

BEACH HOUSE WELL

KODIAK AIRPORT

MAIN GATE

DEVIL'S CREEK

ST. PAUL HARBOR

HAZARDOUS WASTE STORAGE BUILDING

WOMENS BAY (INNER BASIN)

WOMENS BAY (OUTER BASIN)

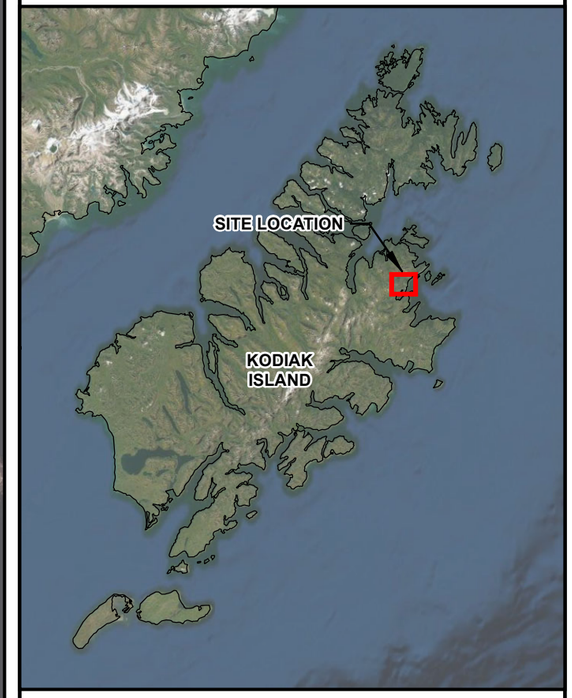
NYMAN PENINSULA

N

ATTACHMENT 1 PART A PERMIT APPLICATION AND FACILITY DESCRIPTION

USCG BASE KODIAK, KODIAK, ALASKA

LOCATION OF BEACH HOUSE WELL & BUSKIN LAKE PUMP HOUSE



Legend

- River/Creek
- Road Outlines
- Lake

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

0.5 0.25 0 0.5 1

SCALE IN MILES

PROJECT No.:	DATE:	FIGURE:
680411	8/19/2020	6
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCGBase_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT1_F06.mxd

1 INCH

PETERSON SCHOOL
ELEVATION: 48 FEET (APPROXIMATE)

ADMINISTRATION BUILDING
ELEVATION: 40 FEET (APPROXIMATE)

USCG HANGERS

HAZARDOUS WASTE STORAGE BUILDING
ELEVATION: 56 FEET (APPROXIMATE)

KODIAK TIDE GAUGE

WOMENS BAY
(INNER BASIN)

WOMENS BAY
(OUTER BASIN)

ST. PAUL HARBOR

NYMAN
PENINSULA

N

ATTACHMENT 1 PART A PERMIT APPLICATION AND FACILITY DESCRIPTION

USCG BASE KODIAK, KODIAK, ALASKA

BASE KODIAK SCENARIO-BASED TSUNAMI INUNDATION LEVELS

Legend

- Location Modeled for Maximum Water Level
- River/Creek
- Road Outlines
- Scenerio 1
- Scenerio 5
- Scenerio 10
- Tsunami Inundation Area (Maximum Extent)/Scenario 6
- Facilities
- Lake

Notes

1. Scenario 1 presents a modeled repeat of the 1964 M_W 9.2 Great Alaska Earthquake.
2. The maximum inundation level at Base Kodiak is presented by Scenario 6. It is a model of a M_W 9.1 earthquake rupturing near Kodiak Island on the Aleutian megathrust with an epicenter 15-25 kilometers deep.

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Tsunami Inundation Level Source:
   Suleimani, E.N., Nicolsky, D.J., and Koehler, R.D. (2017). Updated tsunami inundation maps of the Kodiak area, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2017-8, 38 p., 10 sheets. http://doi.org/10.14509/29740

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

1,500 750 0 1,500 3,000

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	7
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT1_F07.mxd

This page intentionally blank

Draft
Attachment 2
Waste Analysis Plan

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 INTRODUCTION AND FACILITY DESCRIPTION **1**
2.0 BASE KODIAK WASTE TYPES **5**

2.1 Batteries 6
2.2 Paint Slopes and Waste Paint 6
2.3 Solvents 6
2.4 EEBD Cartridges 7
2.5 Used Oil 7
2.6 Used Antifreeze 7
2.7 Waste Fuel 7
2.8 Solids and Liquids from Spill Cleanups 7
2.9 Wastes from Historical Operations 8
2.10 Off-Specification or Out-of-Date Commercial Chemical Products 8
2.11 Medical and Dental Clinic Waste 8
2.12 Universal Waste Bulbs and Hazardous Waste Bulbs 9
2.13 Wastes from Offsite Generators 9

3.0 WASTE PROFILES [40 CFR 264.13(B)(2)] **11**

3.1 Waste Characterization Procedures for Waste Profiles 11
3.2 Sampling and Analysis for Waste Profiles 14
3.2.1 Analytical Methods 14
3.2.2 Sampling Methods 17
3.3 Frequency of Waste Profiling 21
3.4 Waste Analysis Requirements Pertaining to Land Disposal Restrictions 21
3.4.1 Frequency of Analysis 22
3.4.2 Notifications and Certification 22

4.0 WASTE STORAGE ACCEPTANCE CRITERIA AND WASTE VERIFICATION **25**

4.1 Waste Storage Acceptance Criteria 25
4.2 Waste Verification Prior to Acceptance at the HWSB 26
4.2.1 Waste Verification for Onsite Generating Locations 26
4.2.2 Waste Analysis for Offsite Generators 29
4.2.3 Wastes from Other Offsite Sources 30
4.2.4 Waste Shipment 30
4.3 Final Acceptance of Waste upon Receipt at the HWSB 30
4.4 Preparation for Offsite Shipment of Wastes 33
4.4.1 Fingerprint Samples Required by the TSDF 33
4.4.2 Final Preparation for Waste Shipment 33

5.0 WASTE ANALYSIS FOR SPILLS AND UNKNOWN LIQUIDS AT THE HWSB **35**
6.0 QUALITY ASSURANCE/QUALITY CONTROL **37**

6.1 QA/QC Objectives 37
6.2 Data Quality Objectives 37
6.2.1 Precision 37

TABLE OF CONTENTS (CONTINUED)

6.2.2 Accuracy 38
6.2.3 Representativeness 38
6.2.4 Sensitivity (Reporting Limits) 38
6.3 Laboratory QA/QC 38

7.0 RECORDKEEPING 39

TABLES

Table 1 Analytical Parameters for HWSB Hazardous Waste Characterization and Rationale for Selection 15
Table 2 Sample Collection Methods 17
Table 3 Typical Sample Container Requirements for Liquid, Solid, and Sludge Samples 19
Table 4 Qualitative Waste Verification Parameters 29

FIGURES

Figure 1 Hazardous Waste Storage Building
Figure 2 Waste Characterization Procedures for Base Kodiak HWSB
Figure 3 Procedures for Onsite Generated Waste Verification and Pickup
Figure 4 Waste Analysis and Verification Procedures for Receipt of Wastes from Offsite Locations

APPENDICES

Appendix A Example Waste Profile
Appendix B Sampling Standard Operating Procedures
Appendix C Field Verification Checklist

ACRONYMS AND ABBREVIATIONS

ATON	Aids to Navigation
ADOT&PF	Alaska Department of Transportation and Public Facilities
CFR	Code of Federal Regulations
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Officer
EEBD	emergency escape breathing device
EPA	U.S. Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOL	Forward Operating Location
HSWA	Hazardous and Solid Waste Amendments
HWMU	Hazardous Waste Management Unit
HWSB	Hazardous Waste Storage Building
LDR	Land Disposal Restrictions
LORAN	long-range navigation
LOWS	Liquid Oily Waste System
MEK	methyl ethyl ketone
MIBK	methyl isobutyl ketone
MS/MSD	Matrix Spike/Matrix Spike Duplicate
PCB	polychlorinated biphenyl
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SDS	Safety Data Sheet
SOP	Standard Operating Procedures
SVOA	Semi-Volatile Organic Analyte
SWMU	Solid Waste Management Units
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, Disposal Facility
UHC	Underlying Hazardous Constituents
USCG	U.S. Coast Guard
VOA	Volatile Organic Analyte
VSQG	very small quantity generator

This page intentionally blank

1.0 INTRODUCTION AND FACILITY DESCRIPTION

This Waste Analysis Plan has been prepared for the waste management activities that occur at the Hazardous Waste Storage Building (HWSB) at Base Kodiak. The HWSB provides interim storage of hazardous wastes until the waste is shipped offsite for permanent treatment and/or disposal. The wastes accepted include those regulated by the Resource Conservation and Recovery Act (RCRA); the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); and the Toxic Substances Control Act (TSCA); and other non-hazardous wastes that are stored prior to shipment offsite for disposal. The HWSB is located on Nyman Peninsula adjacent to the Base Kodiak Liquid Oily Waste (LOWS) Facility and across from the Base Central Steam Plant. Access to the HWSB is restricted and controlled by the Fuel Farm perimeter fence. Figure 1 shows the HWSB floor plan.

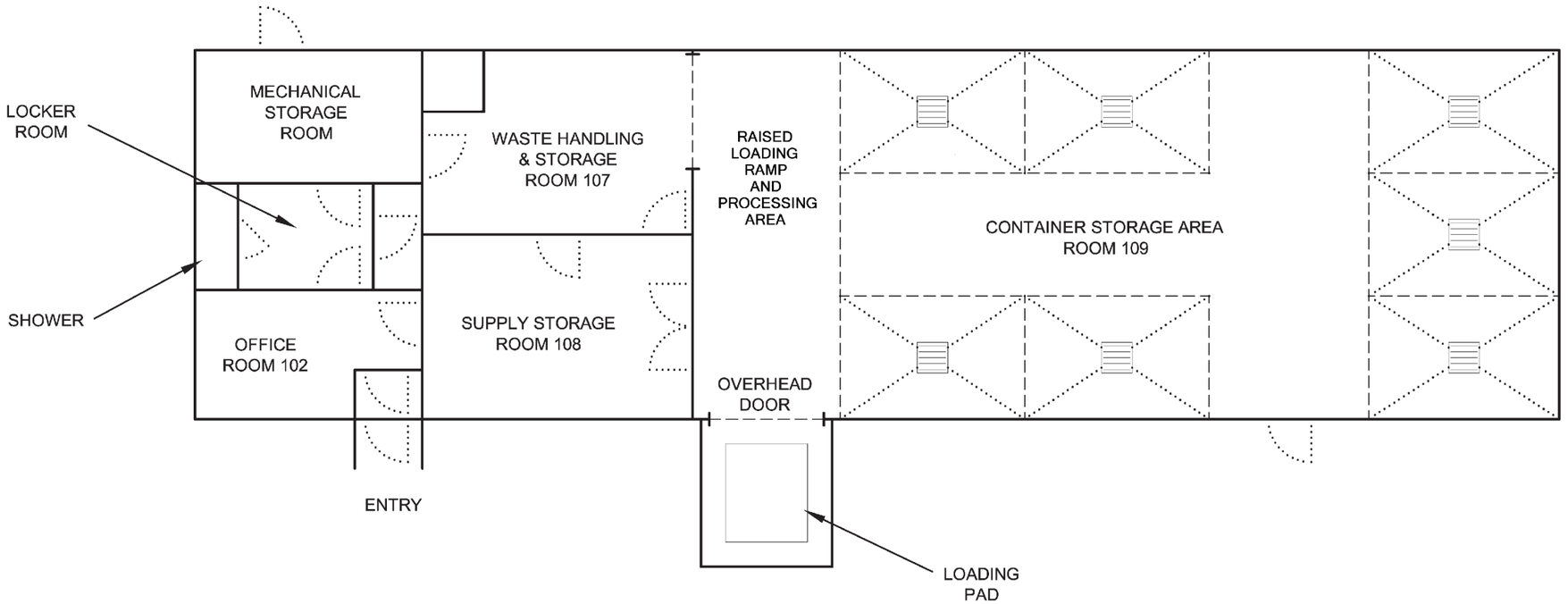
Base Kodiak has also established less-than-90-day hazardous waste accumulation areas in portable buildings each equipped with built-in secondary containment. Should wastes not meet the acceptance criteria for the HWSB, they may remain at the generating location, or may be placed in the less-than-90-day accumulation area for secure storage while additional waste determination is undertaken. Once the waste has met the necessary regulatory benchmarks, waste is shipped off of Base Kodiak for permanent disposal.

Activities conducted at the HWSB include receiving, interim storage, and shipment of containerized waste. Associated activities, such as overpacking of leaking containers, spill cleanup, and maintenance may also take place on an as-needed basis. The HWSB is constructed to provide secondary containment, to include spill catchment sumps, for all containers inside the building.

Section 2.0 of this Waste Analysis Plan presents an overview of the waste storage acceptance criteria, waste sources, and characteristics of the types of wastes received at the HWSB. Section 3.0 presents the waste analysis requirements for waste characterization. Section 4.0 presents the waste verification process. Section 5.0 presents the waste analysis requirements for spills or unknown liquids at the HWSB. Section 6.0 describes the Quality Assurance and Quality Control requirements. Section 7.0 presents recordkeeping requirements associated with waste analysis.

This page intentionally blank

1 INCH



ATTACHMENT 2 WASTE ANALYSIS PLAN

USCG BASE KODIAK, KODIAK, ALASKA

HAZARDOUS WASTE STORAGE BUILDING LAYOUT

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

0.5 0.25 0 0.5 1

SCALE IN MILES

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	1
P.M.: CS	DRAWN: JC	

Document Path: Q:\GEOSPATIAL_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT2_F01.mxd

This page intentionally blank

2.0 BASE KODIAK WASTE TYPES

The HWSB accepts a wide range of wastes for storage. This section presents an overview of the waste sources and waste types received at the HWSB for storage as well as the waste acceptance practices.

The HWSB provides interim storage of hazardous wastes generated from aircraft maintenance and support; support for Base Kodiak-based vessels and visiting vessels; facility maintenance; maintenance of aids to navigation (ATON), including far north U.S. Coast Guard (USCG) Aviation Detachments, and Forward Operating Locations (FOL); and oil spill response activities. Waste generated from RCRA corrective action activities associated with discontinued historical operations may also be stored at the HWSB. Hazardous waste is stored in the HWSB until such time it is transported offsite to a RCRA facility for treatment or disposal. Some nonhazardous solid wastes and recyclable materials are also stored at the HWSB. Most of the wastes that are accepted for storage at the HWSB are hazardous because they exhibit one or more of the hazardous waste characteristics as defined under 40 Code of Federal Regulations (CFR) 261.20 through 261.24. A number of RCRA "listed" wastes, as defined under 40 CFR 261.30 through 261.33, are also accepted for storage.

Other regulated materials are accepted at the HWSB that are not RCRA hazardous wastes. These may include wastes regulated by TSCA, FIFRA, or by other state or federal regulations. Such materials include polychlorinated biphenyls (PCBs) or PCB-contaminated materials, universal wastes, recyclable materials such as scrap metal, lead-acid batteries, and other nonhazardous solid waste. Recycling of scrap metal that is not exempt from 40 CFR Section 261.4(a)(13) precludes all RCRA hazardous waste regulations from applying. Lead-acid batteries that are generated, collected, or stored prior to reclamation at a facility that does not perform the reclamation process are not subject to hazardous waste regulations as determined by the applicability requirements in 40 CFR Section 266.80. Base Kodiak does not manage intact lead-acid batteries as universal waste. All of these materials are stored pending shipment offsite for recycling, storage, treatment, or disposal.

Wastes generated from operations at Base Kodiak, ancillary facilities, and federal vessels that are subsequently stored in the HWSB generally fall into one of the following routine waste categories:

- Universal waste batteries: lithium, nickel-cadmium, zinc-air primary;
- Paint slops and waste paints, coatings and thinners;
- Spent chlorinated and non-chlorinated solvents;
- Emergency escape breathing device (EEBD) Cartridges;
- Used oil;
- Used antifreeze;
- Waste fuel and solids contaminated with fuel;
- Solids and liquids from spill cleanups;
- Wastes from historical operations at Base Kodiak;
- Off specification, partially used, or out of date products;
- Medical and dental clinic wastes; and
- Universal waste bulbs and hazardous waste bulbs.

Waste profiles have been developed for each of these routine waste types. A description of each of these waste types follows.

2.1 Batteries

There are five types of batteries commonly used at Base Kodiak. These are:

- **Lead-Acid Batteries**. Used mainly in cars, boats, motorized vehicles, and solar-powered ATONs. Intact, unbroken lead-acid batteries generated at Base Kodiak are now recycled or reclaimed when shipped off Base Kodiak per the processes outlined in 40 CFR 266.80. When intact, they are considered hazardous material under the provisions of 40 CFR 266 Subpart G and are not managed in the HWSB. Broken lead-acid batteries that exhibit characteristics outlined in 40 CFR Parts 260 through 272 are considered to be hazardous waste and will be managed as such.
- **Lithium Batteries**. Used as a power source in portable electronic equipment and emergency aviation equipment. These batteries are considered universal waste.
- **Nickel-Cadmium Batteries**. Used as rechargeable batteries in a variety of applications throughout Base Kodiak. These batteries are considered universal waste.
- **Zinc-Air Primary Batteries**. Used in ATONs. These batteries consist of a potassium hydroxide liquid, zinc-mercury alloy anode and carbon cathode. These batteries are considered universal waste.
- **Nickel Metal Hydride Batteries**. Used as rechargeable batteries in a variety of applications throughout Base Kodiak. These batteries are considered universal waste.

Alkaline batteries are not regulated as they do not fit this definition of "battery"; however, USCG does manage these materials for recycling. These recycled materials are shipped as "alkaline batteries managed as Universal Waste," and a certificate of recycling is provided.

2.2 Paint Slopes and Waste Paint

Paints, solvents, thinners, and cleaners are generated in several shops at Base Kodiak. Paints are used in vehicle, aircraft, vessel, and facility maintenance and repairs. Paints, solvents, thinners, and cleaners are purchased from a restricted list of materials that meet military specification for their identified use. Therefore, process knowledge of the generated waste streams is directly connected to the purchase of materials. Paints used may contain lead (D008), mercury (D009), cadmium (D006), chromium (D007), or methyl ethyl ketone (MEK) (D035), and vinyl chloride (D043). Flashpoints of paint slops and thinners may be below 140 degrees Fahrenheit, and thus would be classified as D001 waste. Where thinners have been used for their solvent properties, and disposed of when spent, they may be classed as an F003 or F005 waste. Thinners may also be unused, but out of date, and thus may be classified as a U-listed waste.

2.3 Solvents

Both chlorinated and non-chlorinated solvents are generated at Base Kodiak. Common chlorinated solvents include 1,1,1-trichloroethane, trichloroethylene, tetrachloroethylene, methylene chloride, and chlorinated fluorocarbons. These wastes are typically classed as F001 or F002, or are disposed of when unused and out-of-date, and are classified as U- listed wastes. Non-chlorinated solvents are also generated; these may include PD-680™, Agitene™, Citrikleen™, MEK, methyl isobutyl ketone (MIBK), toluene and mixtures of these solvents. These non-chlorinated solvents are typically classed as F003, F005, D001, or D002 wastes. Solvents used in aircraft and vessel maintenance and electronics applications are typically purchased from a restricted list of materials that meet military specification for their identified use. This accounts for 75 to 80 percent (%) of solvents used at Base Kodiak. Solvents used in contractor

vehicle maintenance and general cleaning applications are less tightly specified, but based on the operating history of Base Kodiak do not vary widely from year to year. Thus, process knowledge of the generated waste streams is directly connected to the purchase of materials.

2.4 EEBD Cartridges

Spent and unused out-of-specification EEBD cartridges are generated onboard ship and in onshore drills. These are considered hazardous waste because they are classified as oxidizers (D001) and have a barium content which may exceed Toxicity Characteristic Leaching Procedure (TCLP) limits (D005). Spent cartridges are returned to the manufacturer for recycling.

2.5 Used Oil

Used oils and solids containing used oil generated at Base Kodiak may be classified as a hazardous waste if they are mixed with other hazardous wastes (typically solvents). Used oil and oily water mixtures represent a large volume waste stream that is generated at many shops during routine maintenance activities at Base Kodiak. Petroleum-based used oil is burned at the steam plant. Synthetic used oils that cannot be burned are processed though waste disposal shipments.

2.6 Used Antifreeze

Used antifreeze is generated from the routine maintenance and repair of heat transfer systems in light- and heavy-duty vehicles, equipment, generators, vessels and buildings. While it is not always regulated as a RCRA hazardous waste, used antifreeze may exceed TCLP metals thresholds, most commonly for lead (D008), cadmium (D006) or chromium (D007), or exceed the TCLP benzene threshold (D018).

2.7 Waste Fuel

Waste fuels and solids containing fuel are a common waste stream at Base Kodiak. Waste fuels are often a result of accidental mixing of fuels at the gas pump. The preferred alternative for the management of waste fuel or fuel/oil mixtures is to blend it at the steam plant for continued use as fuel. This reuse precludes the fuel from becoming waste. If reuse at the steam plant is not possible, the fuel or solids contaminated with fuel are sent to the HWSB. Solids or mixtures contaminated with gasoline may be hazardous waste due to benzene content (D018). Liquids contaminated with gasoline are assumed to be a hazardous waste due to benzene content (D018) and may exhibit the ignitability characteristic (D001). However, the majority of gasoline-contaminated liquids are shipped off Base Kodiak for recycling via energy recovery. If contaminated with diesel, a mixture is not considered hazardous for benzene, but may still be ignitable (D001) if liquid. Sorbents contaminated with diesel only (from a spill, for example) would be classified as nonhazardous.

2.8 Solids and Liquids from Spill Cleanups

Spills occurring at Base Kodiak may involve hazardous materials (which when spilled become a hazardous waste), or hazardous waste. Both solids (soil, debris, absorbents, etc.) or liquids (waste liquid or contaminated water) may be generated and need to be tested and, if appropriate, disposed as a hazardous waste. Fuel spills tend to be the most common source of this waste stream, generating hazardous waste if ignitable (D001), or having a benzene content exceeding the TCLP maximum contaminant level (D018). Spill debris is characterized based on the Safety Data Sheet (SDS) for the product spilled, the profile for the waste spilled, or by analytical testing.

2.9 Wastes from Historical Operations

More than 30 Solid Waste Management Units (SWMUs) have been identified at Base Kodiak. The USCG is conducting RCRA Facility Investigation/Corrective Measures Study activities at a number of these SWMUs. Several types of waste may be generated from remediation activities at these SWMUs. These wastes include: wastes in containers or tanks which are present at the SWMUs; investigation-derived waste which, based on testing, is a characteristic hazardous waste (D004-D043); or wastes which will result from corrective measures activities taken at the facility in the future. Investigation-derived wastes include drill cuttings and purge water from installation and sampling of groundwater monitoring wells. Drill cuttings and water from each boring drilled at Base Kodiak are managed in accordance with the Base Kodiak Investigation-Derived Waste Management Plan as described in the site-specific work plans.

Waste from corrective actions taken at Base Kodiak are expected to be generated within the next 5 to 10 years. Based on investigations undertaken to date, it is highly unlikely that any corrective action wastes will be identified as characteristic hazardous waste (D004- D043). If any corrective action wastes are identified as hazardous wastes, these wastes may be shipped offsite for disposal.

In addition to wastes from SWMUs, hazardous wastes may also be generated from Hazardous Waste Management Units (HWMUs) undergoing closure. Of the eight units that have undergone RCRA closure (Site 3 – U.S. Coast Guard Laundry, Site 6A - MOGAS tanks, Site 7A - Barrel Storage Area No. 1, Site 7B - Barrel Storage Area No. 2, Site 8 - Battery Storage Area, AUW Building, Navy Landfill Lead Waste Pile, and the Nyman Peninsula Lead Waste Pile), only Site 3 and Site 6A managed listed waste. All but three of these units (Sites 3, 6A, and 7A) have been clean-closed. Sites 3, 6A, and 7A have been closed as landfills and are undergoing post-closure monitoring. Sites 3 and 7A are also undergoing groundwater corrective action through the use of air sparge/vapor extraction systems to remove contaminants.

At Sites 3 and 7A, purge water from wells in which perchloroethylene and its breakdown products are routinely measured is considered hazardous waste and is containerized, then is processed through particulate filters in the site operations building for each unit, and through a final carbon filter prior to placement back into the unit. At Site 6A, purge water from wells sampled are placed back on the ground at the well at the time of sampling.

2.10 Off-Specification or Out-of-Date Commercial Chemical Products

Off-specification and out-of-date products are frequently turned in to the HWSB. Where possible, these products are issued for reuse through the Base's hazardous material pharmacy system. However, when the product cannot be used, it may need to be disposed of as hazardous waste. These products are characterized based on the SDS, and may contain cadmium (D006), chromium (D007), lead (D008), benzene (D018), or MEK (D035). They may also be characteristic for ignitability (D001), corrosivity (D002), or reactivity (D003 – water reactive or reactive sulfide). Pure products may be U- or P-listed. The product SDS and the U and P lists will be used to determine whether a discarded material is a U- or P- listed waste. Some materials may require the appropriate lab tests be performed to validate the information in the SDS.

2.11 Medical and Dental Clinic Waste

The medical and dental clinic routinely accumulates three hazardous wastes: silver solution destined for silver recovery, waste dental amalgam, containing mercury and silver, destined for recycling, and epinephrine (not including epinephrine salts). There is a potential for off-specification pharmaceuticals to be generated at the clinic as well. Although these pharmaceuticals are generally returned to the

manufacturer, there is a potential that they become hazardous waste on an infrequent basis. P-listed wastes are kept at the clinic for pickup, rather than transported to the HWSB. They may be stored in the HWSB less than 90-day lockers when shipment is considered scheduled.

Non-creditable Pharmaceuticals, hazardous and non-hazardous, are managed in accordance with 40 CFR 266 Subpart P. They are stored at the clinic or may be stored at the HWSB less than 90-day lockers once the pick-up is scheduled.

2.12 Universal Waste Bulbs and Hazardous Waste Bulbs

Light bulbs, lamps, and incidentally broken bulbs are managed and shipped as Universal Waste and are shipped to a reclamation facility.

2.13 Wastes from Offsite Generators

Wastes are routinely accepted at the HWSB from the decommissioned long-range navigation (LORAN) and ancillary facilities and the Navy Seal facility in Kodiak. These generators are typically very small quantity generators (VSQG). Routine wastes generated at these locations include:

- Batteries;
- Paint slops and waste paints, coatings and thinners;
- Spent chlorinated and non-chlorinated solvents;
- EEBD cartridges;
- Used fuel and oil are managed as materials for recycling via energy recovery. Solids contaminated with these materials are managed as hazardous waste; and
- Solids and liquids from spill cleanups.

LORAN stations have been decommissioned and thus no longer generate waste.

Occasionally, Base Kodiak may receive wastes from other offsite generators. Typically, this waste is from ships that are not home-ported at Base Kodiak, or from other USCG generating locations within Alaska. The generators from which Base Kodiak occasionally accepts wastes have industrial and maintenance activities that are similar to the routine generators from which Base Kodiak accepts waste. Therefore, waste streams from these non-routine generators are typically easily identified and verified.

This page intentionally blank

3.0 WASTE PROFILES [40 CFR 264.13(B)(2)]

The methods and procedures for waste profiles designed to promote safe waste management practices at the HWSB are described in this section. The objectives of these waste profiling activities are: 1) to provide safe handling and storage of all waste materials; 2) to establish uniform and comparable waste characterization requirements for all generators; 3) to verify that incoming waste materials are properly described in the accompanying documentation; and 4) to verify that sufficient waste characterization data are collected to support the eventual treatment or disposal of the wastes. All waste characterization, profiling and/or verification activities required to properly store wastes are completed prior to transfer of waste into the HWSB.

3.1 Waste Characterization Procedures for Waste Profiles

Waste characterization procedures followed by The HWSB Operations Manager are shown in Figure 2. Wastes are characterized using a combination of generator knowledge and sampling and chemical analysis to develop a waste profile for each hazardous waste stream.

Operations at Base Kodiak are routine maintenance and repair operations conducted on facilities, aircraft, vehicles, and vessels, along with supporting logistics and communications activities. 75-80% of the wastes generated at Base Kodiak and offsite locations from which wastes are received result from a limited set of purchased chemicals used in standard applications year-round. As a result, processes, materials used, and wastes generated are well-defined. Therefore, the primary source of information used to develop the waste profile is process knowledge. At each generating location, the generator conducts process inspections to determine what materials are purchased and how they are used. Generator knowledge may include, but is not limited to, the following:

1. **Chemical Specifications** - chemical specifications may be available from the purchase specifications of the particular chemical in question, from product information provided by the manufacturer, or on the labels for the particular chemical in question. For "pure" chemicals where the material contents and characteristics are well known (e.g., hydrochloric acid), standard chemical reference materials may supply the required information. The pH or flash point are routinely checked to verify the data provided.
2. **Safety Data Sheets** - chemical specifications and related information are available on these standard reference materials. The SDSs may be provided by the manufacturer or acquired through available SDS databases from which the information can be electronically downloaded. The pH or flash point are routinely checked to verify the SDS data.
3. **Process Description** - pertinent details of the process generating the waste and the chemicals used that may have generated the particular waste can be described. This knowledge is generally backed up by a one-time analysis, to include any underlying constituents reasonably expected to be present. Subsequent to that analysis, confirmation sampling may be done to validate the profile to meet Defense Reutilization and Marketing Office (DRMO) standards. If a significant change to the process occurs, new information will be collected to validate or modify the profile. Further discussion regarding profile frequency is provided in Section 3.4.

Figure 2

Waste Characterization Procedures for Base Kodiak HWSB

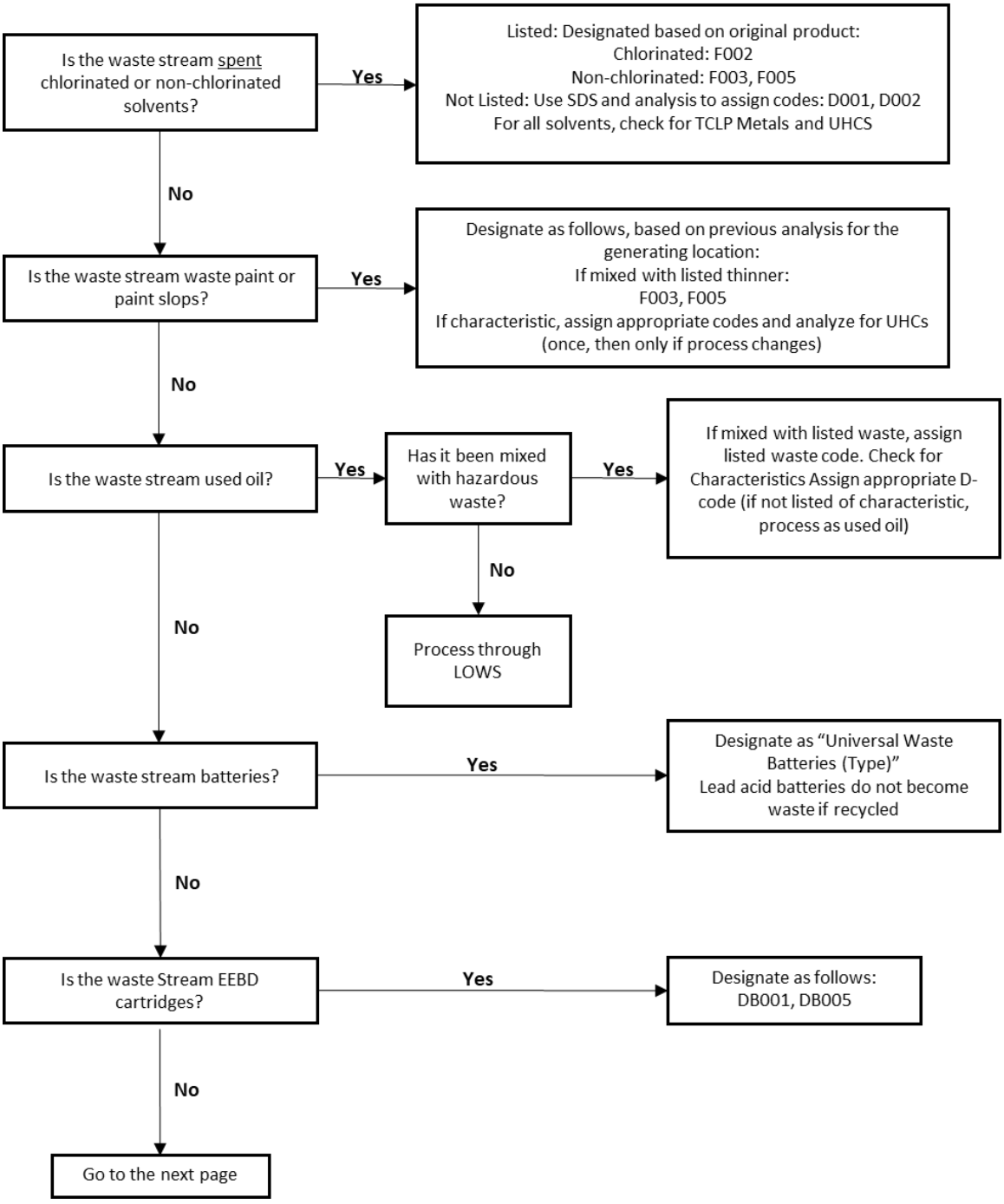
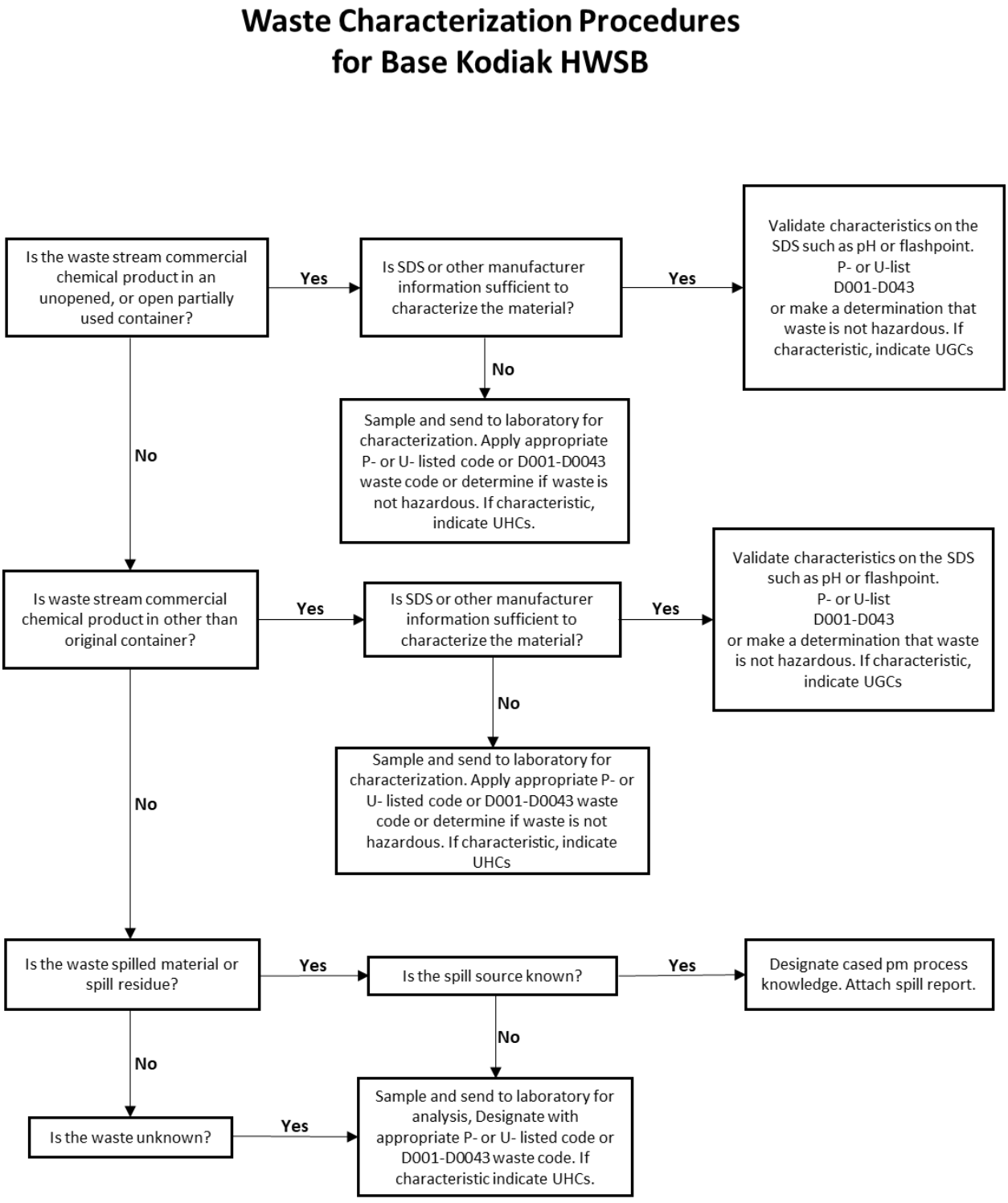


Figure 2 (continued)



Other information sources may be used to provide detailed information on the chemical constituents present, chemical concentrations, and material characteristics (physical state, ignitability, etc.) as defined in Table 1.

Sampling and analysis of waste streams is performed when no other information is available or additional information is required prior to waste acceptance that may be obtained only through waste sampling and analysis. Fingerprint sampling and analysis is also performed as part of the waste profile development, the verification program for the HWSB waste acceptance, and the waste acceptance programs at the offsite Treatment, Storage, Disposal Facility (TSDF) (see Section 4.0).

3.2 Sampling and Analysis for Waste Profiles

This section addresses the waste analysis requirements of 40 CFR 264.13. The methods used to determine when a waste needs to be sampled, parameters for which waste will be sampled, the rationale for selection of the parameters, and the test methods used to test for these parameters are shown in Table 1. The sampling methods used to obtain a representative sample are addressed in Section 3.2.2, and the frequency with which the initial analysis of the waste will be reviewed or repeated is addressed in paragraph 3.4. These procedures and requirements are also used in waste verification sampling and characterization of spills and unknown liquids. An example waste profile is provided in Attachment A.

3.2.1 Analytical Methods

Waste may be profiled based on chemical data, materials profiles, or other process-related information. However, waste analysis may be necessary if the data provided in lieu of analysis are determined to be inadequate. Analysis may also be performed to validate that the wastes matches the SDS or other chemical data. Table 1 lists the recommended analytical methods to be used to determine the waste characteristics and levels or types of contaminants. To the extent possible, analytical test methods will be those specified in U.S. Environmental Protection Agency's (EPA's) *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd edition* (1986) as updated. Equivalent methods may be used.

The specific parameters selected for characterization are determined on a case-by-case basis. Thus, not all of the parameters identified in Table 1 will be selected for each waste stream.

Table 1 Analytical Parameters for HWSB Hazardous Waste Characterization and Rationale for Selection

WASTE TYPE	PARAMETERS	EPA TEST METHODS	RATIONALE
Organic wastes, to include: Spent solvents, solvent constituents, or degradation products Paint slops and waste paints, coatings and thinners	F001 to F005, D001, D004 to D011; D018 to D043 Underlying Hazardous Constituents (UHCs): TCLP Th, Sb, Ni, and Be; Volatile Organic Analyte (VOA), and Semi-Volatile Organic Analyte (SVOA) solvent and fuel constituents	**F-list determinations** will be made using the SDS to determine the concentration of listed constituent prior to use. **Liquids**: **VOC**: Method 8260 **SVOC**: Method 8270 **Metals** (except mercury): Method 6010 **Mercury**: Method 7470/7471 **Alternative methods may include**: **Silver**: Method 7760 **Selenium**: Method 7740 **Arsenic**: Method 7060 **Thallium**: Method 7841 **Ignitability**: Methods 1010B, 1020C or equivalent. **Solids** will be extracted using Method 1311 prior to testing. UHCs require total analysis for VOA and SVOA	Spent solvents may be contaminated with other constituents through use. Constituents expected to be present are metals from parts cleaning; fuel constituents such as benzene, toluene, and xylene; and carryover of other solvents, such as carburetor cleaners. These wastes will also be tested for ignitability if deemed relevant based on generator knowledge. Paint and paint wastes will have characteristics similar to spent solvents, although in different ratios. These may include solvents as product constituents, and metals such as pigments. These wastes will also be tested for ignitability if deemed relevant based on generator knowledge.
Fuel and fuel mixtures	D001, D018	**Ignitability**: Method 1010B, 1020C, or equivalent. **Benzene**: Method 8021 **Solids** will be extracted using Method 1311 prior to testing. **Physical state**: Paint filter test (no EPA test method)	Tests for ignitability and benzene will be used to confirm the identity of the fuel. UHCs for fuel have been determined, and will be tested only once, for confirmation. If it is unclear whether the waste should be characterized as a liquid or solid. A paint filter test will be performed.
Reactive wastes: oily sludges	D003	**Sulfide reactivity**: Method 9031	Reactive sulfides are a potential problem in oily sludges stored under anaerobic conditions:
Inorganic and aqueous wastes, may include: Water-miscible solvents, antifreeze, spent acids and bases, spill cleanup wastes	D004 to D011, D001, D002 UHCs: Th, Sb, Ni, and Be; VOAs, SVOAs	**Metals** (except mercury,): 6010 **Mercury**: Method 7470/7471 **Solids** will be extracted using method 1311 prior to testing. **Alternative methods may include**: **Silver**: Method 7760 **Selenium**: Method 7740 **Arsenic**: Method 7060 UHCs will be tested once per process. UHC testing will consist of: **VOA**: Method 8260 **SVOA**: Method 8270 **UHC metals** (except thallium): Method 6010,	Constituents expected to be present are metals, fuel constituents such as benzene, toluene, and xylene, and solvents carried over from other operations. Used-Battery electrolyte will be sampled for metals and pH if there is doubt as to these characteristics.

Table 1 Analytical Parameters for HWSB Hazardous Waste Characterization and Rationale for Selection

WASTE TYPE	PARAMETERS	EPA TEST METHODS	RATIONALE
		Thallium: Method 7841 **pH**: Method 9040 or equivalent	
Unused Products	U002, U051, U080, U112, U121, U151, U159, U210, U220, U226, U227, U228	Characterize using SDS or label information. Confirm the identity or purity of the product, by confirming: **Ignitability**: Method 1010 **pH**: Method 9040 or equivalent Confirmation of pure product will be accomplished using the gas chromatography/mass spectrometer method appropriate to the chemical. (e.g., 8260 or 8270)	U-listed wastes are defined as pure or reagent grade product or as the sole active ingredient in a product. No sampling beyond confirmation sampling should be required to characterize this waste.
Unknown wastes	D001 to D043 U codes listed above UHCs including metals, VOA, SVOA and PCB contaminants	**Water solubility**. Field test by addition of small amount of water to small amount of unknown. **Soluble** compounds: test as inorganic and aqueous waste, above **Insoluble** compounds: test as organic wastes, above. **Pesticides/herbicides/PCBs**: Method 8082 **Solids** will be extracted using Method 1311 prior to testing.	The methods listed for organic and aqueous based compounds listed above will also find hazardous constituents in an unknown waste. Water reactivity will be apparent when determining solubility. Pesticides, herbicides and PCBs may need to be determined if the ingredients cannot be identified using VOA and SVOA analyses.

3.2.2 Sampling Methods

Sampling methodologies are selected based on the physical state of the waste. Sampling methods are outlined in Table 2, and standard operating procedures (SOPs) for sampling are provided in Appendix B. Sample container requirements are listed in Table 3.

Table 2 Sample Collection Methods

WASTE CATEGORY	CONTAINER TYPE	SAMPLING DEVICE
Aqueous Liquid	Tank, Homogeneous	Tap or weighted bottle
	Tank, Stratified	Weighted bottle, drum thief or COLIWASA
	Drum	Glass drum thief or COLIWASA
Organic Liquid	Tank, Homogeneous	Tap or weighted bottle (glass)
	Tank, Stratified	Weighted bottle, glass drum thief or COLIWASA
	Drum	Glass drum thief or COLIWASA
Solid	Pile, Dumpster, Drum	Trier, stainless steel scoop, or grain sampler

Notes:
Sampling standard operating procedures are provided in Attachment A.

Sample receiving, handling, storage, and associated record-keeping procedures are integral to the quality assurance program. Procedures are designed to ensure that each sample is accounted for at all times. A permanent log of sampling activities is maintained. The log entries include the following: date of collection, sample number, sampling location, waste container designation, number of samples, field observations, and field measurements (e.g., pH, percent lower explosive limit). These logs (or copies of them) are maintained at the HWSB after completion of sampling activities.

A chain-of-custody record accompanies samples at all times. The record contains the sample number, date and time of collection, sample description, and signatures of the collector and all subsequent custodians.

Transportation of samples is carried out in accordance with the U.S. Department of Transportation (DOT) requirements. Hazardous waste samples are properly packaged, marked, and labeled. Shipping papers are prepared as required by DOT regulations.

All equipment used to sample waste materials is disposable or designed for easy decontamination. Contaminated disposable equipment is managed as hazardous waste as appropriate. Cleanable equipment is thoroughly decontaminated prior to reuse. Decontamination solutions are managed as hazardous waste as appropriate.

The appropriate sampling technique and container is selected based on knowledge of the waste material matrix (solid, liquid, sludge) and the specific analytes of interest. Sampling is conducted in accordance with the SOPs in Attachment A. Samples are processed offsite at one of several laboratories qualified to perform analysis of waste samples in accordance with EPA SW-846 methods.

Sampling information, custody records, and analytical results are maintained as part of the data package supporting the profile. Sampling procedures are designed to ensure that each sample is accounted for at all times. The primary objectives of the sample control procedures are as follows:

- Uniquely identify each sample received for analysis.
- The correct samples are analyzed and are traceable to the applicable data records.

- Important and necessary sample constituents are preserved.
- Samples are protected from loss, damage, or tampering.
- Any alteration of samples during collection or shipping (e.g., filtration, preservation, breakage) is documented.
- A record of sample custody and integrity is established that will satisfy legal scrutiny.

The basic sampling procedure is as follows:

1. Obtain samples using a precleaned sampling device.
2. Fill sample containers in the following sequence: headspace volatile organics, volatile organics, semivolatile organics, metals, ignitability, pH (corrosivity), reactivity.
3. Label sample containers.
4. Properly clean and decontaminate the exterior of the sample containers and the sampling equipment.
5. Place containers in a leaktight polyethylene bag, and place samples in a durable cooler or comparable receptacle for transport to the laboratory.
6. Complete the chain-of-custody and request-for-analysis forms.
7. Review all paperwork and enclose the forms in a leaktight, polyethylene bag taped to the underside of the cooler lid.
8. Seal and mark the coolers or comparable receptacles in accordance with DOT requirements.
9. Transport coolers to the analytical laboratory.

Sample container selection is critical to sample quality. Considering waste compatibility, durability, volume, and analytical sensitivities, the containers listed in Table 3 are recommended for these efforts.

All samples are labeled with at least the following information:

- A unique alphanumeric identifier;
- Date and time of collection;
- Sample collector's name;
- Preservatives used; and
- Analyses requested.

Immediately after collection, samples are placed on ice, if necessary, in durable coolers or comparable receptacles for transport to the laboratory. Before shipping, coolers or comparable receptacles are tightly sealed with duct tape and are custody-sealed along the edges of the lids. Samples are then transported via air to laboratories within 24 hours of collection or as soon as possible, weather permitting (all samples will be refrigerated prior to shipping).

During all sampling activities, strict compliance with industrial hygiene and safety standards is mandatory. Personnel are required to wear eye, skin, and respiratory protection gear, as dictated by safety personnel. If samplers accidentally contact waste material, decontamination procedures are immediately performed.

Table 3 Typical Sample Container Requirements for Liquid, Solid, and Sludge Samples

PARAMETER	CONTAINER	VOLUME REQUIRED			PRESERVATION			MAXIMUM HOLDING TIMES[1]	
		ORGANIC LIQUID (mL)	AQUEOUS (mL)	SOLIDS / SLUDGES (oz)	ORGANIC LIQUIDS	AQUEOUS	SOLIDS / SLUDGES	AQUEOUS (days)	SOLIDS / SLUDGES (days)
Organic Methods									
Purgeable aromatic hydrocarbons	G; Teflon lined septum	1 x 40	2 x 40	4	none	4°C; HCl to pH <2	4°C	14 days; 7 days if not pH adjusted	14
Volatile organics	G; Teflon lined septum	1 x 40	3 x 40	4	4°C	4°C; HCl to pH <2	4°C	14 days; 7 days if not pH adjusted	14
Semivolatile organics	Amber G; Teflon lined cap	125	2,000	8	none	4°C	4°C	7/40	14/40
TCLP Volatile organics	G; Teflon lined cap	1,000	1,000	4	none	4°C	4°C	14/14	14/14
TCLP Semivolatile organics	G; Teflon lined cap	1,000	2,000	8	none	4°C	4°C	14/7/40	14/7/40
Inorganic Methods									
Metals	P, G	1,000	500	10	none	4°C; HNO_3 to pH<2	4°C	28	28
TCLP[2] Metals	G; Teflon lined cap	1,000	1,000	1,000	none	4°C	4°C	28	28
pH	P, G	250	1,000	1,000	none	none	none	Test Immediately	Test Immediately
Ignitibility	G; Teflon™ lined cap	250	8 oz	N/A	none	4°C	4°C	28/28	28/28

Notes:

[1] Holding times are stated in the following format: When a method has a single holding time, it is stated. When a method has an extraction time and an analysis holding time it is stated as "extract holding time/analysis holding time". For TCLP analyses, format is 14 days for leaching procedures, 7 days for extraction and 40 days for extract analysis.

[2] If collecting 1,000 ml or 2,000 ml (as directed) sample will be good for all tests. Volatiles must be collected in a separate container.

G = glass
P = polyethylene

This page intentionally blank

A chain-of-custody record accompanies samples at all times. The record contains the sample number, date and time of collection, sample description, and signatures of the collector and all subsequent custodians. The sampler is responsible for initiating and following chain-of-custody procedures. A chain-of-custody record form is used to document sample collection activities, including sampling site, sample identification, number of samples, and data and time of collection. Additionally, the form documents the chain-of-custody including names of responsible individuals and dates and times of custody transfers. The receiving laboratory signs and dates the chain-of-custody form after verifying that all samples submitted are listed and that the required information is listed on the form.

3.3 Frequency of Waste Profiling

The hazardous waste streams that are regular and ongoing sources of wastes accepted at the HWSB are initially profiled using one or more of the methods described above. At least annually, each onsite and offsite generating location is required to document the following information:

- Changes in materials purchased for each process; and
- Changes in process occurring at each generating location.

At a minimum, every 3 years, each routine waste type is reprofiled. As in the original profiling process, reprofiling may involve evaluation of generator knowledge or sampling and analysis. Such waste characterization is generally considered adequate since the generating process is highly controlled and waste composition usually remains consistent over a 3-year period. However, a number of waste streams accepted by the HWSB are generated on an irregular or one-time basis. Each such "new" waste stream will be characterized prior to acceptance.

More frequent waste characterization of routine waste types will be conducted under the following circumstances:

- A new waste stream is generated;
- The process generating the waste changes;
- The waste characteristics are highly variable from shipment to shipment;
- USCG personnel have reason to suspect a change in the waste based on inconsistencies in packaging or labeling of the wastes;
- EPA modifies regulations to require additional waste characterization; or
- The offsite TSDF rejects the waste because its fingerprint samples are inconsistent with the waste profile provided by the USCG.

All waste characterization data submitted in support of the waste profiles are reviewed to determine whether the waste can be accepted at the HWSB for storage. Additional or repeat analysis may be conducted to substantiate waste characteristics.

3.4 Waste Analysis Requirements Pertaining to Land Disposal Restrictions

The RCRA Hazardous and Solid Waste Amendments (HSWA) prohibit the land disposal of certain types of wastes that are subject to RCRA. Some of the wastes managed at the HWSB fall within the purview of these land disposal restrictions (LDRs). Information presented in this section describes how generators and the operators of the HWSB characterize, document, and certify the wastes subject to LDR requirements.

3.4.1 Frequency of Analysis

All LDR waste streams are characterized at least once every 3 years. Waste characterization may be required more frequently under the following circumstances:

- A new waste stream is generated;
- A process generating the waste changes;
- The waste characteristics are highly variable from shipment to shipment;
- USCG personnel have reason to suspect a change in the waste based on inconsistencies in packaging or labeling of the wastes; and
- The offsite TSDF rejects the waste because its fingerprint samples are inconsistent with the waste profile provided by the USCG.

3.4.2 Notifications and Certification

The HWSB provides interim storage for hazardous wastes eventually destined for treatment or disposal at offsite facilities. The HWSB has received and stored and will continue to receive and store LDR wastes. Since waste treatment will not occur at the HWSB, the USCG is required to provide all notifications and certifications to any interim storage units as mandated by Title 40 CFR Part 268.7 (40 CFR 268.7). These are described briefly below.

In cases where the USCG determines that an LDR waste does not meet the applicable treatment standards set forth in 40 CFR 268, Subpart D, or exceeds the applicable prohibition levels set forth in 40 CFR 268.40, 40 CFR 268.45, or 40 CFR 268.48, the USCG provides the offsite TSDF with a written notice that includes the following information:

- EPA Hazardous Waste Number;
- The manifest number associated with the first shipment of the waste;
- Identification of the waste category (i.e., waste or wastewater);
- Identification of any applicable subdivision within the waste category;
- For any waste coded F001 to F005 or F039, identification of constituents of concern;
- For any waste coded D001 to D043 (except high total organic carbon [TOC] D001), identification of any underlying hazardous constituents; and
- All available waste analysis data.

In cases where the USCG determines that a restricted waste is being managed that can be land-disposed without further treatment, the Coast Guard submits to the offsite TSD facility a written notice and certification stating that the waste meets applicable treatment standards set forth in 40 CFR 268, Subpart D, and the applicable prohibition levels set forth in 40 CFR 268.32 or Section 3004(d) of RCRA. The notice includes the following information:

- EPA Hazardous Waste Number;
- The manifest number associated with the first shipment of the waste;
- Identification of the waste category (i.e., waster or wastewater);
- Identification of any applicable subdivision within the waste category;
- For any waste coded F001 to F005 or F039, identification of constituents of concern;

- For any waste coded D001 to D043 (except high TOC D001), identification of any underlying hazardous constituents; and
- All available waste analysis data.

The certification accompanying any of the above-described notices is signed by an authorized representative of Base Kodiak and states the following or something very similar:

I certify under penalty of law that I personally have examined and am familiar with the waste through analysis and testing or thorough knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D. I believe that the information I submitted is true, accurate and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of a fine and imprisonment.

Copies of all notices and certifications described above are retained at the HWSB Operating Record for at least 3 years from the date that the waste that is the subject of documentation was last sent to an offsite TSDF.

This page intentionally blank

4.0 WASTE STORAGE ACCEPTANCE CRITERIA AND WASTE VERIFICATION

4.1 Waste Storage Acceptance Criteria

Following are the waste acceptance criteria for the HWSB:

1. The following wastes and waste containers are specifically excluded from receipt or storage at the HWSB:
   a. Leaking or unsound containers or containers with excess exterior dirt, moisture, rust, or other undesirable substances;
   b. Radioactive waste or containers contaminated with radioactive material (no radioactive wastes are generated at Base Kodiak at the present time);
   c. Waste in a gaseous state (as opposed to a liquid/vapor equilibrium state), excluding the aerosol cans discussed above;
   d. Hazardous waste containing DOT Class 1.1, 1.2, or 1.3 explosives as identified in 49 CFR 173 Subpart C; and
   e. Shock-sensitive and pyrophoric materials (as defined by DOT).
2. Wastes which are accepted at the HWSB must meet the following conditions:
   a. Cyanide- and sulfide-bearing waste solutions must have a pH greater than 9 and must be overpacked.
   b. All wastes within a container must be compatible with each other and the container. Containers of incompatible materials must not be placed on the same pallet for movement to the HWSB.
   c. Batteries, piezoelectric crystals, thermo-electric generators, and similar devices that may yield an electric spark must not be placed in the same container with flammables or materials which may generate flames, ignitable gases, or vapors.
   d. Combination packaging of chemically compatible materials within a DOT-approved container is acceptable The drum must be accompanied by an inventory list. Individual waste containers in the drum will be itemized on the inventory list. The inside packaging may be glass (not to exceed a 1-gallon capacity), metal, or plastic (not to exceed a 5-gallon rated capacity). Overpacked containerized liquids must be surrounded by a compatible material capable of absorbing the total liquid contents in the event the inner container ruptures. The wastes must be compatible with the inside packaging and the drum. The drum must be labeled with orientation arrows indicating the placement of the inside packaging.
   e. PCB-containing or PCB-contaminated transformers and items must be packaged and labeled in accordance with TSCA requirements (40 CFR 761) and DOT requirements. The concentration of PCBs will be indicated on the PCB label (ML).
   f. A minimum 10% ullage (3 inches at top or 5 gallons for a 55-gallon drum) will be left when filling containers with liquid.

g. Bulky and heavy waste items will be blocked and/or braced inside the waste container to prevent a shift of the waste during transport and handling. Heavy items will be placed at the bottom of the containers. To the fullest extent practicable, all void space will be filled with packing material.
h. Internal packaging, absorbent, etc. shall generally be noncombustible unless DOT- approved overpacks or DOT-recognized materials are used.
i. Overpacking of waste containers is allowed in DOT-approved overpacks drums.
j. Containers shall be free of major dents, bulges, holes, rust, and similar evidence of degradation. Waste packaged in bulged or swelled containers will not be accepted or handled at the HWSB and will be overpacked or bulked prior to storage in the HWSB.
k. Reuse of DOT specification containers requires that the reusable containers be reconditioned to meet 49 CFR 173.28 requirements for the specific container. All former markings must be painted over or removed.
l. Bung plugs or caps must be properly gasketed and tightened securely to prevent leakage.
m. Open head containers with closure ring bolts must be secured by locknuts.
n. Corrosive liquids must be packaged in metal drums with compatible liners or appropriate polyethylene drums.

Containers should be placed on pallets where practical. Boxes and other containers (greater than 5 gallons) will be placed on pallets if not provided with hoisting means. Pallets will be in new or structurally sound condition without extensive splits or significant cracks or crushing. Pallets will be free of mud, clogged dirt, and any residue. Pallets that show rot will not be used. Wooden pallets will be constructed of approximately 1-inch minimum dimension lumber with 4-inch vertical spacing for forklift tine entry.

Prior to acceptance, the waste must have a valid profile created in accordance with Section 3.0 of this plan Any hazardous waste received at the HWSB that violates the Waste Acceptance Criteria is placed in the less-than-90-day accumulation area for resolution or corrected at the individual generator's location prior to storage. The HWSB operations manager has the responsibility and authority to evaluate the Waste Acceptance Criteria violations and to determine the corrective action required.

4.2 Waste Verification Prior to Acceptance at the HWSB

Base Kodiak has a waste verification program for the purpose of providing additional assurance that the waste package contents received at the HWSB are consistent with the documentation provided by the generating locations.

4.2.1 Waste Verification for Onsite Generating Locations

Field verification of waste containers at Base Kodiak generation locations is accomplished as shown in Figure 3. Appendix C is a checklist utilized in the field verification process. This field verification program consists of the following:

- Visual observation of waste material at the generator location;
- Discussions with the generator to identify process and products involved in generating the waste;

- Physical characteristic verification and, where required, qualitative field analysis of the waste at the generator location. Table 4 identifies the field analysis parameters, methods, and ranges of acceptance for these field verification parameters;
- Documentation of observations, test activities and results, and container numbers on the waste verification field form, which will accompany the waste to the Kodiak HWSB; and
- Verification of container numbers upon waste receipt at HWSB.

Waste verification will be conducted on the following fraction of containers from each generating location at each pickup:

- 1 - 9 containers 1 verified
- 10 - 19 containers 2 verified
- 20 - 29 containers 3 verified
- 30-39 containers 4 verified

Typically, field verification will be carried out at satellite accumulation areas located in generator's shops where potentially hazardous wastes are located. The following wastes are exempt from field verification:

- Empty product containers;
- Unused commercial chemical products;
- Residues from spills of known substances;
- Demolition debris; and
- Equipment removed from service.

Physical characteristics of the waste examined during the waste verification process will include color, odor, volume, phases, physical state, and layering. Chemical qualitative field test parameters, methods, and criteria for acceptance are identified in Table 4. Qualitative tests will be documented in accordance with the ranges established for acceptance. Data obtained through the waste verification process will be used to ascertain that the information provided by the generator on Form DD-1149 or manifest matches the waste in the container. If there is a discrepancy between the waste profile, the DD-1149 or manifest, and the qualitative test results, the HWSB Operations manager will be contacted for assistance in sampling and reprofiling the waste as necessary. Resolution of discrepancies will range from immediate on-the-scene resolution, to the rejection of the waste until a complete chemical and physical analysis of the waste is obtained. If it is necessary to remove the container from the generating location, it will be placed in the less-than-90-day accumulation area until it is characterized for safe storage in the HWSB.

Empty containers and unused chemical containers will be verified by comparing the inventory provided by the generator to the contents of the lab packs, and labels on containers.

All waste verification activities will be documented in a waste verification log book.

Figure 3

Procedures for On-Site Generated Waste Verification and Pickup

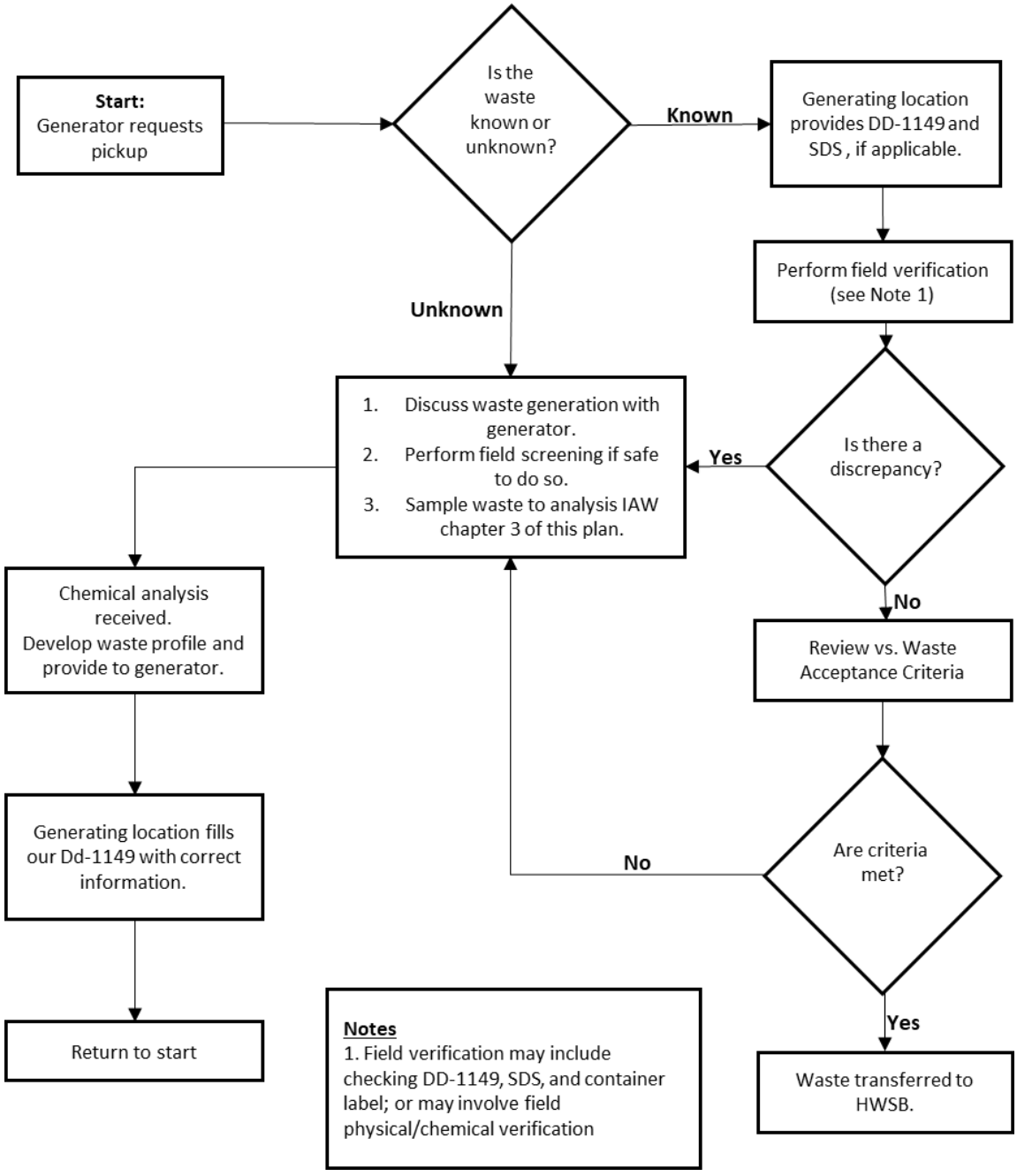


Table 4 Qualitative Waste Verification Parameters

WASTE STREAM	QUALITATIVE IDENTIFICATION METHOD[1]	EXPECTED TEST RESULT
Chlorinated solvents	Water solubility Iodine Crystal Test Copper Wire Test	Will sink in water Turns red or purple Green flame
Mineral spirits	Viscosity Water solubility Iodine Crystal Test Copper Wire Test Flammability Test	Water-like Floats Purple Negative (no color change) Flammable
Paint thinners	Viscosity Water solubility Iodine Crystal Test Copper Wire Test Flammability Test	Water-like Floats Purple Negative (no color change) Flammable
Waste JP-5	Viscosity Water solubility Iodine Crystal Test Copper Wire Test Flammability Test	Water-like Floats Purple Negative (no color change) Combustible
Waste gasoline	Viscosity Water solubility Iodine Crystal Test Copper Wire Test Flammability Test	Water-like Floats Opaque red to brown on water. Water will be yellow. Negative (no color change) Extremely flammable
Paints and paint-related waste	Water solubility Combustibility test Refrigerator Gun Test	Floats Flammable, combustible[2] Negative[3]
Acids (must be liquid for these tests)	pH Paper	pH < 7
Bases (must be liquid for these tests)	pH paper	pH > 7

Notes:

1 Identification methods are based on the Sensidyne/HazTech Systems, Inc., HazCat® Kit. This kit has been purchased by Base Kodiak and is located at the HWSB. If other kits are used, these identification parameters will change.

2 Paint and paint-related waste is potentially a complex mixture of compounds. If the generator has bulked paint-related waste, the assumption is that latex paints have been separated out. Latex paints dissolve in water and are not flammable; they are not hazardous waste. Therefore, information on latex paints has not been included in this table.

3 The refrigerator gun test is used to determine if there are chlorinated organics in paint. In general, this test result should be negative (i.e., no chlorinated solvents). If the paint (as product) contains trichloroethane, this test will be positive. This result is acceptable, so long as no other chlorinated solvents are expected.

4.2.2 Waste Analysis for Offsite Generators

Base Kodiak regularly receives waste from offsite generators such as FOLs, the Navy Base at Spruce Cape, and other visiting vessels for storage at the HWSB. All of these generators have historically met the qualifications to be considered VSQGs. Hazardous waste generated at these sites is shipped to Base Kodiak on USCG logistics flights or is transferred to Base Kodiak via USCG or USCG Contractor-owned vehicle. Base Kodiak may also occasionally receive wastes from other offsite generating locations, such as National Oceanic and Atmospheric Administration and other USCG generating locations in Alaska.

A flow chart describing the procedures for waste profiling, preparation of waste shipments, waste verification and waste acceptance from offsite generating locations is provided in Figure 4.

4.2.3 Wastes from Other Offsite Sources

Acceptance of wastes for shipment to the HWSB from other offsite sources will be accomplished in a similar manner to the FOLs (See Figure 4). Prior notification to Base Kodiak from the generator regarding the waste proposed for shipment will be required (except in shipboard emergencies). Base Kodiak reviews the documentation received from the generator and formally notifies the generator that Base Kodiak will or will not accept the waste. Because FOLs are seasonally manned, waste documentation will be maintained at Base Kodiak in accordance with regulatory requirements.

4.2.4 Waste Shipment

Wastes from the FOLs and other offsite generators are shipped to Base Kodiak with a Form DD-1149 or manifest. The DD-1149 or manifest is reviewed by the HWSB Operations Manager prior to approval of the shipment on the logistics flight or receipt by USCG or USCG Contractor-operated vehicle. Any problems that are identified by review of the DD-1149 or manifest are resolved prior to waste pickup. Waste from other offsite locations are shipped to Base Kodiak using either a DD-1149 or with a manifest. When wastes are received at Base Kodiak from offsite, they undergo the same verification procedures and frequencies described in Section 4.2.1 of this Waste Analysis Plan.

4.3 Final Acceptance of Waste upon Receipt at the HWSB

At the time of waste receipt at the HWSB, the HWSB Operations Manager or their designee inspects the load to verify that the waste received is the same as that identified on Form DD-1149 or manifest and that the containers are in good condition. This inspection includes:

- Discrepancies between the requirements of the Waste Acceptance Criteria and the physical condition of the shipment;
- Discrepancies between the waste and the label(s) or markings;
- Discrepancies among the waste, the label(s), the markings, and Form DD-1149 or manifest; and
- Container integrity.

The HWSB Operations Manager also inspects the shipment for safe container storage requirements, in addition to inspection of the documentation. The purpose of this inspection is to:

- Verify that the number of containers on the truck is the same as on Form DD-1149 or manifest;
- Verify packaging, marking, and labeling;
- Confirm that bung caps are not loose or missing;
- Confirm that drum lock ring bolts are securely fastened;
- Inspect containers for leakage and integrity; and
- Confirm that containers are properly stabilized for unloading.

Figure 4

Waste Analysis and Verification Procedures for Receipt Of Wastes from Off-Site Locations

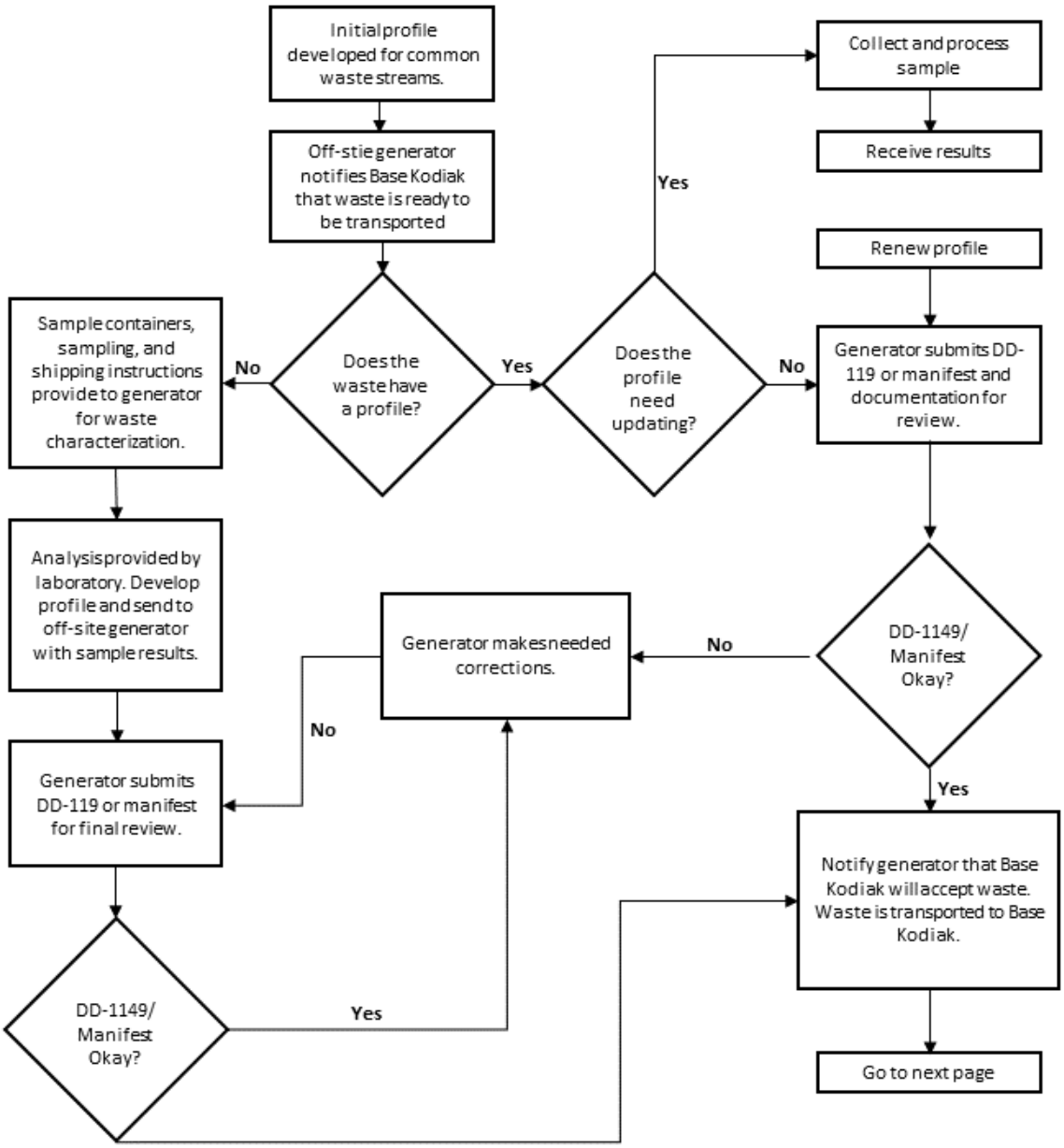
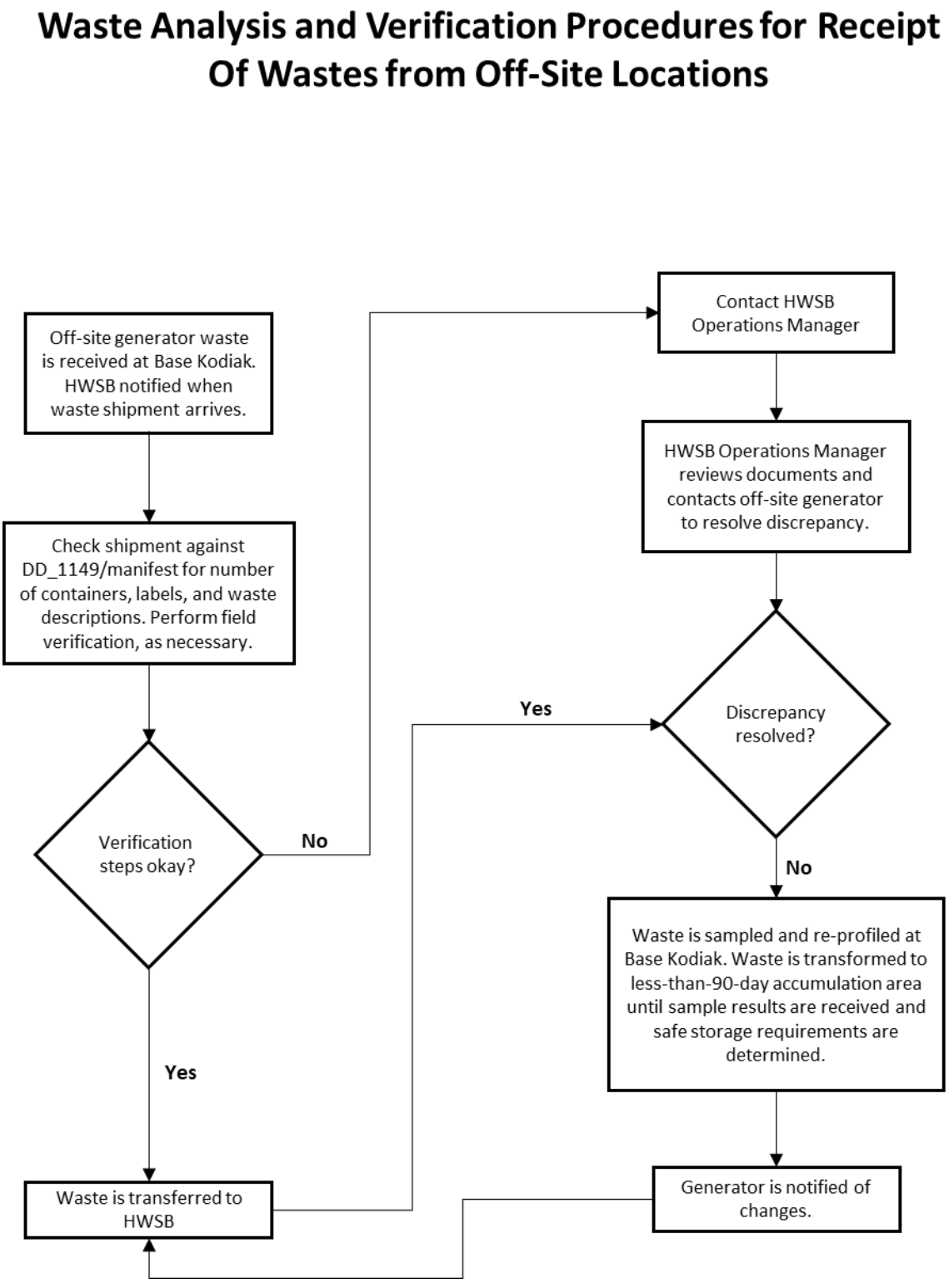


Figure 4 (continued)



Waste containers are unloaded in accordance with standard operating procedures for HWSB activities. The transport vehicle pulls into the unloading/loading area and container tie downs are removed. Appropriate hoisting and rigging equipment (e.g., forklift) is used to unload containers from the transport vehicle to move them into the HWSB. The containers are transferred to the appropriate storage location using hand-operated equipment (e.g., pallet jack, drum dolly, hand-truck, etc.) or manually if safe to do so. These practices are described further in Attachment 5.

4.4 Preparation for Offsite Shipment of Wastes

4.4.1 Fingerprint Samples Required by the TSDF

Fingerprint samples may be required by the offsite TSDF prior to acceptance of wastes for shipment. There are several circumstances under which these may be requested by the TSDF:

- For routinely-generated wastes, these fingerprint samples are generally required once per year to verify that the waste profile information has not changed;
- In the event of a rejected shipment of routine waste, fingerprint samples may be required at any time;
- For non-routine wastes, a fingerprint sample will typically be required by the offsite TSDF prior to each waste shipment; and
- For new waste streams for which SDSs or other process or purchasing information is not available.

For generating locations other than Base Kodiak, the HWSB Operations Manager will determine if a sample is required during the profiling process prior to acceptance of the waste at Base Kodiak. This analytical information will be used for documentation to the TSDF when this waste is to be transferred offsite to a final disposal facility.

A fingerprint sample is submitted to the offsite TSDF for analysis, verification, and approval for TSDF acceptance. Typical sample size is a 1-liter glass or plastic container, but other sample sizes may be accepted or required. Sampling information required by the offsite TSDF is provided by the HWSB Operations Manager. The HWSB Operations Manager or his designee may collect a sample of an ongoing waste stream to update the offsite TSDF approval of that waste stream, as necessary. Any time an approved waste stream changes (e.g., the process changes), the waste stream must be re-profiled and another fingerprint sample may be required.

4.4.2 Final Preparation for Waste Shipment

Wastes are shipped from the HWSB to offsite TSDF in accordance with USCG procedures. Waste disposition from the HWSB is initiated by the HWSB Operations Manager and involves the following:

- Review the waste profile data to verify hazardous waste characterization and acceptability to an approved offsite TSDF.
- Prepare and submit the offsite TSDF waste characterization forms for approval and acceptance of the waste.
- Submit fingerprint samples of new waste streams to the offsite TSDF for characterization. (Additional fingerprint samples may be required on a periodic basis to verify continuity of the waste streams.)

- Obtain pre-approval numbers from the offsite TSDF. Approval numbers for each waste stream must be received from the offsite TSDF prior to offsite transportation of these wastes.
- Review all shipping manifests and/or delivery orders prior to shipping. Resolve any discrepancies with shipper and TSDF prior to loading of wastes.
- Schedule hazardous waste shipments.

When the shipment is scheduled from the HWSB, the following activities are initiated by the responsible individuals:

1. The HWSB Operations Manager prepares a list of the containers which are labeled and packaged for shipment, in accordance with DOT requirements. The list includes proper DOT shipping names, EPA waste codes, weights, volumes, container sizes, etc.;
2. The HWSB Operations Manager or their designee makes all necessary arrangements with the offsite TSDF to provide transportation (usually through DRMO contract);
3. Once the transporter arrives at the HWSB, the HWSB Operations Manager or their designee coordinates and supervises loading of the truck in accordance with Coast Guard loading procedures;
4. The HWSB Operations Manager or their designee locates the containers to be shipped from the HWSB and verifies that they are those specified on the approved list;
5. The shipper and the Hazardous Waste Technician load the containers on the transport vehicle, and secures the load;
6. The HWSB Operations Manager or their designee directs a final inspection of the load prior to shipment and signs shipping documents; and
7. The HWSB Operations Manager records shipment proceedings in the HWSB Operating Log. Information recorded includes date of shipment, and manifest numbers 1042620.

5.0 WASTE ANALYSIS FOR SPILLS AND UNKNOWN LIQUIDS AT THE HWSB

In the event of a spill or release of hazardous waste within the HWSB, the following steps shall be implemented:

- Determine the drum number on the leaking container based on visual inspection. If the container(s) involved cannot be approached, the location of the pallet(s) involved and the associated pallet location designations can be determined from a distance.
- Use the drum number to track the container to the waste characterization file or use the data in the waste inventory log.
- Locate the waste characterization file containing all applicable information regarding the contents of the container and determine the hazards associated with the waste prior to exercising the emergency response procedures outlined in the Hazardous Waste Contingency Plan, which is reviewed and updated annually.
- Respond to the spill in accordance with the requirements of Hazardous Waste Contingency Plan.

If a leak or other liquid is discovered within the HWSB which cannot be tracked to a specific container due to safety or logistics reasons, the procedures outlined in the Hazardous Waste Contingency Plan would be implemented for responding to an "unknown" chemical release. The residues of such a release would be sampled and analyzed in accordance with the requirements in Section 3.0 of this Waste Analysis Plan to determine the characteristics of the waste residue as defined by 40 CFR 261.

In the event that a spill while unloading/loading wastes, the following will be performed:

1. The material involved in the spill will be known based on the waste profile. In the event that the material spilled is not known (e.g., two different wastes spill and react resulting in other chemical combinations), a sample will be collected and analyzed to characterize the material. This analysis will include flash point, pH, TCLP metals, volatile organics, and semivolatile organics, as appropriate. Sampling and analysis will be performed as described in Section 3.0 of this Waste Analysis Plan. Spill response will continue in accordance with the Hazardous Waste Contingency Plan.
2. Absorbents will be applied to the spill area in order to clean up the spilled material. If necessary, neutralizing or other chemical agents will be applied to mitigate potential chemical reactions or to better control highly toxic materials. Containment boom will be deployed as needed to prevent expansion of the spill area.
3. Absorbed waste will be cleaned up with brooms, shovels, and dust pans. Then all contaminated materials will be placed in compatible containers. The absorbed material may also be manually collected (while wearing proper protective equipment). The containers will be labeled appropriately (based on characterization under Item 2 above), managed as hazardous waste if appropriate, and placed in the HWSB for storage. If the waste determination is unknown (see Item 2), the containers will be placed in the less-than-90-day storage area until determinations can be made.

4. The affected area will be decontaminated with cleaning agents appropriate to the material spilled, the cleaning and rinse solutions collected in containers, and the rinse solutions sampled and analyzed for parameters indicative of the material spilled based on the characterization under Item 2 above. Results of the analysis will determine successful decontamination. If contamination remains, decontamination will be repeated as needed and completion of decontamination verified by sampling and analysis.
5. The collected cleaning and rinse solutions will be labeled and managed at the less-than-90- day storage area pending the receipt of analytical results. The cleaning and rinse solutions will be reclassified as to their waste type upon receipt and review of the analytical results and disposed of accordingly.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

The following discussion presents the objectives of the Quality Assurance/Quality Control (QA/QC) Program that supports the sampling of waste.

6.1 QA/QC Objectives

The objective of this plan is to assure production of high-quality data that meet regulatory requirements and accurately characterize measurement parameters. It provides the protocol for collecting samples, measuring and controlling data quality, and documenting data so that the data are useable in determining if land disposal restrictions are applicable to the waste. It also establishes the QC procedures and protocols to be implemented for sample handling, laboratory analyses, and reporting.

QA/QC activities that may be performed include:

- Field inspections. Field inspections include reviewing the sample collection techniques employed, appropriateness of sample containers and preservation methods used, chain-of-custody procedures, and verify that the analytes selected match this plan. The purpose of these inspections is to verify that a specific guideline, specification, or procedure for the activity is successfully completed.
- Analysis of QC Samples. The following QC samples may be collected and analyzed to monitor data quality.
  - Field duplicates to measure precision of sampling technique;
  - Sample splits to evaluate precision of laboratory analysis; and
  - Sample spikes to evaluate accuracy of laboratory analysis and potential matrix interferences.

6.2 Data Quality Objectives

The objectives of this program are to achieve acceptable levels of precision, accuracy, representativeness and sensitivity in the waste analysis process. These terms are defined as follows:

6.2.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is quantitatively expressed as the relative percent difference (RPD) between the matrix spike/matrix spike duplicate (MS/MSD) or field duplicates. In this program, precision within the laboratory will be measured using the MS/MSD RPD, and precision of field sampling methods will be measured by the RPD of field duplicate samples. An RPD of 25% will be considered acceptable. Precision will be calculated as the RPD as follows:

$$\%RPD_i = \frac{2 \mid Oi - Di \mid}{(Oi + Di)} \times 100\%$$

where:

$\%RPD_i$ = Relative percent difference for compound I
Oi = Value of compound I in original sample
Di = Value of compound I in duplicate sample

6.2.2 Accuracy

Accuracy measures the closeness of the measured value to the true value. The accuracy of chemical test results is assessed by "spiking" samples with known standards (surrogates, matrix spikes, and check samples) and establishing the average recovery. Surrogate recoveries will be determined for every sample analyzed for organics. An accuracy in the range of 75 to 125% will be considered adequate, however, if there are recognized matrix interferences this range may be extended. Accuracy shall be calculated as percent recovery of matrix spikes as follows:

$$\%Ri = (Yi \div Xi) \times 100\%$$

where:

%Ri = percent recovery for compound I
Yi = measured spike concentration in sample I (measured - original sample concentration)
Xi = known spike concentration in sample I

6.2.3 Representativeness

Representativeness measures how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the matrix sampled. Representativeness is a function of sampling, handling, and shipping methods and analytical techniques. Sampling methodology is described in Section 3.2 of this plan. Representativeness will be maintained by performing all sampling, sample handling, and analyses in compliance with the procedures described in this Waste Analysis Plan and the referenced analytical methods.

It is difficult to establish quantitative representativeness criteria. Representativeness will be judged qualitatively through observation of the sampling and handling methods, and comparison of actual field practices to the practices required by this plan.

6.2.4 Sensitivity (Reporting Limits)

Reporting limit goals will be adequate to identify target analyses to compare results to applicable regulations. An acceptable analysis will have reporting limits lower than the regulatory threshold. However, the reporting limit goals specified in applicable regulations may not always be achievable; matrix interference and dilutions may result in higher sample reporting limits.

6.3 Laboratory QA/QC

The day-to-day quality of analytical data generated in the project laboratories will be controlled by the implementation of the laboratory's Quality Assurance Plan.

Prior to commencement of the contract for analytical work, the laboratory will submit its QA Plan to the HWSB Operations Manager and the Contracting Officer's Representative or his designee for approval. At a minimum, the plan will document the following:

- Sample custody and management practices;
- Sample preparation and analytical procedures;
- Instrument maintenance and calibration procedures;
- Internal QA/QC measures including the use of method blanks;
- Capability to perform the analyses requested; and
- Sample preservation methods used.

7.0 RECORDKEEPING

This Waste Analysis Plan is kept with manuals containing all documents referenced in the plan except for the laboratory documents, which are maintained at the laboratories. Records associated with the Waste Analysis Plan and waste verification program are maintained at the HWSB. A copy of the waste profile package for each waste stream accepted at the HWSB is also maintained at the HWSB.

The Waste Analysis Plan will be revised under the following circumstances:

- Whenever test methods are changed;
- When waste streams or process operations are modified, thus requiring a change in the parameters to be tested;
- Referenced personnel, organizations, or procedures change; and
- Whenever regulations change affecting the plan.

Waste characterization data for each waste stream profiled or characterized (e.g., SDS, analytical data, field verification or fingerprinting data), waste acceptance procedures, and the HWSB Waste Acceptance Criteria are maintained in hard or electronic copy in the HWSB Operating Records.

A current, up-to-date inventory is kept of all containers stored in the HWSB using the container logbooks. Records of wastes currently in storage are also maintained in the electronic hazardous waste inventory log. The electronic log is updated whenever the container storage or contents change. Whenever waste is received at or shipped from the HWSB, logbooks and the electronic log are also updated. The electronic log is maintained by the HWSB Operations Manager or their designee. The information in the log is normally updated within 1 working day whenever:

- New containers are received for storage at the HWSB;
- Containers are shipped, moved, or removed from the HWSB; and
- Marking, labeling, or location discrepancies are noted during an inspection or physical inventory of the HWSB.

Information maintained in the HWSB inventory log for each container includes container control number, the proper shipping name, the RCRA waste code(s), date received, container type, waste profile number, source from which the waste was received, manifest number (for offsite wastes received and waste shipped from the HWSB), and date shipped offsite.

The HWSB inventory log provides several capabilities for management of hazardous wastes received at the HWSB. This information is used to:

- Maintain a current, up-to-date inventory of all hazardous wastes stored at the HWSB;
- Record the location by bay number of each container so that specific containers and their contents can be located easily for shipments and in the event of an emergency;
- Cross-reference container identification numbers with waste profile numbers for easy retrieval of waste characterization information; and
- Cross-reference container identification numbers with manifest numbers for easy waste tracking.

Copies of all manifests, notifications, certifications, and associated shipping forms are maintained at the HWSB. All records associated with waste profiles, characterization, receipt, shipment, and storage are retained for at least 3 years.

Draft
Appendix A
Example Waste Profile Sheet

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

HAZARDOUS WASTE PROFILE SHEET

Prescribed by: DoD 4160.21-M &
DRMS-I 4160. 14
Sponsor: Disposition Services

Note: Explosives, Shock Sensitive, Pyrophoric, Radioactive, and Etiological Waste are not normally accepted by the DLA Disposition Site .

Contact your DLA Disposition Service Site for further guidance if your waste meets any of these categories.

PART I

A. GENERAL INFORMATION

1. GENERATOR'S NAME: USCG Base Kodiak

WASTE PROFILE NO.KOD0556

2. FACILITY ADDRESS:
HAZARDOUS WASTE STORAGE BLDG.
BLDG. N48 STORIS DR.
KODIAK, AK USA 99619

3. ZIP CODE: 99619

4. GENERATOR USEPA ID: AK9690330742

5. GENERATOR STATE ID: NA

6. TECHNICAL CONTACT: Scott Griffin

7. TITLE: Environmental Protection Specialist

8. PHONE: 907-487-5588

8. WASTE INFORMATION

1. NAME OF WASTE: ACETONE, WASTE

2A. USEPA WASTE CODES: D001, F003

2B. DEMIL CODE: ● A ☐ B ☐ C ☐ D ☐ E ☐ F ☐ G ☐ P ☐ Q

2B. STATE/LOCAL/HOST-NATION WASTE CODES: NA

3. PROCESS GENERATING WASTE: EQUIPMENT CLEANING

4. PROJECTED ANNUAL VOL: 500

5. MODE OF COLLECTION: DRUMS

6. IS THE WASTE A DIOXIN LISTED WASTE AS DEFINED IN 40 CFR 261.31? ☐ Yes ☐ No

7. IS THE WASTE RESTRICTED FROM LAND DISPOSAL? (40 CFR 268): ☑ Yes ☐ No

HAS AN EXEMPTION BEEN GRANTED? ☐ Yes ☐ No

DOES THE WASTE MEET APPLICABLE TREATMENT STANDARDS ALREADY? ☐ Yes ☐ No
(If yes, Enter Reference standards in Part 3, block 6):

PART II

1. MATERIAL CHARACTERIZATION *(Optional - Not Required Data)*

COLOR: CLEAR TO YELLOW | **DENSITY:** | **BTU/lb**

TOTAL SOLIDS: 0 **ASH CONTENT:** **LAYERING:** ☐ MULTILAYERED ☐ BILAYERED ☑ SINGLE PHASE

PHYSICAL STATE ○ SOLID ◉ LIQUID ○ SEMI-SOLID ○ GAS OTHER:

2. RCRA CHARACTERISTICS (Check all that apply) ☒ IGNITABLE (D001) ☐ CORROSIVE (D002) ☐ REACTIVE (D003)

☐ WATER REACTIVE ☐ CYANIDE REACTIVE ☐ SULPHIDE REACTIVE Flash Point -.4 pH:

☐ High TOC>10% ☐ Low TOC<10% TREATMENT GROUP: Wastewater Non-Wastewater X

☐ TOXICITY CHARACTERISTIC (D004-D043) ☐ CORRODES STEEL

3. CHEMICAL/MATERIAL COMPOSITION *List all components and contaminents, including PCB's, and any applicable F-Listed and Underlying Hazardous Constituents*

CAS#	COMPONENT (Be as descriptive as possible. Chemical names as well as generic descriptions e.g. 'sludge', 'paint solids', 'water', etc. are acceptable.)	CONCENTRATION	RANGE
	ACETONE		70-100%
	PAINT RELATED MATERIALS		0-20%

HAZARDOUS WASTE PROFILE SHEET *(Continued)*

WASTE PROFILE NO.KOD0556

3. MATERIAL COMPOSITION / UNDERLYING HAZARDOUS CONSTITUENTS

CAS#	COMPONENT	CONCENTRATION	RANGE

4. SHIPPING INFORMATION

DOT HAZARDOUS MATERIAL? ☑ YES ☐ NO (If "NO" skip to block 5)

PROPER SHIPPING NAME: WASTE ACETONE

HAZARD CLASS 3	U.N. or N.A. NO. 1090	PACKING GROUP II

ADDITIONAL DESCRIPTION

METHOD OF SHIPMENT: ☐ BULK ☑ NON-BULK ☐ OTHER:

DOT REPORTABLE QTY (RQ): 1000LB (REF: 49 CFR 72.101, Appendix A)

EMERGENCY RESPONSE GUIDE EDITION 2016	EMERGENCY RESPONSE NO: 197

5. SPECIAL HANDLING INFORMATION

6. GENERATOR CERTIFICATION

☑ CHEMICAL ANALYSIS *(Attach Test Results)*

☑ USER KNOWLEDGE *(Attach Supporting Documents)*

Explain how and why these documents comply with RCRA requirements. SDS & LABS SUPPORT HWP

CERTIFICATION

I SCOTT GRIFFIN HEREBY CERTIFY THAT ALL INFORMATION SUBMITTED IN THIS AND ALL ATTACHED DOCUEMNTS IS TO THE BEST OF MY KNOWLEDGE AN ACCURATE REPRESENTATION OF THE WASTE TURNED IN TO THE DRMO. ALL KNOWN OR SUSPECTED HAZARDS HAVE BEEN DISCOLOSED.

Scott Griffin

Signature of Generator's Representative

DATE: 12/05/2019

HAZARDOUS WASTE PROFILE SHEET *(Continued)*

WASTE PROFILE NO.KOD0556

3. MATERIAL COMPOSITION / UNDERLYING HAZARDOUS CONSTITUENTS

CAS#	COMPONENT	CONCENTRATION	RANGE

This page intentionally blank

Draft
Appendix B
Sampling Standard Operating Procedures

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

1. BULK MATERIALS SAMPLING SOPS

METHOD 1.1: SAMPLING BULK MATERIALS WITH A GRAIN THIEF

Discussion

The grain thief (Figure 1) consists of two slotted telescoping tubes, usually made of brass or stainless steel. The outer tube has a conical, pointed tip on one end that permits the sampler to penetrate the material being sampled. The sampler is opened and closed by rotating the inner tube. Grain thiefs are generally 61 to 100 cm long by 1.27 to 2.54 cm in diameter, and they are commercially available at laboratory supply houses.

Uses

The grain thief is used for sampling powdered or granular wastes or materials in bags, fiberdrums, sacks or similar containers. This sampler is most useful when the solids are no greater than 0.6 cm in diameter.

Procedures for Use

1. While the sampler is in the closed position, insert it into the granular or powdered material or waste being sampled from a point near a top edge or corner, through the center, and to a point diagonally opposite the point of entry.

2. Rotate the inner tube of the sampler into the open position.

3. Wiggle the sampler a few times to allow materials to enter the open slots.

4. Place the sampler in the closed position and withdraw from the material being sampled.

5. Place the sampler in a horizontal position with the slots facing upward.

6. Rotate and slide away the outer tube from the inner tube.

7. Transfer the collected sample in the inner tube into a suitable sample container.

8. If composite sampling is desired, collect two or more core samples at different points, and combine the samples in the same container.

9. Check that a Teflon liner is present in the cap if required. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemented by a minimal holding time.

10. Label the sample bottle with the appropriate sample tag. Be sure to label the tag carefully and clearly, addressing all the categories or parameters. Complete all chain-of-custody documents and record in the field logbook.

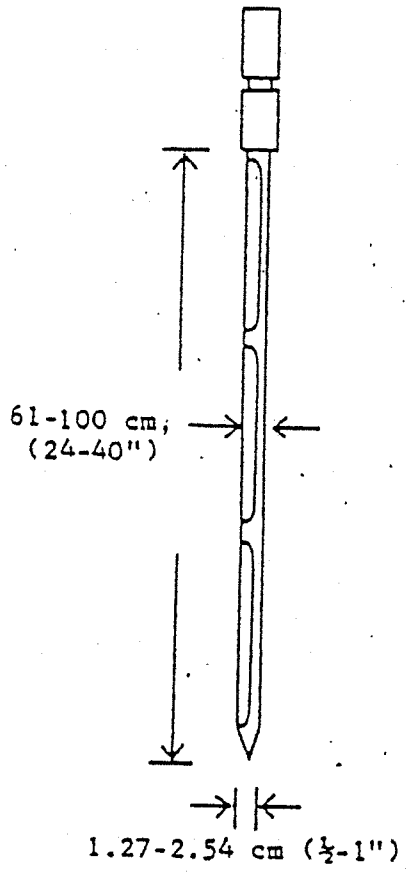
11. Place the properly labeled sample bottle in an appropriate carrying container maintained at 4°C throughout the sampling and transportation period.

Sources

deVera, E.R., Simmons, B.P., Stephens, R.D., and Storm, D.L. "Samplers and Sampling Procedures for Hazardous Waste Streams." EPA-600/2-80-018. January 1980.

Horwitz, W., Sensel, A., Reynolds, H., and Parks, D.L., editors. Animal Feed: Sampling Procedure. In: Official Methods of Analysis. The Association of Official Analytical Chemists. 12th Edition. Washington, D.C. 1979.

Figure 1 SAMPLING BULK MATERIALS WITH A GRAIN THIEF



METHOD 1.2: SAMPLING OF BULK MATERIAL WITH A SCOOP OR TRIER

Discussion

A typical sampling trier (Figure 1) is a long tube with a slot that extends almost its entire length. The tip and edges of the tube slot are sharpened to allow the trier to cut a core of the material to be sampled when rotated after insertion into the material. Sampling triers are usually made of stainless steel with wooden handles. They are about 61 to 100 cm long and 1.27 to 2.54 cm in diameter. They can be purchased readily from laboratory supply houses.

A laboratory scoop or garden variety trowel can also be used to sample bulk material. The trowel looks like a small shovel. The blade is usually about 7 by 13 cm with a sharp tip. A laboratory scoop is similar to the trowel, but the blade is usually more curved and has a closed upper end to permit the containment of material. Scoops come in different sizes and shapes. Stainless steel or polypropylene scoops with 7 by 15 cm blades are preferred. A trowel can be bought from hardware stores; the scoop can be bought from laboratory supply houses.

Uses

The use of the trier is similar to that of the grain sampler discussed in Method 4-10. It is preferred over the grain sampler when the powdered or granular material to be sampled is moist or sticky.

The trowel or lab scoop can be used in some cases for sampling dry, granular or powdered material in bins or other shallow containers. The lab scoop is a superior choice since it is usually made of materials less subject to corrosion or chemical reactions.

Procedures for Use

1. Insert the trier into the waste material at a 0 to 45° angle from horizontal. This orientation minimizes the spillage of sample from the sampler. Extraction of samples might require tilting of the containers.

2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.

4. Transfer the sample into a suitable container with the aid of a spatula and/or brush.

5. If composite sampling is desired, repeat the sampling at different points two or

more times and combine the samples in the same sample container.

6. Check that a Teflon liner is present in the cap if required. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemented by a minimal holding time.

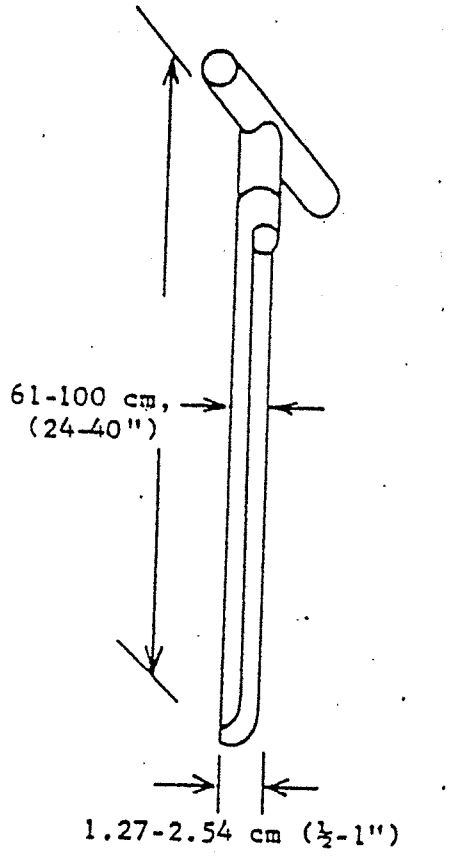
7. Label the sample bottle with the appropriate sample tag. Be sure to label the tag carefully and clearly, addressing all the categories or parameters. Complete all chain-of-custody documents and record in the field logbook.

8. Place the properly labeled sample bottle in an appropriate carrying container maintained at 4°C throughout the sampling and transportation period.

Sources

deVera, E.R., Simmons, B.P., Stephens, R.D., and Storm, D.L. "Samplers and Sampling Procedures for Hazardous Waste Streams." EPA-600/2-80-018. January 1980.

Figure 1 SAMPLING OF BULK MATERIAL WITH A SCOOP OR TRIER



2. CONTAINERIZED LIQUIDS SAMPLING SOPS

METHOD 2.1: COLLECTION OF LIQUID CONTAINERIZED WASTES USING GLASS TUBES

Description

Liquid samples from opened containers (55-gallon drums) are collected using lengths of glass tubing. The glass tubes are normally 122 cm in length and 6 to 16 mm inside diameter. Larger diameter tubes may be used for more viscous fluids if sampling with the small diameter tube is not adequate. The tubing is broken up and discarded in the container after the sample has been collected, eliminating difficult cleanup and disposal problems. This method should not be attempted with less than a two-man sampling team.

Uses

This method provides for a quick, relatively inexpensive means of collecting concentrated containerized wastes. The major disadvantage is from potential sample loss which is especially prevalent when sampling low viscosity fluids. Splashing can also be a problem and proper protective clothing (e.g., butyl rubber apron, face shields, boot covers) should always be worn.

Procedures for Use

1. Remove cover from sample container opening.

2. Insert glass tubing almost to the bottom of the container. Try to keep at least 30 cm of tubing above the top of the container.

3. Allow the waste in the drum to reach its natural level in the tube.

4. Cap the top of the tube with a safety-gloved thumb or a rubber stopper.

5. Carefully remove the capped tube from the drum and insert the uncapped end in the sample container.

6. Release the thumb or stopper on the tube and allow the sample container to fill to approximately 90 percent of its capacity.

7. Repeat steps 2 through 6 if more volume is needed to fill the sample container.

8. Remove the tube from the sample container and replace the tube in the drum.

9. Cap the sample container tightly with a Teflon-lined cap and affix the sample identification tag.

10. Break the glass sampling tube in such a way that all parts of it are discarded inside the drum. (Note: see the initial discussion to this section for exceptions.)

11. Replace the bung or place plastic over the drum.

12. Place sample container in a Ziplock plastic bag (one per bag).

13. Place each bagged container in a 1-gallon metal paint can (or appropriate sized container) and pack in vermiculite packing material. Place lid on the can.

Optional Method (if sample of bottom sludge is desired)

1. Remove cover from container opening.

2. Insert glass tubing slowly almost to the bottom of the container. Try to keep at least 30 cm of tubing above the top of the container.

3. Allow the waste in the drum to reach its natural level in the tube.

4. Gently push the tube towards the bottom of the drum into the sludge layer. Do not force it.

5. Cap the top of the tube with a safely-gloved thumb or rubber stopper.

6. Carefully remove the capped tube from the drum and insert the uncapped end in the sample container.

7. Release the thumb or stopper on the tube and allow the sample container to fill to approximately 90 percent of its capacity. If necessary, the sludge plug in the bottom of the tube can be dislodged with the aid of a stainless steel laboratory spatula.

8. Repeat if more volume is needed to fill sample container and recap the tube.

9. Proceed as in Steps 9 through 14 above.

Note:

1. If a reaction is observed when the glass tube is inserted (violent agitation,

smoke, light, etc.) the investigators should leave the area immediately.

2. If the glass tube becomes cloudy or smokey after insertion into the drum, the presence of hydrofluoric acid is indicated and a comparable length of rigid plastic tubing should be used to collect the sample.

3. When a solid is encountered in a drum (either layer or bottom sludge) the optional method described above may be used to collect a core of the material, or the material may be collected with a disposable scoop attached to a length of wooden or plastic rod.

(This Page Intentionally Left Blank)

Draft
Appendix C
Field Verification Checklist

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

Field Verification Checklist

GENERATING LOCATION:		DATE:	
PARAMETER	**RESULT**	**MEETS CRITERIA**	**DOES NOT MEET CRITERIA**
COLOR (matches profile)			
ODOR (matches profile)			
VOLUME (matches profile)			
PHYSICAL STATE (matches profile)			
LAYERS (matches profile)			
pH (meter: ±1 unit; paper: ±2.5 units			
CHLORINATED COMPOUNDS (presence / absence)			
WATER REACTIVITY (physical changes)			
OXIDIZER (changes color)			
REDUCER (changes color)			
FLASHPOINT (±10% of profile record)			
FREE LIQUIDS			

Notes:

If any marks are placed in the "Does Not Meet Criteria" category, notify the Environmental Protection Specialist. DO NOT accept waste for transfer to the HWSB.

This page intentionally blank

Draft
Attachment 3
Personnel Training Outline

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 INTRODUCTION **1**

2.0 OUTLINE OF TRAINING PROGRAM **3**

2.1 Job Descriptions 5

2.1.1 Occasional Workers 7

2.2 Training Content, Frequency, and Techniques 7

2.2.1 HWSB Operations Manager Training 7

2.2.2 HWT Training 7

2.2.3 Hazardous Waste Manager Training 8

2.2.4 Environmental Division Chief Training 8

2.2.5 General Training Requirements 8

2.3 Relevance of Training to Job Descriptions 9

2.4 Training for Emergency Response 9

3.0 IMPLEMENTATION OF TRAINING PROGRAM **11**

4.0 TRAINING RECORDS **13**

5.0 OTHER PERSONNEL TRAINING ASSOCIATED WITH GENERATION OF HAZARDOUS WASTE **15**

TABLES

Table 1 Training Matrix 4

This page intentionally blank

ACRONYMS AND ABBREVIATIONS

BOSS	Base Kodiak Operating Support Services
CFR	Code of Federal Regulations
COMDTINST	Commandant Instruction
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HAZWOPER	Hazardous Waste Operations and Emergency Response
HWSB	Hazardous Waste Storage Building
HWT	hazardous waste technician
LDR	Land Disposal Restriction
OJT	on-the-job training
OSHA	Occupational Safety and Health Act
PPE	personal protective equipment
PWS	Performance Work Statements
RCRA	Resource Conservation and Recovery Act
SAP	satellite accumulation point
TSDF	Treatment, Storage, and Disposal Facility
USCG	U.S. Coast Guard

This page intentionally blank

1.0 INTRODUCTION

This section describes the training program for personnel involved in hazardous waste handling, management, and unit operations for the Hazardous Waste Storage Building (HWSB). The HWSB is a Resource Conservation and Recovery Act (RCRA) permitted container storage unit for RCRA regulated hazardous waste and non-RCRA regulated hazardous materials at the U.S. Coast Guard (USCG) Base Kodiak, Kodiak, Alaska.

It is USCG policy (Commandant Instruction [COMDTINST] M16478.1 series) that every person who has responsibility for handling or managing hazardous waste be trained in the proper and safe receipt, handling, storage, and shipment of hazardous waste, as appropriate to their specific job responsibilities.

Persons assigned to the HWSB need to be trained in state and federal hazardous and solid waste, shipping and safety laws and regulations, as well as HWSB site-specific safety plan, HWSB management, spill prevention, emergency response procedures, and hazard communications, as these pertain to the performance of their duties. Training of personnel assigned to the HWSB is the responsibility of the employer of each person. Personnel may be barred from working in the facility if they do not have appropriate training within the designated time limits.

Section 1.0 outlines the training program for HWSB personnel and the USCG interface. Section 3.0 describes how the training program is implemented. Section 4.0 describes the training records that are maintained. Section 5.0 describes other training activities related to hazardous waste generation that are associated with, but not specifically required by RCRA Permit AK9 69033 0742.

This page intentionally blank

2.0 OUTLINE OF TRAINING PROGRAM

The training program for personnel assigned to the HWSB consists of a combination of classroom instruction and on-the-job training (OJT) and is designed to train personnel to perform their specific job assignments as they relate to operation of the HWSB. The program incorporates training required by the RCRA, U.S. Department of Transportation (DOT), and the Occupational Safety and Health Act (OSHA). HWSB personnel receive this training to the level required by their job function and responsibility before they are allowed to engage in hazardous waste handling or management activities without supervision. At a minimum, personnel assigned to the HWSB are trained in the following areas:

- Site Specific (may be classroom or OJT);
  - General description of the HWSB;
  - Job-related procedures, policies, and instructions;
  - Training for emergency response (Section 2.4); and
  - Names of personnel and alternates responsible for safety and health at Base Kodiak.
- General Training will include;
  - Waste identification;
  - Hazardous material shipping;
  - Use of personal protective equipment (PPE);
  - Ways to minimize risks from hazards;
  - Safe use of engineering controls and equipment on the job;
  - Recognition of symptoms and signs which are indicative of exposure to hazards;
  - OSHA 1910.120 Hazardous Waste Operations and Emergency Response (HAZWOPER);
  - Respirator training and fit test; and,
  - Medical surveillance requirements.

All new employees involved with the handling and management of hazardous waste are required to attend a health and safety orientation prior to starting work. This orientation is conducted by the HWSB operations manager or a hazardous waste technician (HWT). The HWSB operations Manager determines the training needs of HWSB personnel and their employer schedules them for onsite or offsite training.

The HWSB training program and site-specific safety plan are reviewed at least annually by the HWSB operations manager and the Environmental Division Chief. The program is evaluated through:

- Evaluation of employee written exams and observation of employee performance of job-related tasks;
- Management observation and appraisal of OJT performance; and
- Feedback and retraining/evaluation in weak areas.

Additionally, the HWSB training program is upgraded as needed in response to changes in job assignments or descriptions, process or procedural changes, technological changes, or implementation of new regulatory requirements. A training matrix is provided in Table 1.

Section 2.1 briefly gives the job descriptions related to hazardous waste handling or management at the HWSB. Section 2.2 describes training content, frequency, and techniques. Section 2.3 describes the relevance of training to job descriptions. Section 2.4 describes training for emergency response.

Table 1 Training Matrix

TRAINING TYPE	HWSB OPERATIONS / RCRA PROGRAM MANAGER	HAZARDOUS WASTE MANAGER	HAZARDOUS WASTE TECHNICIAN	ENVIRONMENTAL DIVISION CHIEF	OCCASIONAL WORKER
HAZWOPER 40 hr. (29 CFR 1910.120)	X	X	X	X	X**
HAZWOPER-annual refresher (29 CFR 1910.120)	X	X	X	X	X**
RCRA Waste Identification (40 CFR 264.16)	X	X	X	X	
RCRA Waste Management Standards (40 CFR 264.16)	X	X	X	X	
Annual Re-Occurring RCRA Waste Management Training	X	X	X	X	
Hazardous Material Shipping Initial training and 3-year refresher (49 CFR 172.700)	X	X	X		
Forklift Operator Training (29 CFR 1910.178)	X	X	X		X*
HWSB operations / procedures (40 CFR 264.16)	X	X	X		
RCRA site-specific safety and emergency response*** (40 CFR 264.16)	X	X	X	X	X*
OSHA Supervisor-8 hr (29 CFR 1910.120)	X				
Respiratory Protection (29 CFR 1910.134)	X	X	X		X*
Hazard Communication (29 CFR 1910.1200)	X	X	X	X	X
Hazardous Waste Sampling (40 CFR 264.16)	X		X		X*

Notes:

* Depending on tasks performed.

** Fire Department personnel only.

*** This training is provided by the HWSB Operations Manager to personnel listed in Table 1.

2.1 Job Descriptions

Following is a brief description of duties and responsibilities of the personnel (by job description) involved with waste handling or management and emergency response at the HWSB.

HWSB Operations and RCRA Program Manager. This position is filled by a civilian USCG employee and has the responsibility to:

- Direct all activities associated with wastes being accepted into and shipped from the HWSB including the management of the less-than-90-day accumulation area outside the HWSB;
- Develop and update waste profiles;
- Conduct profile and verification sampling activities;
- Coordinate waste verification and sampling prior to waste being accepted at the HWSB.
- Prepare for and coordinate shipments of waste to Treatment, Storage, and Disposal Facilities (TSDFs) or other appropriate facilities;
- Prepare manifests, Land Disposal Restriction (LDR) notifications and certifications, exception reports, and any other required shipping documents;
- Conduct or coordinate required inspections of the HWSB, the less-than-90 day area and satellite accumulation points;
- Keep facility operating record complete and up-to-date;
- Verify that HWSB workers have required training prior to allowing them to work unsupervised;
- Coordinate with Environmental Division Chief to provide training to onsite and offsite generators and coordinators;
- Provide and/or coordinate with Environmental Division Chief for completion of training for government-operated satellite accumulation point (SAP) managers;
- Inspect, coordinate with, and advise onsite and offsite Base Kodiak hazardous waste generators on appropriate management of hazardous waste at satellite accumulation areas;
- Coordinate training for the government generators on hazardous waste management in satellite areas;
- Inspect and provide verification of training for non-government accumulation area managers and hazardous waste technicians; reports to the Environmental Division Chief any discrepancies found;
- Maintain government training records for the HWSB. Ensure all training records are in compliance with current RCRA, DOT, and OSHA regulations. Copies of non-governmental employee training records are provided and maintained onsite by the respective employers;
- Provide periodic quality control review of the Base Kodiak RCRA Permit to assist in keeping it current and accurate as it pertains to HWSB operations;
- Check that hazardous waste manifests, exception reports and any other shipping documents are prepared in accordance with Coast Guard, RCRA and DOT regulations;
- Identify and document facility and equipment maintenance and repair needs at the HWSB, initiates requests for maintenance and repair; and,
- Participate in spill response.

Environmental Division Chief. This job is filled by a civilian USCG employee. The Environmental Division Chief responsibilities may include:

- Sign exception reports and requisitions; and
- Provide oversight and coordination of training for USCG environmental staff.

Hazardous Waste Manager. This position is filled by a civilian USCG employee and has the responsibility to:

- Provide oversight of accumulation areas for Base residents and contractors;
- Perform quality assurance inspections for accumulation areas base-wide;
- Review and approve changes to accumulation areas on Base Kodiak;
- Inspect and provide verification of training for non-government accumulation area managers and hazardous waste technicians; reports to the Environmental Division Chief any discrepancies found;
- Conduct or coordinate required inspections of the HWSB, the less-than-90 day area and satellite accumulation points;
- Prepare for and coordinate shipments of waste to the HWSB , treatment or other appropriate facilities;
- Inspect, coordinate with and advise onsite and offsite Base Kodiak hazardous waste generators on appropriate management of hazardous waste at satellite accumulation areas; and
- Assist with keeping facility operating records complete and up-to-date.

HWT. Responsibilities include:

- Transport waste from Base Kodiak satellite accumulation areas or offsite very small quantity generators to the HWSB or less-than-90-day accumulation area;
- Operate waste handling equipment;
- Assist in loading, unloading, and re-warehousing activities;
- Conduct building inspections;
- Verify outgoing and incoming containers for correct labelling in accordance with U.S. Environmental Protection Agency (EPA) and DOT procedures;
- Perform waste identification, classification, and compatibility prior to transport of waste;
- Labelling waste containers in accordance with most current RCRA and DOT regulations;
- Perform waste verification and sampling, as directed;
- Transport waste to the Kodiak Island Borough Landfill or other offsite locations;
- Provide training to non-government HWTs and personnel on HWSB procedures and operations as required to fulfill their assigned duties;
- Perform basic facility and grounds maintenance work;
- Perform general housekeeping duties;
- Update container logs to reflect current status; and
- Participate in spill responses.

2.1.1 Occasional Workers

Occasionally, the services of non-HWSB personnel may be required to perform duties for events including, but not limited to, acts of nature and government shutdowns. This includes but is not limited to USCG firefighters, USCG Military Police, and Base Kodiak Operating Support Services (BOSS) Contractor trades personnel (electricians, carpenters, plumbers, etc.) and janitors who perform routine maintenance activities in the HWSB. A brief description of their job duties in relation to the HWSB is provided below:

- **USCG Firefighters**. Provide fire prevention and suppression and emergency response services throughout the Base Kodiak Complex, including the HWSB; provide Hazardous Waste Technician level response and assistance to the HAZMAT/ HAZWASTE spill teams. USCG conducts a self-contained training program for its firefighters, which includes procedures for handling fires and spill emergencies that involve hazardous wastes and hazardous materials at Base Kodiak; training of USCG firefighters is therefore not discussed further in this plan.
- **USCG Military Police**. Provide physical security services throughout the Base Kodiak Complex including perimeter and building checks; provide emergency services support to the Base Kodiak Fire Department. USCG Military Police is not stationed at the HWSB nor is it involved in the management or handling of hazardous waste or material. Military Police receive training from the USCG relative to their positions and the facilities they serve; training of military Police personnel in therefore not discussed further in this plan.
- **Crafts Personnel**. Includes USCG and/or contractor personnel to include electricians, plumbers, painters, mechanics, telephone and communications technicians, janitors and similar tradesmen. These personnel provide periodic maintenance and repair work and support at the HWSB on an as needed basis. These personnel do not manage or handle hazardous waste.
- **Short-term laborers**. Periodically, a laborer (for example a forklift operator) may be asked to assist in HWSB operations. These employees would not work at the HWSB except under the supervision of a trained HWT or the HWSB Manager. They will be given a safety orientation prior to the start of work, and will have appropriate training to do their assigned job.

2.2 Training Content, Frequency, and Techniques

2.2.1 HWSB Operations Manager Training

The HWSB Operations Manager is the person in charge of the HWSB, and assists waste generators on and offsite in managing their waste. The HWSB Manager is required to have had the training shown in Table 1 within 6 months of filling the job. This training may be classroom or OJT.

The HWSB Operator is generally an individual with background in environmental science or engineering. Knowledge of general chemistry through course work or work experience is required for the job. Other knowledge of chemistry and how it relates to HW characterization is gained through the courses listed above, and through work experience with the laboratories conducting chemical analysis for Base Kodiak.

2.2.2 HWT Training

The HWT training program for HWSB personnel involves a combination of formal and OJT training sessions. Each HWT is required to be trained to do their job and maintain compliance with the most current EPA, DOT, and OSHA regulations. Training for all non-government technicians and workers is

provided by and the responsibility of the employer. Job descriptions for each individual describe the minimum training requirements for each job at the HWSB.

Personnel receive a significant portion of detailed job knowledge through OJT. OJT may include the following, as determined by the employee's job:

- RCRA requirements as they relate to the HWSB;
- Waste identification, classification, and compatibility;
- Hazardous materials transportation with refresher every 3 years;
- HWSB operations/procedures, to include (as needed for job assignment):
  - HWSB systems and components (including waste handling equipment and procedures for use);
  - Normal operating procedures and shutdown procedures;
  - Emergency or off-normal operating procedures as discussed in the HWSB emergency response procedures;
  - Inspections (if expected to perform inspections);
  - Equipment maintenance;
  - HWSB administrative procedures;
- Forklift operator training;
- OSHA and other, related health and safety requirements (40-hour HAZWOPER if employee is expected to work at the HWSB unsupervised, or as more than an occasional visitor); and
- Waste sampling techniques (if performing sampling).

2.2.3 Hazardous Waste Manager Training

The Hazardous Waste Manager is a key person in monitoring and verifying the effective management of hazardous waste at Base Kodiak. Training for the Hazardous Waste Manager is essentially the same as the HWSB Operations Manager's training, and may involve a combination of formal and OJT training for the job. At a minimum, the Hazardous Waste Manager receives the training shown in Table 1.

2.2.4 Environmental Division Chief Training

The Division Chief has the overall responsibility for the effective management of hazardous waste and other environmental programs at Base Kodiak. Training may involve a combination of formal and OJT training. At a minimum, the Government Manager receives the training shown in Table 1.

2.2.5 General Training Requirements

To test the knowledge of individuals participating in the HWSB training program, the HWSB operations manager may prepare and administer written examinations. In addition to written examinations, the HWSB operations manager may administer oral examinations, operational evaluations, and reviews to verify that personnel are adequately trained relative to their job.

Individuals who have completed initial training programs are periodically retrained and reevaluated to ensure they maintain proficiency. At a minimum, HWSB employees receive annual training in abnormal and emergency procedures and annual respirator refresher training, and biennial retraining relative to their specific job assignment. Employees who handle or manage hazardous waste receive annual refresher training in RCRA and OSHA requirements and training in newly promulgated RCRA regulations that apply

to HWSB waste management and handling activities within 6 months of the effective date of the regulations.

Personnel who demonstrate by documentation or certification an equivalency that initial training requirements have been met are not required to complete the initial requirements. However, personnel with equivalent training are required to complete training specific to the HWSB and have appropriate experience prior to engaging in work activities at the HWSB. Equivalent training includes any academic training or the training the employee might have already received from actual hazardous waste site work experience at a location other than the HWSB. The HWSB Operations Manager must approve exemptions or equivalencies. Each exemption or equivalency is documented in the individual's training record.

Non-Government employees assigned to transport waste to the HWSB must have a Hazardous Waste Commercial Driver's License. The license is obtained by the successful completion of a written and driving test administered by the Alaska Department of Motor Vehicles.

Occasionally, HWSB personnel attend training classes conducted by outside vendors. In order to verify an employee's attendance at an outside vendor training course, information on the course attended, course content, and number of hours is obtained from the vendor. Personnel attending the class retain their original certificate. Copies of certificates are maintained as described in Section 3.0.

2.3 Relevance of Training to Job Descriptions

The training is focused on training the individual to make decisions about waste types to be received at the HWSB, to be able to identify wastes based on analytical data, to be able to safely sample potentially hazardous wastes, and to assist the HWSB operations manager in making a determination that wastes are acceptable for storage in the HWSB.

Job descriptions/Performance Work Statements (PWS) should identify the minimum training requirements for contractor personnel assigned to the HWSB. At a minimum, the job description identifies the following:

- Basic purpose of job;
- Accountabilities;
- Basic qualifications; and
- Required training – initial and continued.

The HWSB Operations Manager evaluates training requirements for HWSB employees and passes this information to contract employees through the contracting officer's representative.

2.4 Training for Emergency Response

The HWSB Operations Manager or their designee conducts emergency response training for HWSB personnel. Emergency response training includes the relevant elements of the Base Kodiak Integrated Emergency Response and Prevention Plan, the RCRA contingency plan, spill response standard, operating procedures for the job, PPE to be worn and procedures for handling emergency incidents. The following presents an overview of emergency response training received by HWSB personnel.

- Location and content of the HWSB RCRA contingency plan and emergency response procedures including spill response;
- Reasons for emergency plans;

- Special precautions during an emergency;
- Identification, locations, and functions of the emergency equipment and supplies;
- Location and inventory of hazardous materials/waste within the HWSB and their specific hazards;
- Use of emergency communications systems and equipment including Base Kodiak alarms and their meanings;
- Use of proper controls, including administrative and engineering controls;
- Personnel accountability and the role of the individual worker during the emergency;
- Spill Control Plan;
- Planning an evacuation;
- Arranging emergency medical care;
- Methods used to detect hazardous materials/substances and symptoms of overexposure to these materials;
- Hazardous waste disposal practices; and
- Situations that require evacuation, evacuation routes, and emergency assembly areas.

All HWSB employees receive initial training and annual retraining on HWSB emergency procedures. The HWSB Operations Manager develops and coordinates an annual emergency action exercise at the HWSB. All HWSB employees are required to participate. This exercise is intended to test the practical application of emergency response procedures. Annual training includes applicable actions from the previous training exercise. The annual exercise is used to evaluate the emergency personnel abilities and to evaluate the adequacy of the RCRA contingency plan and Base Kodiak emergency response procedures as an effective tool for protecting human health, the environment, the HWSB, the waste in storage, and the HWSB equipment.

In conjunction with OJT, employees are familiarized with shutdown procedures where applicable. No training is conducted for key parameters for automatic waste feed cut-off systems because no systems of this type are present at the HWSB.

3.0 IMPLEMENTATION OF TRAINING PROGRAM

Before engaging in hazardous waste handling or management activities, HWSB personnel are required to complete the minimum training requirements identified for their job descriptions. RCRA training is completed within the first 6 months of the individual's employment or assignment to a HWSB job involving waste management or handling. Throughout the training program and until completion, employees do not perform their job duties unsupervised.

This page intentionally blank

4.0 TRAINING RECORDS

Training records for all employees working in the HWSB employees are maintained in the HWSB and the office of their employer. The HWSB Operations Manager maintains the training record component of the HWSB operating record; employers maintain the training records of their employees. The USCG Facilities Engineering Division maintains the training records of the USCG personnel.

Personnel files maintained by each employer and the HWSB Operation Manager include, as a minimum, the following:

- Job description;
- Name of person filling the job;
- Education, work experience, and employment history; and
- Verification of most recent medical examination.

Training records maintained by the HWSB Operations Manager contain the following additional information:

- Training certificates, class rosters, or other documentation which demonstrates completion of training;
- Results of exams, walkthroughs, and job performance assessments related to certification; and
- Correspondence relating to exceptions to training requirements and extensions of qualification or recertification.

Training records are maintained until closure of the HWSB or until the employee terminates or transfers. Training records of employees who terminate or transfer are maintained as part of the HWSB Operating Record for a minimum of 3 years.

This page intentionally blank

5.0 OTHER PERSONNEL TRAINING ASSOCIATED WITH GENERATION OF HAZARDOUS WASTE

Other training activities are conducted by Base Kodiak and other generators to comply with statutory and regulatory RCRA requirements not addressed by RCRA Permit AK9 69033 0742. The training is provided to comply with (as applicable):

- Training requirements for large quantity generators, per 40 CFR 262.17(a)(5) and 265.16;
- Training requirements for small quantity generators per 40 CFR 262.34(d)(5)(iii);
- Training requirements for universal waste handlers per 40 CFR 273.16 and 273.36.

It is the responsibility of the USCG to ensure that employers are properly training employees who are hazardous waste generators and coordinators. Generators include, but are not limited to, tenants and BOSS contractors. Training for hazardous waste generators and coordinators is to be conducted on an annual basis.

Records for such training are maintained at the trained employee's unit/organizational level in accordance with the applicable record keeping provisions.

This page intentionally blank

Draft
Attachment 4A

Consolidated Post-Closure Plan: Sites 3, 6A, and 7A

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS III

1.0 INTRODUCTION TO CONSOLIDATED POST-CLOSURE PLAN 1
2.0 GENERAL UNIT DESCRIPTION AND REGULATORY HISTORY 3

2.1 Site 3 – Coast Guard Laundry 3
2.2 Site 6A – MOGAS 4
2.3 Site 7A – Barrel Storage Area No. 1 5

3.0 TOPOGRAPHIC MAPS OF THE FACILITY 7
4.0 HYDROGEOLOGIC INFORMATION 9

4.1 Site 3 – Coast Guard Laundry 9
4.2 Site 6A – MOGAS 9
4.3 Site 7A – Barrel Storage Area No. 1 9

5.0 POST-CLOSURE INSPECTIONS 11

5.1 Landfill Caps 11
5.2 Groundwater Monitoring System 11
5.3 Corrective Action Systems 11

6.0 POST-CLOSURE GROUNDWATER MONITORING 13

6.1 Site 3 – Coast Guard Laundry 13
6.2 Site 6A – MOGAS 13
6.3 Site 7A – Barrel Storage Area No. 1 13
6.4 Compound Quantitation Limits 13
6.5 Groundwater Sampling and Analysis Procedures 13
6.6 Investigation-Derived Waste Management 13

7.0 POST-CLOSURE CONTACT OFFICE 15
8.0 CORRECTIVE ACTION PLAN 17

8.1 Corrective Action Technologies 17
8.2 Groundwater Corrective Action System Performance Analysis 18
8.2.1 Groundwater Contaminant Concentration Trend Analysis 18
8.2.2 Total Organic Vapor Mass Removal Measurements 18
8.3 Reporting 18

9.0 EXPOSURE INFORMATION REPORT 19
10.0 HEALTH AND SAFETY 21
11.0 SECURITY AND TRAINING 23

11.1 Security 23
11.2 Personnel Training 23

12.0 POST-CLOSURE NOTICE AND CERTIFICATION 25

12.1 Post-Closure Notice 25
12.2 Post-Closure Certification 25

TABLE OF CONTENTS (CONTINUED)

13.0 REFERENCES 27

TABLES

Table 1 Project Roles and Responsibilities T-1
Table 2 Site 3 Monitoring Well Uses During Post-Closure T-2
Table 3 Site 6A Monitoring Well Uses During Post-Closure T-3
Table 4 Site 7A Monitoring Well Uses During Post-Closure T-4

FIGURES

Figure 1 General Location Map
Figure 2 Site 3 – Coast Guard Laundry
Figure 3 Site 6A – MOGAS
Figure 4 Site 7A – Barrel Storage Area No. 1

APPENDICES

Appendix A RCRA Quarterly Sampling and Analysis Plan
Appendix B Post-Closure Groundwater Monitoring Quality Assurance Project Plan

ACRONYMS AND ABBREVIATIONS

AS	air sparge
AS/SVE	air sparge/soil vapor extraction
BLM	Bureau of Land Management
BOSS	Base Operating Support Services
CFR	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
FP	field procedure
GAC	granular activated carbon
HWMU	Hazardous Waste Management Units
$KMnO_4$	potassium permanganate
MWR	Morale, Well-Being, and Recreation
QA	quality assurance
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
SAA	satellite accumulation area
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TPH	total petroleum hydrocarbons
USCG	U.S. Coast Guard
VOC	volatile organic compound

This page intentionally blank

1.0 INTRODUCTION TO CONSOLIDATED POST-CLOSURE PLAN

This post-closure plan addresses three regulated Resource Conservation and Recovery Act (RCRA) units at U.S. Coast Guard (USCG) Base Kodiak. Hazardous Waste Management Units (HWMUs) include Site 3 – Coast Guard Laundry, Site 6A - MOGAS, and Site 7A - Barrel Storage Area No. 1. They are located on Nyman Peninsula, as shown in Figure 1. These HWMUs are 3 of 37 Solid Waste Management Units (SWMUs) located at Base Kodiak that are subject to RCRA corrective action.

Post-closure permit applications for each of these three HWMUs were provided in the RCRA Permit (EPA 2021). These three plans (SAIC 1997a, b, c) included duplicative information particularly with regard to field operations and inspections. This revision to the post-closure plan is structured to consolidate the operational portions of the plans for these three HWMUs, to incorporate the findings of interim actions conducted between the RCRA Permit issuance (January 1998) and Permit modifications (July 2000, November 2000, August 2001, September 2002, April 2003, April 2004, January 2005, September 2006, October 2009, August 2014, January 2018, October 2019) and renewals (February 2011, March 2021), and to reference historical investigation and hydrogeological characterization activities. The background and investigation information presented in Sections 3, 4, 5, and 9 of the 1997 revisions to post-closure plans is still applicable.

As part of the September 2002 revision, the RCRA Quarterly Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) were placed as appendices to this document so that these plans can be easily updated in the future. The QAPP was previously updated to add new petroleum analytical methods. The 2014 revision to the Consolidated Post-Closure Plan updated wells and purpose of sampling at Site 3, and updated analytical methods for all sites. The 2016 revision included updates to figures, sampling procedures, and analytical methods in the QAPP. The 2021 Permit renewal includes updates to the QAPP and SAP to reduce redundancy between the plans, to better align practices with industry standards and field practices, and resolve discrepancies between the plans and the permit updates.

The project roles with primary quality assurance (QA) responsibility for continuing the post-closure actions at the Sites 3, 6A, and 7A HWMUs and a brief description of responsibilities are presented in Table 1.

This page intentionally blank

2.0 GENERAL UNIT DESCRIPTION AND REGULATORY HISTORY

2.1 Site 3 – Coast Guard Laundry

The Coast Guard Laundry is located on the northwesterly portion of the Nyman Peninsula. The site layout is depicted on Figure 2. Laundry and dry-cleaning operations were conducted in the former Coast Guard Laundry facility from the building's construction in 1941 as part of the U.S. Naval Air Station, through the transfer of the station to USCG in 1972, until 1999 when the building became the Morale, Well-Being, and Recreation (MWR) Boathouse. A building addition constructed in 1952 increased the size of the building to its current size of 8,800 square feet and added dry-cleaning operations. Personnel are reported to have disposed of dry-cleaning solvent still bottoms on the ground outside the facility's back door (south side of building) from the late 1940s or early 1950s to 1987. The exact area of disposal is unknown. Approximately 5 gallons per week of tetrachloroethene (perchloroethylene) still bottoms were reportedly disposed of in this manner for an unknown period of time until the practice was discontinued in 1987. Carbon tetrachloride, widely used as a dry-cleaning agent until the late 1950s, may also have been disposed of at this location. A hazardous waste satellite accumulation area (SAA) on the south side of the former Coast Guard Laundry facility was used following discontinuation of direct disposal to the ground in 1987. Hazardous waste, including approximately one 55-gallon drum of waste solvent and sludge generated every 3 months, and new solvent for the facility were stored in the SAA (SAIC 1997a).

Because some contaminated soils remain in place and because groundwater is contaminated with tetrachloroethene and its degradation products, the unit was closed as a landfill. The Coast Guard Laundry was closed under the interim status regulations (Code of Federal Regulations [CFR] Title 40 Part 265). A revised, final post-closure plan governing post-closure care and groundwater monitoring activities has been in place since 1997 (SAIC 1997a); the site has been in the post-closure period since 1995. The Coast Guard Laundry unit was closed by installing an asphalt cap south of the building and installing an air sparge/soil vapor extraction (AS/SVE) system. A perimeter drain surrounds the cap and routes surface water runon/runoff to a catch basin located off the southeast corner of the Laundry building. Underlying the asphalt cap is the AS/SVE system. The AS/SVE system commenced operation in January 1997, was increased to a continuous cycle in 2001, and reduced to operating seasonally (July through October) in pulse mode without the AS component in 2014 (HDR 2014). The AS/SVE system was discontinued after the 2019 seasonal shutdown based on analysis of historical data showing diminishing returns on the system operation (USCG 2020a).

In addition to installation and historical operation of the AS/SVE system and placement of the cap, other corrective measures have been implemented at Site 3. Ongoing groundwater monitoring and soil investigations identified a second source area on the east side of the MWR Boathouse in 2005. The release may have been caused by spills or leaks of solvents into drains of the boathouse, which may have leaked out the sewer pipe. In situ chemical oxidation using potassium permanganate ($KMnO_4$) was implemented in the second source area. Initially, a 3.5 percent solution of potassium permanganate was injected into the subsurface; however, a preferential flow pathway was identified in a storm drain that allowed the solution to discharge to Inner Womens Bay. To continue the corrective action and prevent $KMnO_4$ from migrating offsite, approximately 12,000 pounds of $KMnO_4$ solid powder was poured into boreholes in the source area to allow the powder to dissolve in groundwater. Two rounds of groundwater sampling were conducted following the injections to track conditions. The revised remedy did not sufficiently reduce concentrations of chlorinated compounds in soil and groundwater (Hart Crowser 2006).

Following identification of a complete vapor intrusion pathway in 2008 (Windward 2009), further corrective actions were employed to mitigate concentrations of volatile organic compounds (VOCs) exceeding risk standards. Ducts and fans were installed in Barracks Building 1, the galley/pizza parlor, and the MWR Boathouse to create negative pressure in sub-basements and crawlspaces; vapor barriers were installed in these buildings as well. The air extracted through the duct and fan system was/is passed through a granular activated carbon (GAC) treatment system. Indoor air quality has since been monitored. The current monitoring plan is described in the *Vapor Monitoring Plan* (Ahtna 2018).

In 2009, a groundwater interceptor trench was installed immediately upgradient of the AS/SVE system equipment shed at Site 3 to significantly reduce groundwater flow through the original source area located south of the former Coast Guard Laundry facility. The trench was lined vertically with plastic sheeting, and a sump pump was installed to intercept shallow groundwater flow and convey it to a surface ditch across Storis Drive (Ahtna 2019a).

The most recent corrective actions include 2016 excavations, removing a preferential pathway, and soil amendment injections. The remediation pilot treatment study (i.e., Phase III) followed the removal and reconfiguration of sub-grade utilities and removal of preferential flow pathways during Phase II. An old wood-stave drainpipe was removed from the east side of the MWR Boathouse, and sanitary and stormwater systems on the east side of the building were reconfigured to avoid the areas of greatest contamination. Phase III consisted of excavating localized contaminated soil down to bedrock with large-diameter augers. Most boreholes were backfilled with amended sand, which contained Daramend, a product that has a blend of zero valent iron and organic carbon. Daramend enhances biological growth, resulting in depleted oxygen in groundwater, promoting reducing conditions, and degrading chloroethenes in groundwater (Ahtna 2019b).

A *Pilot Treatment Study Addendum* (Ahtna 2019b) was recently completed for the site, which assesses the effectiveness of 2016 pilot treatment, removal action, and amendment installation. The Pilot Study Addendum's monitoring results revealed that Daramend has locally treated chloroethene contamination; however, it did not have a strong effect on downgradient groundwater. Further, full delineation of the eastern source area has not been completed. Contamination remains, most likely below the eastern wall of the MWR Boathouse.

Corrective Actions at Site 3 currently consist of the asphalt cap covering contaminated soil and long-term groundwater monitoring; the AS/SVE system is maintained in a readiness state, to be reactivated if an increasing trend in contaminant concentrations is observed.

2.2 Site 6A – MOGAS

When operational, the MOGAS unit consisted of a set of 18 25,000-gallon steel underground storage tanks, installed in 1951 or 1952. They were located on the southern portion of the Nyman Peninsula, situated nearly at the crest of the peninsula ridge in two rows of nine tanks each. The site layout is shown in Figure 3. The entire array of tanks covered an area approximately 205 by 110 feet. Concrete tank supports rested on bedrock, which ranges from about 14.5 to 22.5 feet below grade. The tanks were installed by the U.S. Navy for aviation fuel and motor gasoline storage when the current Base Kodiak was a naval air station, before the property came under USCG jurisdiction. After the USCG assumed operation of the base in 1972, the tanks were apparently used for storage of motor gasoline. Eventually, the USCG used the tanks for storage of waste oil, such as off-specification fuels, and waste solvents.

Groundwater within the unit was impacted by releases from the tanks, although no contaminants were above their respective action levels. To address the potential for contaminated water to migrate from the

piping utilidor and under the unit, the USCG implemented an interim measure in November 1994. The interim measure included construction of a "french drain" capture pit at the south entrance to the pipe tunnel and a 300-foot-long transmission pipeline to transfer collected groundwater to a 10,000-gallon aboveground collection tank. The interim measure was terminated with U.S. Environmental Protection Agency (EPA) approval in February 1999 (EPA 1999).

ln 1995, the MOGAS unit was closed under interim status regulations (40 CFR 265). Tank contents were removed and disposed. Tanks were cleaned, removed, decontaminated and disposed. The unit was then covered with an engineered asphalt cap. A revised, final post-closure plan governing post-closure care and groundwater monitoring activities has been in place since 1997 (SAIC 1997c). Groundwater contaminants have not been detected at concentrations exceeding their respective groundwater protection standards. As such, the unit is currently under a detection groundwater monitoring program.

2.3 Site 7A – Barrel Storage Area No. 1

Site 7A, Barrel Storage Area No. 1, is a HWMU located near the center of Nyman Peninsula within the fuel farm. The site layout is depicted in Figure 4. The site was used by the Navy during the early 1940s for waste oil drum storage and later by USCG for storage of hazardous materials and waste petroleum products. The drums were stored on gravel pads (with no secondary containment) for many years. The contents of drums present at the unit in 1987-1988 included used spill absorbents, JP-5 and FS-6 fuels, solvents, paint wastes, lubricants, oils, carbon tetrachloride, methylene chloride, 1,1,1-trichloroethane, trichloroethene, and petroleum products containing benzene, toluene, and xylene (USGS 1990a). All drums were removed by June 1990. The storage of a wide variety of materials without an underlying containment structure allowed leaks and spills to enter the site's surface soil. Subsequent migration of organic and inorganic analytes apparently occurred to subsurface soil and groundwater. Soil and groundwater sampling was carried out in 1988-1989, and between 1992 and 1994. These sampling activities established the presence of contaminants unique to this unit (within the fuel farm) in soil and groundwater.

Site 7A was closed under interim status regulations (40 CFR 265). The unit was closed as a landfill in 1996 because not all contaminated soil and groundwater could be removed at closure. The unit was closed with the placement of an asphalt cap, runon/runoff controls, and the installation of an AS/SVE system intended to remediate both soil contamination and groundwater contamination to the greatest extent possible. The AS/SVE system commenced operation at the site in January 1997 and was operated seasonally (July through October). Beginning in 2003, the system was turned on for 2 hours once per quarter during the other times of the year, and system operation was reduced to seasonal pulse mode without the AS component in 2014. The Site 7A AS/SVE system will be discontinued after the 2020 seasonal shutdown based on analysis of historical data showing diminishing returns on the system operation (USCG 2020b).

A post-closure plan governing post-closure care and groundwater monitoring activities has been in place since 1997 (SAIC 1997b). Corrective actions at Site 7A currently consist of the asphalt cap covering contaminated soil and long-term groundwater monitoring; the AS/SVE system is maintained in a readiness state, to be reactivated if an increasing trend in contaminant concentrations is observed.

This page intentionally blank

3.0 TOPOGRAPHIC MAPS OF THE FACILITY

A topographic map of Base Kodiak is included with Attachment 1 of the RCRA Permit (EPA 2021). The topography of all three HWMUs is displayed on Figures 2 through 4 of this Consolidated Post-Closure Plan.

This page intentionally blank

4.0 HYDROGEOLOGIC INFORMATION

Information included in the 1997 revised final post-closure permit applications for the three HWMUs is a comprehensive history of investigations through that year. Sites 3 and 7A have been extensively studied since 1997, and additional information is referenced below. The reader is encouraged to peruse the reports listed for a thorough understanding of the geology and hydrogeology of these sites.

4.1 Site 3 – Coast Guard Laundry

The hydrogeologic setting and investigations undertaken are described in the following reports:

> Windward Environmental. 2009. Final Current Conditions Report, Site 3 - Former Laundry, USCG, ISC Kodiak. Prepared by Windward Environmental, LLC and Shannon and Wilson, Seattle, WA, July 2009.
>
> SAIC. 1997a. Revised Final Post-Closure Plan, Site 3 - Laundry, US Coast Guard Integrated Support Command Kodiak, Kodiak, Alaska. Prepared for US Coast Guard Facilities Design and Construction Center, Seattle, WA. Prepared by SAIC, Olympia, WA, July 1997.

In addition, the reader is referred to the RCRA quarterly reports and other technical reports in the Administrative record for information regarding contaminant concentrations, trends, quarterly changes in groundwater flow, and mass removal of contaminants from below ground surface.

4.2 Site 6A – MOGAS

The major report describing the hydrogeologic setting at the MOGAS site remains the post-closure permit application (SAIC, 1997c). Additional investigations are described in:

> Hart Crowser. 2004. Supplemental Investigation Report, Site 6A - MOGAS, USCG, ISC Kodiak. Prepared for US Coast Guard. Prepared by Hart Crowser, Seattle, WA, September 24, 2004.

ln addition, the reader is referred to the RCRA semi-annual reports for information regarding contaminant concentrations and semi-annual changes in groundwater flow.

4.3 Site 7A – Barrel Storage Area No. 1

The hydrogeologic setting and investigations undertaken are described in the following reports:

> SAIC. 1997b. Revised Final Post-Closure Plan, Site 7A - Barrel Storage Area No. 1, US Coast Guard Integrated Support Command Kodiak, Kodiak, Alaska. Prepared for US Coast Guard Facilities Design and Construction Center, Seattle, WA. Prepared by SAIC, Olympia, WA, July 1997.
>
> Hart Crowser. 2004. EPA Draft Pulsing Plan and Rebound Analysis, Site 7A. ISC Kodiak, AK. Prepared for US Coast Guard. Prepared by Hart Crowser, Seattle, WA, February 17, 2004.
>
> Hart Crowser. 2006a. Hazardous Waste investigation Report, Site 7A - Barrel Storage Area. USCG ISC Kodiak. Prepared for US Coast Guard. Prepared by Hart Crowser, Seattle, WA, March 2006.

ln addition, the reader is referred to the RCRA quarterly reports for information regarding contaminant concentrations, trends, quarterly changes in groundwater flow, and mass removal of contaminants from below ground surface.

This page intentionally blank

5.0 POST-CLOSURE INSPECTIONS

Post-closure inspections are conducted at least as frequently as the groundwater sampling events at each of the three HWMUs. Inspection checklist and report forms are provided to personnel conducting the inspections. Any repairs required are documented on the deficiency forms, which are maintained in the operating record at the facility. The inspection and deficiency forms will be kept on file throughout the post-closure period.

5.1 Landfill Caps

Each landfill cap is inspected quarterly for cracks, heaving, and overall integrity. An appropriate sealer will be applied if cracks develop and are found. The degree and possible effects of heaving, if noted, will be evaluated and repairs will be made, if necessary. The runon/runoff controls are inspected for clogging, breaching and overall function, and repairs scheduled as necessary. Protective barriers are inspected for signs of tampering. Posted warnings are examined to determine whether they are secure and the condition of the signs are noted. Cap inspection forms are provided in Appendix A, the *RCRA Quarterly Sampling and Analysis Plan.*

5.2 Groundwater Monitoring System

Inspections of monitoring wells in the networks at Sites 3 and 7A are conducted semi-annually in concurrence with monitoring well gauging; inspections of monitoring wells in the Site 6A network are conducted annually in concurrence with sampling and gauging. Monitoring well caps and locks are inspected to determine whether they are in good working order and functioning properly. The wells are inspected for damage and obstructions. Bollards are assessed for damage, effectiveness, and visibility. Necessary repairs or replacements will be made in a timely fashion. Vertical elevations of wells are surveyed each October to determine any effects of freeze-thaw heave that may have occurred during the previous winter. The degree of damage (if any) will be evaluated and remedied as necessary, including possible well abandonment and installation of replacement wells if damage renders the well unusable. Inspection and deficiency forms are provided in Appendix A, the *RCRA Quarterly Sampling and Analysis Work Plan*.

5.3 Corrective Action Systems

Corrective actions at Sites 3, 6A, and 7A include a cap to physically separate contaminated media from receptors and long-term monitoring of groundwater (and surface water at Site 6A) to track contaminant concentrations and identify trends.

AS/SVE systems have been constructed for corrective actions historically conducted at Sites 3 and 7A. These systems are maintained in a readiness state, to be reactivated if an increasing trend in contaminant concentrations is observed. The AS/SVE systems are inspected weekly during system operation to ensure they are in working order. The inspection forms for this system are maintained onsite along with an operations and maintenance manual.

This page intentionally blank

6.0 POST-CLOSURE GROUNDWATER MONITORING

Sites 3 and 7A are undergoing post-closure groundwater corrective action. Site 6A is undergoing post-closure groundwater detection monitoring only. The monitoring program for each site is described below.

6.1 Site 3 – Coast Guard Laundry

Uses of the Site 3 wells during the post-closure period are listed in Table 2. Well MW-03-107S is the upgradient monitoring well. Wells screened in bedrock or in the shallow aquifer are designated for one or more of the following uses: compliance monitoring, corrective action monitoring, effectiveness monitoring and/or elevation monitoring (Table 2). Shallow aquifer well MW-03-013 is the designated monitoring well to sample for constituents listed in 40 CFR 264, Appendix IX every 3 years (the "Appendix IX well").

6.2 Site 6A – MOGAS

The uses of each of the wells at Site 6A during the post-closure period are listed in Table 3. Most wells capture the major discharge pathways from the unit and are used to detect any groundwater contamination. As listed in Table 3, several monitoring wells further downgradient are inspected and maintained for water level measurements to support mapping the potentiometric groundwater surface across the site.

6.3 Site 7A – Barrel Storage Area No. 1

The uses of each of the wells at Site 7A during the post-closure period are listed in Table 4. Well MW-7A-023 is an upgradient well. Because groundwater flows radially from the site, the other wells are downgradient wells. Well MW-7A-013 is the designated monitoring well to sample for constituents listed in 40 CFR 264, Appendix IX every 3 years (the "Appendix IX well").

6.4 Compound Quantitation Limits

Practical quantitation limits for site waste-related compounds are identified in Appendix B, *Post-Closure Groundwater Monitoring Quality Assurance Project Plan*.

6.5 Groundwater Sampling and Analysis Procedures

Standard operating procedures (SOPs) to support these activities are maintained in the onsite field operations office. These SOPS include, but may not be limited to: Well Purging (Field Procedure [FP] 5-5), Equipment Decontamination (FP 3-1), Well Development (FP 5-4), Groundwater Sampling Procedures (FP 6-5), and Sample Preservation, Designation and Shipment (FP 6-7). These SOPs may be found in Appendix A, *RCRA Quarterly Sampling and Analysis Plan*, and are updated as required.

6.6 Investigation-Derived Waste Management

During RCRA quarterly and semi-annual sampling events, purge water is routinely generated at each of the wells. At Sites 3 and 7A, purge water from corrective action wells is containerized and pumped through a particulate filter and then through the water treatment portion of the AS/SVE system. Particulate filters

will be managed as hazardous waste. Water from the effectiveness wells is discharged directly to the ground surface. At Site 6A, purge water is discharged directly to the ground surface onsite.

7.0 POST-CLOSURE CONTACT OFFICE

In accordance with 264.118(b)(3), the following office is designated as the office to contact concerning the hazardous waste disposal units during the post-closure care period:

Title	Commanding Officer USCG Base Kodiak Building N38 PO Box 195000 Kodiak, Alaska 99615-5000 (907) 487-5320	Commanding Officer USCG Civil Engineering Unit Juneau PO Box 25517 709 West Ninth St. Room 817 Juneau, AK 99802-5517

This page intentionally blank

8.0 CORRECTIVE ACTION PLAN

The goal of the Corrective Action Plan for Sites 3 and 7A is to remediate the groundwater contaminated with chlorinated solvents, degradation products, and (in the case of Site 7A) petroleum-related compounds, to the point that the groundwater contamination reaches the Groundwater Protection Standards listed in the RCRA permit. In the event that, after a period of several years of corrective action, Groundwater Protection Standards do not appear to be achievable, a modified corrective action goal based on an alternate concentration limit, may be submitted to EPA.

RCRA regulations require [40 CFR 270.14(c)(8)] that Permit applicants include a corrective action plan that meets the requirements of 40 CFR 264.100 if hazardous constituents have been detected in the groundwater at levels above the acceptable concentration limits. Groundwater contaminated with chlorinated solvents, degradation products, and petroleum-related compounds has been detected at Site 7A site. Groundwater contaminated with chlorinated solvents and degradation products has been detected at Site 3.

This section discusses the selected corrective action technologies and describes the corrective actions anticipated for Sites 3 and 7A. The corrective action regulations of 40 CFR 264.100 address only contaminated groundwater, and corrective actions programs under that regulation generally involve groundwater treatment, either in place or after extraction.

8.1 Corrective Action Technologies

Corrective actions at Sites 3, 6A, and 7A include a cap to physically separate contaminated media from receptors and long-term monitoring of groundwater (and surface water at Site 6A) to track contaminant concentrations and identify trends.

AS/SVE systems have been installed at Sites 3 and 7A and have been operated as part of historical corrective actions. Analysis of Sites 3 and 7A conducted in 2020 identified diminishing returns on the systems, and their operations were discontinued following the 2019 and 2020 operation schedule, respectively. These systems are maintained in a readiness state, to be reactivated if an increasing trend in contaminant concentrations is observed.

Air sparging is a technology that utilizes the injection of contaminant-free air into the saturated zone to remove VOCs. Removal of contaminants occurs by transfer of dissolved contaminants in subsurface soil and groundwater into air introduced to the subsurface. Introduced air bubbles then rise to soil pore spaces in the unsaturated zone where they can be removed by the AS/SVE system.

Several conditions affect the applicability of AS/SVE at any site including the depth to groundwater, volatility of contaminants, permeability of the aquifer, and aquifer type (e.g., confined or unconfined). The depth to groundwater is important because sufficient space must be available for the AS/SVE to function effectively (i.e., to create a sufficient area of reduced pressure to draw off contaminants). Because of the shallow depth to groundwater at Sites 3 and 7A and to provide grade for cap runon/runoff controls, the designs provided for the addition of fill beneath the asphalt caps to provide for a greater unsaturated zone, as well as providing for a slope to promote rainfall drainage from the cap. The AS/SVE system constructed for Sites 3 and 7A collected VOC-contaminated air from the unsaturated zone overlying the air sparging wells installed within the saturated zone. The collected gas was then discharged to the atmosphere after passing through GAC columns or canisters.

Design specifications for the AS/SVE systems for Sites 3 and 7A may be found in final design documents previously provided to EPA.

8.2 Groundwater Corrective Action System Performance Analysis

The primary goal of the corrective action is to attempt to reduce contaminant concentrations in groundwater under and downgradient of the units, and to reduce the soil concentrations of contaminants to the greatest extent possible. Performance of the groundwater corrective action system is measured by performing trend analysis to demonstrate whether the concentrations of VOCs and (in the case of Site 7A) total petroleum hydrocarbons (TPH) in the groundwater are being reduced, and by quantifying the mass of total organic vapor removed from the ground.

8.2.1 Groundwater Contaminant Concentration Trend Analysis

Trend analysis will be performed for individual constituents and total VOCs and TPH in individual wells. Trend analysis will be accomplished by performing the non-parametric Mann-Kendall test for trend (Gilbert, 1987 and Gibbons, 1994). Trend analysis will be performed over no less than the 12 most-recent quarters and no more than 40 quarters. Statistics associated with data collected previous to remedial system startup are useful for evaluating natural attenuation over time, but will not be used for performance trend analysis. This non-parametric method has been proposed to account for the non-normal distribution of the contaminants seen to date, the range of Practical Quantitation Limits associated with the analytical data, and the spread of contaminant concentrations over time. The use of linear regression is not recommended because the assumption of normal distribution associated with linear regression is probably violated, and the spread of contaminant distributions results in a very low correlation coefficient in the regression analysis.

8.2.2 Total Organic Vapor Mass Removal Measurements

If the AS/SVE systems are reactivated, vapor sampling of the AS/SVE systems shall be conducted during periods of operation on a quarterly basis coincident with quarterly groundwater sampling activities. This measurement will be accomplished by sampling at the air sampling port at the blower discharge prior to any treatment. Total mass of organic vapors will be calculated based on the concentrations of VOCs and TPH measured in the air samples and the total AS/SVE operation time and flow rates. Air sampling procedures are described in Appendix A, *RCRA Quarterly Sampling and Analysis Plan*. While these measures are indirect in that they measure organic compounds removed from both soil and groundwater (i.e., anything removed by the system), they provide a measure of the overall effectiveness of the system. Mass removed is expected to be an asymptotic curve over time.

8.3 Reporting

Two types of reports will be provided to EPA during the post-closure period:

- Quarterly reports include the information required in RCRA permit condition V.E.
- Semi-annual reports include the information required in RCRA permit condition V.F.

Reports are submitted in accordance with the schedule in RCRA permit conditions VI.D.3.b and VIII.D.3.b.

9.0 EXPOSURE INFORMATION REPORT

The Exposure Information Reports for Sites 3 and 7A may be found in the following documents:

SAIC. 1997b. Revised Final Post-Closure Plan, Site 7A - Barrel Storage Area No. 1, US Coast Guard Integrated Support Command Kodiak, Kodiak, Alaska. Prepared for US Coast Guard Facilities Design and Construction Center, Seattle, WA. Prepared by SAIC, Olympia, WA, July 1997.

SAIC. 1997a. Revised Final Post-Closure Plan, Site 3 - Laundry, US Coast Guard Integrated Support Command Kodiak, Kodiak, Alaska. Prepared for US Coast Guard Facilities Design and Construction Center, Seattle, WA. Prepared by SAIC, Olympia, WA, July 1997.

This page intentionally blank

10.0 HEALTH AND SAFETY

Health and safety is always a primary concern while conducting fieldwork. Work conducted on this project will conform to the USCG Programmatic Health and Safety Plan for Base Kodiak. A copy of this document, as well as the contractor's health and safety plans, will be kept in the field office during monitoring events.

This page intentionally blank

11.0 SECURITY AND TRAINING

11.1 Security

Security at the Base Kodiak is maintained 24 hours a day, 7 days per week, including holidays, by USCG security personnel whose duties include monitoring entry and exit from the Base Kodiak and providing security control for the various Base Kodiak buildings, operations, and activities. Security at the Base Kodiak is maintained by the following: (1) a 6-foot-high chain link fence surrounds the and side of the 23,000-acre area covered by the Base, (2) property warning signs, (3) surveillance patrols by USCG Military Police, 24 hours per day 7 days per week, (4) security measures specific to the HWMUs, such as warning signs and building security (administrative and physical controls). The sections that follow describe the security control at the Base Kodiak in detail.

In addition to the general security provisions (fencing, gates, and security personnel), several other features contribute to the security of Base Kodiak. Ample lighting is provided throughout the Base, and Military Police are equipped with hand-held two-way radios to report upset or trespass conditions immediately. An internal telephone system encompasses the Base Kodiak and is used for communication outside the Base Kodiak premises as necessary.

24-Hour Surveillance System. Sites 3, 6A, and 7A are located within the Base Kodiak and are therefore subject to the security system that is in place for the Base. Security personnel patrol the Base Kodiak in ground patrol vehicles. USCG security provides 24-hour surveillance to the base. If security personnel observe the unknowing or unauthorized entry of persons onto Base Kodiak property, they immediately investigate and take action as appropriate for the situation. USCG security personnel provide 24-hour surveillance to the base and check the HWMUs during periodic rounds of the Base.

Barrier. At Site 3, a 4-foot-high chain link fence surrounds the asphalt cap and AS/SVE area (Coast Guard Laundry corrective action system). This fence is the primary barrier for access to the asphalt cap. Warning signs are prominently displayed on the fence around the unit. A locked mechanical shed houses blowers and control panels for the AS/SVE system. Access to the shed is through keyed entry only.

Site 6A is located at the end of the Nyman Peninsula. Two fences on the access trail to the site are the primary barrier for access to the capped area of Site 6A. Driving access to the cap is through keyed entry. Warning signs are posted on the gates.

Site 7A is located within the secured area of the Fuel Farm. The fuel farm is surrounded by a 6-foot high, chain link fence, with two gates, one of which is always locked, and the other of which is open only between the hours of 8 a.m. and 5 p.m. Only authorized personnel are allowed access to the fuel farm. A locked mechanical shed houses blowers and control panels for the AS/SVE system. Access to the shed is through keyed entry only. Warning signs are posted around the unit.

11.2 Personnel Training

This section describes the training program for personnel involved in hazardous waste handling, management, and unit operations for Sites 3 and 7A corrective action system at the USCG Base Kodiak, Alaska. Detail on the training program, frequencies and descriptions are provided in Attachment 3 of the RCRA Permit (EPA 2021).

It is USCG policy per Commandant Instruction (COMDTINST) M16478.1 Series that every person who has responsibility for handling or managing hazardous waste be trained in the proper and safe receipt, handling, storage, and shipment of hazardous waste, as appropriate to their specific job responsibilities.

All personnel involved in the direct operation of Sites 3 and 7A corrective action system are contractor employees. The persons performing maintenance on the Sites 3 and 7A systems are a Base Operating Support Services (BOSS) Utility System Operator or BOSS Utility System Helper. These positions are described in the RCRA Permit (EPA 2021). A comprehensive training program has been implemented by the BOSS Contractor to ensure that personnel assigned to Sites 3 and 7A corrective action systems receive training consistent with the requirements of 40 CFR 264.16, 40 CFR 270.14, 29 CFR 1910.120, USCG COMDTINST M16478.1 Series, and the BOSS Contractor's Hazardous Waste Operations Operating Procedures Manual. The BOSS Contractor's Hazardous Waste Operations Operating Procedures Manual discusses the BOSS contractor's training program in detail.

Persons assigned to the corrective action systems will be trained in state and federal laws and regulations, unit management, spill prevention, emergency response procedures, hazard communications, and to perform their duties in a safe, disciplined, and professional manner. Training of BOSS contractor personnel assigned to the corrective action systems is the responsibility of the BOSS Contractor Hazardous Materials Manager. Training of USCG hazardous waste generators is the responsibility of USCG Environmental Protection Specialists. The reader is referred to Attachment 3 of the RCRA Permit for more information on training activities and personnel descriptions (EPA 2021).

The training program for personnel assigned to the corrective action systems will consist of a combination of classroom instruction and on-the-job training and is designed to ensure that personnel are trained to perform their specific job assignments. The training will include instruction on conducting the post-closure inspections and utilize an Operations and Maintenance Manual specific to the AS/SVE systems installed at Sites 3 and 7A.

12.0 POST-CLOSURE NOTICE AND CERTIFICATION

12.1 Post-Closure Notice

Within 60 days after certification of closure of these HWMUs, the USCG submitted to the local land use authority (Bureau of Land Management [BLM]) and to EPA a record of the type, location, and quantity of hazardous wastes disposed of within each disposal unit of the facility. The USCG recorded a notation on the official real estate files maintained by BLM to the Base Kodiak property (or on some other instrument which is normally examined during title search), that will in perpetuity notify any potential purchase of the property of the following:

- The land has been used to manage hazardous wastes;
- Use of the land is restricted under 40 CFR Subpart G regulations; and
- The survey plat and record of the type, location, and quantity of hazardous wastes disposed within the units have been filed with the local land use authority and with EPA.

The USCG submitted to EPA a signed certification stating that the notation specified above has been recorded and a copy of the document in which the notation has been placed.

12.2 Post-Closure Certification

Within 60 days after completion of the established post-closure care period for the HWMUs, the USCG will submit to EPA a certification that activities during the post-closure period for the unit were performed in accordance with the post-closure plan. The certification will be signed by both the USCG and a qualified professional engineer. This certification will state that post-closure care for the HWMU was performed in accordance with the specifications in the approved post-closure care plan. This certification, along with the supporting documentation, will be submitted by registered mail or an equivalent delivery service. Documentation supporting the closure certification will be retained and furnished to EPA upon request. The USCG will certify compliance with the post-closure care plan with the following statement (or similar statement):

> The undersigned, owner/operator of Site__ , hereby certifies that l have reviewed the approved post-closure care plan for Site___ and, to the best of my information and belief, all post-closure care activities were performed in accordance with the specifications identified in the approved post-closure care plan.
> (Signature and date.)

The USCG will engage a qualified professional engineer to certify that post-closure care for the unit was performed in accordance with the specifications in the approved post-closure care plan. The USCG will require the engineer to sign the following statement (or similar statement):

> The undersigned, a qualified professional engineer, hereby certifies that l have reviewed the approved post-closure care plan for Site___ and, to the best of my information and belief, all post-closure care activities were performed in accordance with the specifications identified in the approved post-closure care plan.
> (Signature, date, professional engineer license number, business address, and telephone number.)

In making this statement, the professional engineer will have performed the following specific activities related to post-closure care.

- Reviewed all post-closure monitoring reports, including accompanying laboratory QA data
- Reviewed all groundwater corrective action records
- Verified attainment of closure performance standards if the post-closure care period was shortened
- Reviewed all inspection and repair reports regarding maintenance of the final cover and runon/runoff control systems
- Visually inspected the monitoring wells and final cover within 60 days before the end of the post-closure care period.

13.0 REFERENCES

Ahtna Environmental, Inc. (Ahtna). 2018. *Vapor Monitoring Plan Site 3 Former Laundry Pilot Study Addendum USCG Base Kodiak, Alaska.* July 2018.

Ahtna. 2019a. *Resource Conservation and Recovery Act Quarterly Groundwater Monitoring Report, Second Quarter 2019, Sites 3 and 7A. U.S. Coast Guard Base Kodiak, Kodiak, Alaska.* August 2019.

Ahtna. 2019b. *Draft Pilot Treatment Study Report Site 3, Laundry. USCG Base Kodiak, Alaska.* October 2019.

Gibbons, R.D. 1994. *Statistical Methods for Groundwater Monitoring.* John Wiley and Sons, New York.

Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring.* Van Nostrand Reinhold, New York.

Hart Crowser. 2004. *EPA Draft Pulsing Plan and Rebound Analysis, Site 7A. ISC Kodiak, AK.* Prepared for U.S. Coast Guard. Prepared by Hart Crowser, Seattle, WA, February 17, 2004.

Hart Crowser. 2004. *Supplemental Investigation Report, Site 6A - MOGAS, USCG, ISC Kodiak.* Prepared for U.S. Coast Guard. Prepared by Hart Crowser, Seattle, WA, September 24, 2004.

Hart Crowser. 2006a. *Hazardous Waste Investigation Report, Site 7A - Barrel Storage Area.* USCG ISC Kodiak. Prepared for U.S. Coast Guard. Prepared by Hart Crowser, Seattle, WA, March 2006.

Hart Crowser. 2006b. *Site Investigation and Interim Corrective Action Report Site 3 – Laundry.* USCG Integrated Support Command Kodiak, Alaska, December 2006.

HDR Engineering, Inc. (HDR). 2014. *Site 3 – Former Laundry Air Sparge/Soil Vapor Extraction System Operation Pilot Program Report.* USCG BSU Kodiak. Kodiak, Alaska. April 2014.

Science Applications International Corporation (SAIC). 1992. *Closure Plans for: Nyman Peninsula Barrel Storage Area No. 1, Nyman Peninsula Barrel Storage Area No. 2, Advanced Underwater Weapons (AUW) Building, Battery Storage Area, Coast Guard Laundry, MOGAS Tanks.* U.S. Coast Guard Support Center Kodiak, Alaska. Prepared for U.S. Coast Guard, Contract No DTCG50-91-C-643008. May 1992.

SAIC. 1994a. *Support Center Kodiak, Hazardous Waste Storage Building, RCRA Part B Permit Application, Revision 2.* Prepared for: U.S. Department of Transportation DOT Omnibus Contract No. DTRS-57-89-D-0090, TTD RA 3081.

SAIC. 1994b. *Closure Plan for Site 3 - Barrel Storage Area No. 1, U.S. Coast Guard Support Center, Kodiak Alaska*, Revised November 1994. Prepared for U.S. Coast Guard Maintenance and Logistics Command, Alameda, CA. Prepared by SAIC, Olympia, WA. DOT Contract No. DTCG50-94-R-643V44.

SAIC. 1994c. *Closure Plan for Site 7A - Barrel Storage Area No. 1, U.S. Coast Guard Support Center, Kodiak Alaska*, Revised August 1994. Prepared for U.S. Coast Guard Maintenance and Logistics Command, Alameda, CA. Prepared by SAIC, Olympia, WA. DOT Contract No. DTCG50-94-R-643V44.

SAIC. 1994d. *Closure Plan for Site 6A - Barrel Storage Area No. 1, U.S. Coast Guard Support Center, Kodiak Alaska*, November 1994. Prepared for U.S. Coast Guard Facilities Design and Construction Center, Seattle, WA. Prepared by SAIC, Olympia, WA. DOT Contract No. DTCG50-94-C-643V44.

SAIC. 1995a. *Closure Plan for Site 7A - Barrel Storage Area No. 1, U.S. Coast Guard Support Center, Kodiak, Alaska.* Revision 2. Prepared for U.S. Coast Guard Facilities Design and Construction Center (Pacific), Seattle, WA. Prepared by SAIC, Olympia, WA. DOT Contract No. DTCG50-94-R-643X44.

SAIC. 1997a. *Revised Final Post-Closure Plan, Site 3 - Laundry, U.S. Coast Guard Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared for U.S. Coast Guard Facilities Design and Construction Center, Seattle, WA. Prepared by SAIC, Olympia, WA, July 1997.

SAIC. 1997b. *Revised Final Post-Closure Plan, Site 7A -Barrel Storage Area No. 1, U.S. Coast Guard Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared for U.S. Coast Guard Facilities Design and Construction Center, Seattle, WA. Prepared by SAIC, Olympia, WA, July 1997.

SAIC. 1997c. *Revised Final Post-Closure Plan, Site 6A - MOGAS, U.S. Coast Guard Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared for U.S. Coast Guard Facilities Design and Construction Center, Seattle, WA. Prepared by SAIC, Olympia, WA, July 1997.

U.S. Environmental Protection Agency (EPA). 1994. Letter from R. F. Smith, USEPA and J. Adair, ADEC to C. L. Schnappinger, U.S. Coast Guard. Re: Request for Post-Closure Permit Application, EPA ID# AK9 69033 0742. April 28, 1994.

EPA. 1995. Letter from R. F. Smith, USEPA and J. Adair, ADEC to C. L. Schnappinger, U.S. Coast Guard. Re: Request for Post-Closure Permit Application, EPA ID# AK9 69033 0742. January 3, 1995.

EPA. 1999. Letter from MA Bussell, USEPA, to Captain J. Miller, USCG. Re: Approval for MOGAS Interim Measure Termination Request, USCG ISC Kodiak, EPA ID No. AK9690330742.

EPA. 2021. RCRA Permit. Base Kodiak No. AK9690330742. As amended March 2021.

U.S. Geological Survey (USGS). 1990. Description of Wells Drilled at USCG Support Center, Kodiak, Alaska, 1989-1989. U.S. Geological Survey, Anchorage, Alaska. Prepared for

U.S. Coast Guard (USCG). 1990. Maintenance and Logistics Command Pacific(s). (Draft) February.

USCG. 2020a. *Proposal for Temporary Shutdown of the Air Sparge/Soil Vapor Extraction (AS/SVE) System at United States Coast Guard Site 3 (Former Laundry Building) Base Kodiak, Kodiak Alaska 99619-5014.*

USCG. 2020b. *Proposal for Temporary Shutdown of the Air Sparge/Soil Vapor Extraction System at United States Coast Guard Site 7A (Former Barrel Storage Area 1) Base Kodiak. Kodiak, Alaska 99619-5014.*

Windward Environmental. 2009. *Final Current Conditions Report, Site 3 - Former Laundry, USCG, ISC Kodiak.* Prepared by Windward Environmental, LLC and Shannon and Wilson, Seattle, WA, July 2009.

TABLES

This page intentionally blank

Table 1 Project Roles and Responsibilities

PROJECT ROLE	RESPONSIBILITIES
USCG Project Manager	Ensure that all work is carried out in accordance with contractual obligations and the Task Order statement of work. Assist the Task Manager as needed with technical decisions and in resolving issues. Final reviewer.
Task Manager	Overall responsibility for execution of the Work Plan. Coordinate with USCG Project Manager as necessary to resolve issues.
Corporate Health and Safety Officer	Overall responsibility for resolving health and safety issues (in coordination with Task Manager and Field Coordinator).
Field Manager	Ensure that field activities and analytical sampling are conducted in accordance with project specifications. Coordinate field activities with field personnel.
QA Officer, Project Chemist	Laboratory and data validation coordination. Conduct data quality review to ensure analytical methods and data are consistent with project needs and data quality objectives.
Subcontract Laboratory	Provide analytical services.
Data Validation Subcontractor	Conduct data validation to ensure sample results, analytical methods, and quality control data are consistent with data quality objectives.

Table 2 Site 3 Monitoring Well Uses During Post-Closure

WELL NUMBER	USE DURING POST-CLOSURE PERIOD	COMMENTS
MW-03-003	Effectiveness Monitoring	
MW-03-007	Water table elevations only	
MW-03-010	Water table elevations only	
MW-03-011	Water table elevations only	
MW-03-013	Corrective Action; Appendix IX	
MW-03-014	Water table elevations only	
MW-03-017	Water table elevations only	
MW-03-018	Effectiveness Monitoring	
MW-03-020	Water table elevations only	
MW-03-021	Water table elevations only	
MW-03-022	Corrective Action	
MW-03-024	Water table elevations only	
MW-03-025	Effectiveness Monitoring	
MW-03-101D	Water table elevations only	
MW-03-104S	Water table elevations only	
MW-03-104D	Water table elevations only	
MW-03-106S	Water table elevations only	
MW-03-107S	Corrective Action	Replaces MW-03-007
MW-03-107D	Water table elevations only	
MW-03-201	Water table elevations only	
MW-03-202	Corrective Action	
MW-03-214	Water table elevations only	
MW-03-215	Water table elevations only	
MW-03-216	Water table elevations only	
MW-03-220	Water table elevations only	
MW-03-401	Corrective Action; Compliance Monitoring	Replaces MW-03-023
MW-03-402D	Corrective Action	Replaces MW-03-103D
MW-03-403S	Water table elevations only	Replaces MW-03-102S
MW-03-404	Water table elevations only	Replaces MW-03-224
MW-03-405	Water table elevations only	Replaces MW-03-221
MW-03-406D	Water table elevations only	Replaces MW-03-105D
MW-03-407D	Effectiveness Monitoring	Replaces MW-03-019 and MW-03-024
MW-03-502S	Water table elevations only	Replaces MW-03-103S, Formerly MW-03-402S
MW-03-502M	Corrective Action	Formerly MW-03-402M
MW-03-503D	Corrective Action	Replaces MW-03-101D, Formerly MW-03-403D
MW-03-508	Water table elevations only	Formerly MW-03-203

Table 3 Site 6A Monitoring Well Uses During Post-Closure

WELL NUMBER	USE IN POST-CLOSURE PERIOD
MW-6A-102	Water table elevations only
MW-6A-106	Water table elevations only
MW-6A-107	Detection monitoring
MW-6A-108	Detection monitoring
MW-6A-113	Water table elevations only
MW-6A-114	Water table elevations only
MW-6A-115	Water table elevations only
MW-6A-116	Detection monitoring
MW-6A-117	Detection monitoring
MW-6A-120	Detection monitoring
MW-6A-121	Detection monitoring
MW-6A-122	Detection monitoring
MW-6A-123	Water table elevations only
MW-6A-124	Water table elevations only
MW-6A-125	Water table elevations only

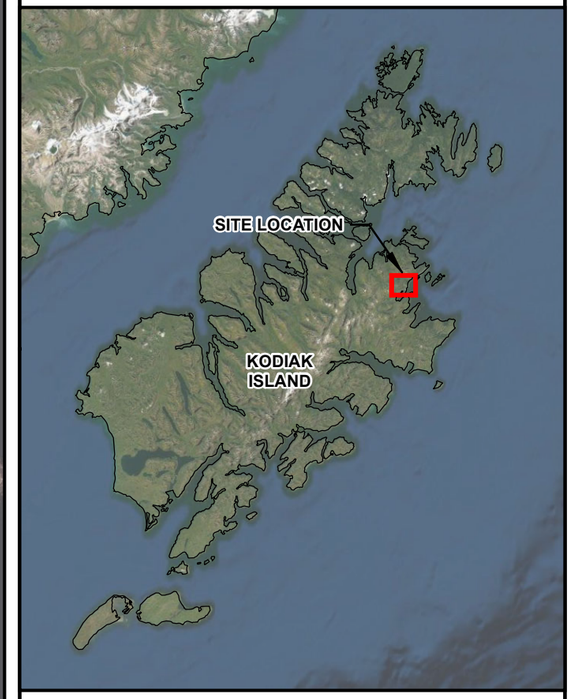
Table 4 Site 7A Monitoring Well Uses During Post-Closure

WELL NUMBER	USE IN POST-CLOSURE PERIOD	COMMENTS
MW-7A-003	Corrective Action	
MW-7A-004	Corrective Action	
MW-7A-005	Water table elevations only	
MW-7A-006	Water table elevations only	
MW-7A-007	Effectiveness monitoring	
MW-7A-009	Water table elevations only	
MW-7A-010	Water table elevations only	
MW-7A-011	Corrective Action; Compliance Monitoring	
MW-7A-012	Corrective Action; Compliance Monitoring	
MW-7A-013	Corrective Action, Appendix IX	
MW-7A-018	Corrective Action	
MW-7A-019	Water table elevations only	
MW-7A-023	Corrective Action; Compliance Monitoring	Replaces MW-07-010
MW-7A-024	Corrective Action; Compliance Monitoring	

1 INCH

CONSOLIDATED POST-CLOSURE PLAN
USCG BASE KODIAK, KODIAK, ALASKA

GENERAL LOCATION MAP



Legend

- River/Creek
- Road Outlines
- Lake

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

0.5 0.25 0 0.5 1

SCALE IN MILES

PROJECT No.:	DATE:	FIGURE:
680402	8/19/2020	1
P.M.: CS	DRAWN: JC	

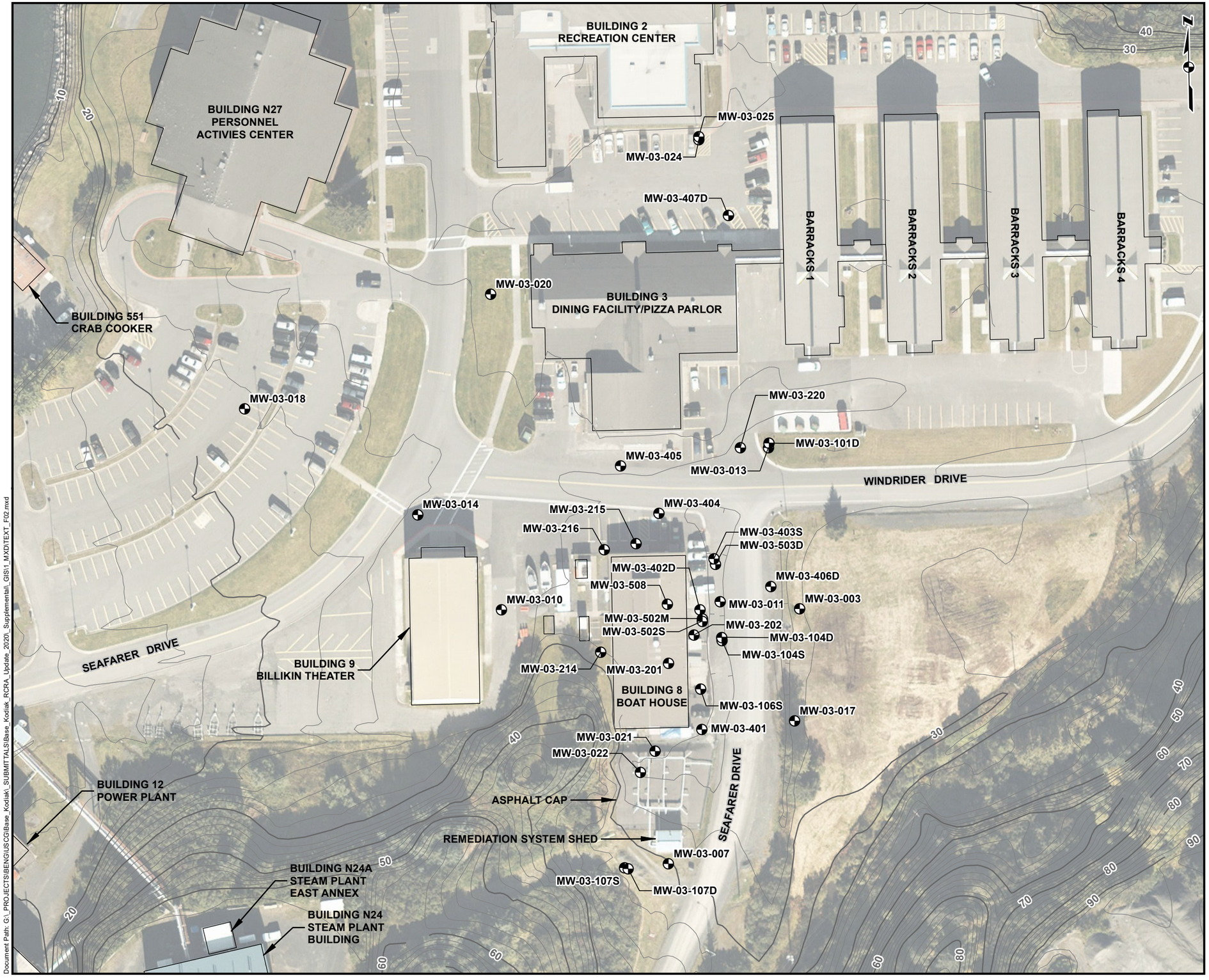
Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\TEXT_F01.mxd

1 INCH

CONSOLIDATED POST-CLOSURE PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 3 - COAST GUARD LAUNDRY



Legend

- Monitoring Well
- Major Contour - 10'
- Minor Contour - 2'
- Facilities

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

80 40 0 80 160
SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/17/2020	2
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\TEXT_F02.mxd

1 INCH

CONSOLIDATED POST-CLOSURE PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 6A - MOGAS

Legend

- Monitoring Well
- Major Contour - 10'
- Minor Contour - 2'
- Facilities

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

200 100 0 200 400

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/19/2020	3
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\TEXT_F03.mxd

1 INCH

CONSOLIDATED POST-CLOSURE PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 7A - BARREL STORAGE AREA NO. 1

MW-7A-010
MW-7A-009
REMEDIATION SYSTEM SHED
ASPHALT CAP
MW-7A-022
MW-7A-012
MW-7A-006
MW-7A-003
MW-7A-004
MW-7A-013
MW-7A-011
MW-7A-023
MW-7A-018
MW-7A-019
MW-7A-024
MW-7A-007
MW-7A-005

Legend

- Monitoring Well
- Major Contour - 10'
- Minor Contour - 2'
- Former Tank Setting

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

60 30 0 60 120
SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/19/2020	4
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\TEXT_F04.mxd

Draft
Appendix A
RCRA Quarterly Sampling and Analysis Plan

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 INTRODUCTION **1**
2.0 BACKGROUND **3**

2.1 Site 3 – Coast Guard Laundry 3
2.2 Site 6A – MOGAS 3
2.3 Site 7A – Barrel Storage Area No. 1 3

3.0 FIELD METHODS **5**

3.1 Monitoring Well Measurements and Inspection 5
3.2 Monitoring Well Purging 5
3.3 Groundwater Sample Collection 6
3.4 Vapor Sampling Procedures and Remediation System Monitoring 8
3.5 Waste Handling 8
3.6 Cap Inspections 9
3.7 Chain-of-Custody and Shipping 9

4.0 REQUIRED ANALYSES **11**
5.0 FIELD QUALITY CONTROL SAMPLES **13**
6.0 REPORTING **19**
7.0 SCHEDULE **21**

TABLES

Table 1 Sample Container, Preservative, and Holding Times 7
Table 2 First Quarter (January) Analysis Schedule 14
Table 3 Second Quarter (April) Analysis Schedule 15
Table 4 Third Quarter (July) Analysis Schedule 16
Table 5 Fourth Quarter (October) Analysis Schedule 17
Table 6 First Quarter (January) Sampling Schedule 21
Table 7 Second Quarter (April) Sampling Schedule 23
Table 8 Third Quarter (July) Sampling Schedule 25
Table 9 Fourth Quarter (October) Sampling Schedule 27

FIGURES

Figure 1 Site 3 – Coast Guard Laundry
Figure 2 Site 6A – MOGAS
Figure 3 Site 7A – Barrel Storage Area No. 1
Figure 4 Site 3 Vapor Sampling Locations
Figure 5 Site 7A Vapor Sampling Locations

TABLE OF CONTENTS (CONTINUED)

EXHIBITS

Exhibit 1 Monitoring Well Inspection and Deficiency Reports
Exhibit 2 Example Groundwater Sample Form and Well Development Form
Exhibit 3 Vapor Sample Form
Exhibit 4 Asphalt Cover Checklist
Exhibit 5 Chain-of-Custody Form
Exhibit 6 Field Standard Operating Procedures
Exhibit 7 Vapor Intrusion Monitoring Plan

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
<	less than
≤	less than or equal to
%	percent
±	plus or minus
AG	amber glass
AK	Alaska Method
AS	air sparge
AS/SVE	air sparge/soil vapor extraction
CoC	chain-of-custody
DO	dissolved oxygen
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
GAC	granular activated carbon
HCL	hydrochloric acid
HDPE	high-density polyethylene
HNO_3	nitric acid
HWMU	Hazardous Waste Management Unit
mL	milliliters
MS	matrix spike
MSD	matrix spike duplicate
mV	millivolts
NaOH	sodium hydroxide
NTU	nephelometric turbidity unit
ORP	oxidation reduction potential
PCB	polychlorinated biphenyl
Q1/Q2/Q3/Q4	First Quarter/Second Quarter/Third Quarter/Fourth Quarter
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RRO	residual-range organics
SIM	selected ion monitoring
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TOC	total organic carbon
TPH	total petroleum hydrocarbons
USCG	U.S. Coast Guard
VOC	volatile organic compound

This page intentionally blank

1.0 INTRODUCTION

The U.S. Coast Guard (USCG) Base Kodiak has requirements for long-term monitoring at three Hazardous Waste Management Units (HWMUs).

This sampling and analysis work plan outlines the monitoring activities required and the methodologies used to accomplish the tasks for these three sites: Site 3, Site 6A, and Site 7A. This work plan is intended to be used by field personnel working on this project.

This page intentionally blank

2.0 BACKGROUND

The three sites at USCG Base Kodiak, Kodiak, Alaska, covered under this work plan are:

- Site 3 – Coast Guard Laundry;
- Site 6A – MOGAS; and
- Site 7A – Barrel Storage Area No. 1.

Monitoring activities at these sites are governed by a Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility permit issued to the USCG. Currently, Sites 3 and 7A are in corrective action monitoring status and Site 6A is in detection monitoring status.

Additional details about each site are discussed below.

2.1 Site 3 – Coast Guard Laundry

Site 3 is located on the northwest portion of the Nyman Peninsula, south of the tarmac and near the recreation center (Figure 1). In the past, chlorinated solvents used in dry-cleaning operations were discharged onto the ground surface outside the building. In 1995, contaminated soils were capped with asphalt and the site was closed as landfill under RCRA.

Site 3 has a network of 36 groundwater monitoring wells as shown on Figure 1, an asphalt cap, and an air sparge/soil vapor extraction (AS/SVE) remediation system that is currently not operated but maintained in standby mode. The AS/SVE system at Site 3 has 17 AS points installed below the water table and near-surface vapor extraction wells. The current remedy consists of the cap covering contaminated soil and long-term groundwater monitoring.

The asphalt cap covers the AS/SVE wells. When in operation, the system runs on a pulsed basis and extracted vapors are treated by two granular activated carbon (GAC) systems.

2.2 Site 6A – MOGAS

Site 6A, MOGAS, is located on the southwestern end of Nyman Peninsula (Figure 2). The facility consisted of eighteen 25,000-gallon storage tanks that contained aviation fuel and motor gasoline. In the 1970s through the early 1980s, the tanks were used exclusively to store motor gasoline. However, as early as 1984, waste oil and waste solvent were also stored in the MOGAS facility. The tanks were emptied and cleaned in 1991. The tanks and associated piping were removed in 1995 during site closure activities.

From 1995 until 1999, groundwater from the site was intercepted by a French drain pit at the downgradient end of the site. The water captured in the pit drained via a pipeline to a 10,000-gallon aboveground storage tank. In March 1999, the system was dismantled and an asphalt cap was placed over the site to control infiltration of stormwater. The site currently has 15 groundwater monitoring wells located as shown on Figure 2.

2.3 Site 7A – Barrel Storage Area No. 1

Site 7A, located near the center of the Nyman Peninsula, was historically used for storing barrels of waste petroleum products, solvents, and other hazardous wastes. The site is located within the Base Kodiak fuel farm (Figure 3). Drums were stored on a gravel pad in this area without secondary containment. The site is contaminated with petroleum hydrocarbons, chlorinated solvents, and chlorinated pesticides as a result

of spills and leaking drums. In 1996, an asphalt cap was placed over the contaminated soils and the site was closed as a landfill under RCRA.

Site 7A has a network of 14 groundwater monitoring wells currently used in post-closure shown on Figure 3, an asphalt cap, and an AS/SVE system that is currently not operated but maintained in standby mode. The AS/SVE system at Site 7A consists of 55 AS points installed below the water table and near--surface vapor extraction wells. The asphalt cap covers the SVE wells. When active, the system runs on a pulsed basis and extracted vapors are treated by two GAC systems. The current remedy consists of the cap covering contaminated soil and long-term groundwater monitoring.

3.0 FIELD METHODS

Fieldwork for this project consists of collecting both groundwater and surface water samples; collecting vapor samples from the AS/SVE systems (when operational); and conducting inspections of the landfill caps and monitoring wells. Field standard operating procedures are provided in Exhibit 6.

3.1 Monitoring Well Measurements and Inspection

At Sites 3 and 7A, the depths to water in monitoring wells will be measured semi-annually during the April and October events; during the April event, the total depth of these wells will also be measured. At Site 6A, the depths to water and total depths of all monitoring wells will be measured annually in October. These measurements will be taken as close together as possible at each site and prior to sampling to minimize temporal variations. An electronic water level indicator probe sensitive to +0.01 foot will be used for the measurements and decontaminated prior to use in each well. The measurements, along with the date and time, will be recorded in the field notebook.

The thickness of sediment accumulated in each monitoring well will be calculated once a year following collection of total depth measurements. Sediment thicknesses will be calculated by comparing current total depth with historical data. If more than 1 foot of sediment exists in a monitoring well used for sampling, the affected wells will be redeveloped with a bailer or pump prior to the next sampling event. As indicated by sediment thickness, Site 3 and 7A wells will be redeveloped prior to sampling during the July event and Site 6A wells will be redeveloped prior to the next October event. Well development procedures are provided in Exhibit 6.

Each monitoring well will be inspected while performing water level measurements for damage to the casing, protective monuments, bollards, and also for evidence of frost heave. Site 3 and 7A wells will be inspected semi-annually and Site 6A wells will be inspected annually. Well caps and locks will be inspected to determine whether they are in good working order and functioning properly. Flush-mount wells will be inspected for any damage by vehicular traffic and to ensure that the rubber seals are functioning properly. A Groundwater Monitoring Wells Quarterly Inspection Sheet (Exhibit 1) will be filled out at each site.

If any deficiencies are noted during the well inspections, a Monitoring Well Deficiency Report form will be filled out for each deficient well, describing the deficiency, and reporting observations or corrective action taken. A Monitoring Well Deficiency Report form is included as Exhibit 1. Completed forms will be filed in the operating record that is kept in the administrative building (N38) at Base Kodiak. The USCG project manager must be informed of the deficiency so that arrangements can be made to have the well repaired.

3.2 Monitoring Well Purging

After measuring the total well depth and depth to water, the inside diameter of the well should be recorded, in order to calculate the volume of water in the well casing. When purging monitoring wells prior to sampling:

- Remove at least three well casing volumes, or
- Monitor water quality parameters until a minimum of three (minimum of four if using temperature as an indicator) of the parameters listed below stabilize, or
- For low-yield wells, the entire well casing is evacuated.

All water quality parameters, except turbidity, must be obtained using a flow-through-cell. Turbidity can be measured using a flow-through cell with turbidity probe or a standalone turbidity probe.

Purging should be performed using low-flow techniques. For low-flow sampling, the goal is minimum drawdown (< 0.3 feet) during purging. The water level must be measured at each interval that the water quality parameters are measured and recorded on a groundwater sample form (Exhibit 2). Flow rate must be between 50 and 500 milliliters (mL) per minute.

Water quality parameters are considered stable and purging complete when three successive readings, collected 3 to 5 minutes apart, are within:

- ± 3 percent (%) for temperature (minimum of ± 0.2 degrees Celsius [°C]),
- ± 0.1 for pH,
- ± 3% for conductivity,
- ± 10 millivolts (mV) for oxidation reduction potential (ORP),
- ± 10% for dissolved oxygen (DO), and
- ± 10% for turbidity (or ≤ 5 nephelometric turbidity units [NTUs]).

A minimum of three (minimum of four if using temperature as an indicator) of these parameters must be monitored and recorded on a groundwater sample form (Exhibit 2). If a well is low yield and purged dry, do not collect a sample until it has recharged to approximately 80% of its pre-purge volume, when practical. Procedures for determining when purging is considered complete for low yield wells, and those that purged dry, may be found in Exhibit 6, Field Procedure 3, Section 3.7.3.

3.3 Groundwater Sample Collection

After purging is complete, laboratory-supplied sample containers will be carefully filled using the recommended Teflon® sampling equipment (e.g., tubing) and a pump. When samples are collected for laboratory analysis, any device used to collect additional information, such as a flow-through cell, must be removed from the sample train before sampling. Sample the wells that are least likely to be contaminated first. Collect water quality parameters and samples in the following order:

- In-field water quality measurements,
- Volatile organic compounds (VOCs),
- Semi-volatile organic compounds (SVOCs),
- Total organic carbon (TOC),
- Total metals, and
- Dissolved metals (filtered).

Table 1 lists the appropriate sample containers, quantities, and preservatives for the various analyses. Samples will be labeled with the following:

- Date and time of sample collection;
- Sample identification code;
- Analysis required; and
- Sampler's initials.

Table 1 Sample Container, Preservative, and Holding Times

ANALYSES	METHOD	SAMPLE CONTAINER[1]	PRESERVATIVE[2]	HOLDING TIME
TPH Diesel/RRO	AK102/AK103	1-L AG	pH < 2 HCl	14/40 days[3]
Cyanide[4]	SW9014	500-mL HDPE	pH > 12 NaOH	14 days
Sulfide	EPA 376.2	500-mL HDPE	Zinc Acetate	7 days
Total Metals (excluding mercury)	SW6020	1-L HDPE	pH < 2 HNO_3	180 days
Total Mercury	SW7470			28 days
PCBs	SW8082	1-L AG		None/40 days[3]
Organochlorine Pesticides	SW8081	1-L AG		7/40 days[3]
Organophosphorus Pesticides	SW8270 SIM	1-L AG		7/40 days[3]
Herbicides	SW8151	1-L AG		7/40 days[3]
Volatile Organics	SW8260	3 x 40-mL VOA	pH < 2 HCl	14 days
Semi-volatile Organics/PAH	SW8270/SW8270 SIM	1-L AG		7/40 days[3]
Dioxins/Furans	EPA 1613/SW8290	1-L AG		30/45 days[3]

Notes:

1 Sample containers may vary but must meet analytical method requirements. A larger container may be substituted to provide adequate sample volume for multiple analyses with the same preservation requirements.

2 All samples shall be maintained at 0 to 6°C. Total metals, excluding mercury, have no temperature preservation requirement.

3 Holding time until extraction/until analysis.

4 Cyanide volume will be preserved with NaOH upon receipt.

AG = amber glass
AK = Alaska Method
EPA = U.S. Environmental Protection Agency
HDPE = high-density polyethylene
HNO_3 = nitric acid
HCl = hydrochloric acid
L = liters
NaOH = sodium hydroxide
PAH= polycyclic aromatic hydrocarbons
PCB = polychlorinated biphenyl
RRO = residual-range organics
SIM = selected ion monitoring
TPH = total petroleum hydrocarbons
VOA = volatile organic analysis

Samples are identified by the following convention: sample matrix, the site number, the well or location number, the sequence of the sample collected from a given location on the same date, and the sampling phase. The codes are further explained below.

Sample Matrix

- GW for groundwater;
- SW for surface water;
- WR for water (trip blanks, field blanks, etc.); and
- AS for vapor samples.

Site Number

- 03 for Site 3 – Coast Guard Laundry;
- 6A for Site 6A -- MOGAS; and
- 7A for Site 7A -- Barrel Storage Area No. 1.

Location Number

- Monitoring wells – the last three digits of the well number;
- AS/SVE systems – 001 for the sample port before the GAC system, 002 for the port between the two GAC filters, and 003 for the port on the exhaust stack; and
- Surface water – the sample location designation.

Sample Sequence Number will typically be 01 for the original sample. If a field duplicate is collected from a given location, the sample sequence number will be 02.

Phase Numbers are assigned sequentially to sampling events. Phase numbers are also used for investigations at sites other than the three discussed in this work plan.

Phase numbers for monitoring rounds are assigned by the contract project manager and the contract data manager.

3.4 Vapor Sampling Procedures and Remediation System Monitoring

The AS/SVE systems at Site 3 and 7A are sampled when the systems are in active operation, typically during the third and fourth quarter to measure system performance. Vapor sampling consists of collecting air samples from the remediation system into SUMMA™ canisters for laboratory analysis.

Three vapor samples are collected from each system. The first sample is collected from the influent stream, the second sample is collected from between the two GAC systems, and the third sample is collected from the effluent stream. Sample locations on each remediation system are identified on Figures 4 and 5. Specific procedures for collecting a vapor sample may be found in Exhibit 3 of this work plan. Vapor samples are shipped to the laboratory in the shipping boxes in which the canisters originally arrived.

At the same time the vapor samples are collected, the sampling team will fill out the remediation system monitoring checklist provided in Exhibit 3.

3.5 Waste Handling

Purge water generated during sampling activities will be handled as follows:

- **Site 3**: The purge water from the corrective action wells will be containerized, then pumped through the water treatment portion of the onsite remediation system. Purge water from the effectiveness wells will be discharged directly to the ground surface.
- **Site 6A**: The purge water will be discharged directly to the ground surface onsite.
- **Site 7A**: The purge water from the corrective action wells will be containerized, then pumped through the water treatment portion of the onsite remediation system. Purge water from the effectiveness wells will be discharged directly to the ground surface.

The water treatment systems at Sites 3 and 7A have filters for removing sediment from the purge water prior to treatment. These filters are replaced as necessary and the spent filters are treated as hazardous waste. After replacement, the spent filters will be placed in the labeled drum located at each system for disposal.

3.6 Cap Inspections

The asphalt cap over each of the three sites will be inspected each quarter for cracks, heaving, and overall integrity. At all sites, the drainage systems will be evaluated to ensure that they are functioning as intended. Also, the perimeter fences will be inspected for indications of intrusion, damage, and frost heaving of the fence posts. Exhibit 4 contains the Asphalt Cover Checklist for each site.

Completed forms will be filed in the operating record, which is kept in the administrative building (N38) at Base Kodiak. The USCG project manager should be informed of any deficiencies noted so that arrangements can be made to have the cap repaired.

3.7 Chain-of-Custody and Shipping

All samples will be tracked using chain-of-custody (CoC) procedures. An example CoC form is included as Exhibit 5. A CoC will be filled out and will accompany each cooler shipped. The CoC will also be scanned and emailed to the laboratory and project manager.

Samples will be shipped directly to the contract laboratory.

Water samples will be cooled to between 0 and 6°C in the field office refrigerator prior to being packed for shipping. Sample coolers will be packed as follows:

- Wrap all glass sample containers in bubble-wrap and secure with a rubber band or place the glass container in a bubble-wrap bag.
- Tape shut any drain plugs on the cooler and fill the cooler with approximately 1 to 2 inches of vermiculite or other absorbent material.
- Line the cooler with a plastic bag and place the sample containers inside the plastic bag, leaving room for ice.
- Place frozen gel ice packs or regular ice in plastic bags around the sample containers, then tie or tape shut the plastic bag lining the cooler.
- If necessary, add more inert insulating material such as bubble-wrap to fill the void spaces above and around the samples.
- Put the CoC in a plastic bag and tape to the inside lid of the cooler.
- Secure the cooler lid with strapping tape and attach both an address label and the airway bill shipping label to the cooler.
- Place a signed custody seal over the front and back of the cooler lid.
- Schedule a pickup with Federal Express or other overnight courier.

After the courier picks up the coolers, email the CoCs and airway bills for the shipment to the laboratory and project manager.

This page intentionally blank

4.0 REQUIRED ANALYSES

The number of monitoring wells to be sampled and the required analyses will vary each quarter. Table 1 lists the sample containers, preservatives, and holding times for required analyses. Tables 2 through 5 list the required analyses for each quarter and the number of quality assurance/quality control (QA/QC) samples required. Tables 6 through 9 list the monitoring wells that are sampled or measured for water level each quarter and describes their use in post-closure.

This page intentionally blank

5.0 FIELD QUALITY CONTROL SAMPLES

Field QC measures are implemented to ensure that the analytical data are of sufficient quality to support project data quality objectives. The following field QC procedures are used for this project:

- **Field Duplicates** – Field duplicates for groundwater samples will be collected by apportioning the contents of the bailer or bladder pump into two identical sets of sample containers for each of the planned analyses. Field duplicates will be collected at a frequency of one for every 10 or fewer primary samples, per analyte, per matrix (10%). Field duplicates will be given unique sample numbers as identified in Section 3.3. No field duplicates are required for air samples from the AS/SVE systems.
- **Equipment Blanks** – Equipment blanks measure the efficacy of decontamination procedures for reusable sampling equipment, such as bladder pumps. Create equipment blanks by pouring reagent grade water into a new disposable bailer, then transferring the water into appropriate sample containers. Equipment blanks will be collected at a frequency of one per site, per sampling event. Equipment blanks receive all the tests which are to be performed on the associated samples.
- **Field Blanks** – Field blanks are also filled with reagent grade water. Field blanks are created in the field and are intended to measure background contamination in the field. Create field blanks by filling the appropriate sample containers while at the site collecting other water samples. Field blanks will be submitted and analyzed at a frequency of one per site, per sampling event. No field blanks are required for air samples from the AS/SVE systems.
- **Trip Blanks** – Trip blanks are provided by the laboratory and accompany the volatile sample containers from the time of shipment to the field, during sample collection, and during sample shipment to the laboratory for analysis. Trip blanks are analyzed for only volatile compounds.

Tables 2 through 5 list specifically how many of each type of QA/QC sample to collect during each sampling event.

Table 2 First Quarter (January) Analysis Schedule

ANALYSES	GROUNDWATER SAMPLES					AS/SVE VAPOR SAMPLES[2]	
	VOC (8260)	SVOC (8270)	DRO/RRO (AK102/103)	CHLORINATED PESTICIDES (8081)	APPENDIX IX[1]	VOC (TO-12 / EPA 25)	VOC (TO-15)
Site 3							
Primary	5	0	0	0	0	0	0
Duplicate	1	0	0	0	0	0	0
MS	1	0	0	0	0	0	0
MSD	1	0	0	0	0	0	0
Field Blank	1	0	0	0	0	0	0
Equipment Blank	1	0	0	0	0	0	0
Trip Blank	1	0	0	0	0	0	0
Subtotal	**11**	**0**	**0**	**0**	**0**	**0**	**0**
Site 7A							
Primary	5	0	5	5	0	0	0
Duplicate	1	0	1	1	0	0	0
MS	1	0	1	1	0	0	0
MSD	1	0	1	1	0	0	0
Field Blank	1	0	1	1	0	0	0
Equipment Blank	1	0	1	1	0	0	0
Trip Blank	1	0	0	0	0	0	0
Subtotal	**11**	**0**	**10**	**10**	**0**	**0**	**0**
Q1 TOTAL	**22**	**0**	**10**	**10**	**0**	**0**	**0**

Notes:

[1] Appendix IX parameters are listed in Code of Federal Regulations Title 40 Part 264. These analyses are conducted triennially (2021, 2024, 2027, 2030, …)

[2] Sample only collected if decision is made to switch on system from standby mode.

AS/SVE = air sparge/soil vapor extraction
DRO = diesel-range organics
EPA = U.S. Environmental Protection Agency
MS = matrix spike
MSD = matrix spike duplicate
Q1 = First Quarter
RRO = residual-range organics
SVOC = semi-volatile organic compound
VOC = volatile organic compound

Table 3 Second Quarter (April) Analysis Schedule

ANALYSES	GROUNDWATER SAMPLES					AS/SVE VAPOR SAMPLES[2]	
	VOC (8260)	SVOC (8270)	DRO/RRO (AK102/103)	CHLORINATED PESTICIDES (8081)	APPENDIX IX[1]	VOC (TO-12 / EPA 25)	VOC (TO-15)
Site 3							
Primary	12	0	0	0	0	0	0
Duplicate	2	0	0	0	0	0	0
MS	1	0	0	0	0	0	0
MSD	1	0	0	0	0	0	0
Field Blank	1	0	0	0	0	0	0
Equipment Blank	1	0	0	0	0	0	0
Trip Blank	1	0	0	0	0	0	0
Subtotal	**19**	**0**	**0**	**0**	**0**	**0**	**0**
Site 7A							
Primary	9	0	9	9	0	0	0
Duplicate	1	0	1	1	0	0	0
MS	1	0	1	1	0	0	0
MSD	1	0	1	1	0	0	0
Field Blank	1	0	1	1	0	0	0
Equipment Blank	1	0	1	1	0	0	0
Trip Blank	1	0	0	0	0	0	0
Subtotal	**15**	**0**	**14**	**14**	**0**	**0**	**0**
Q2 TOTAL	**34**	**0**	**14**	**14**	**0**	**0**	**0**

Notes:

[1] Appendix IX parameters are listed in Code of Federal Regulations Title 40 Part 264. These analyses are conducted triennially (2021, 2024, 2027, 2030, …)

[2] Sample only collected if decision is made to switch on system from standby mode.

AS/SVE = air sparge/soil vapor extraction
DRO = diesel-range organics
EPA = U.S. Environmental Protection Agency
MS = matrix spike
MSD = matrix spike duplicate
Q2 = Second Quarter
RRO = residual-range organics
SVOC = semi-volatile organic compound
VOC = volatile organic compound

Table 4 Third Quarter (July) Analysis Schedule

ANALYSES	GROUNDWATER SAMPLES					AS/SVE VAPOR SAMPLES[2]	
	VOC (8260)	SVOC (8270)	DRO/RRO (AK102/103)	CHLORINATED PESTICIDES (8081)	APPENDIX IX[1]	VOC (TO-12 / EPA 25)	VOC (TO-15)
Site 3							
Primary	5	0	0	0	0	3[2]	3[2]
Duplicate	1	0	0	0	0	0	0
MS	1	0	0	0	0	0	0
MSD	1	0	0	0	0	0	0
Field Blank	1	0	0	0	0	0	0
Equipment Blank	1	0	0	0	0	0	0
Trip Blank	1	0	0	0	0	0	0
Subtotal	**11**	**0**	**0**	**0**	**0**	**3[2]**	**3[2]**
Site 7A							
Primary	5	0	5	5	0	3[2]	3[2]
Duplicate	1	0	1	1	0	0	0
MS	1	0	1	1	0	0	0
MSD	1	0	1	1	0	0	0
Field Blank	1	0	1	1	0	0	0
Equipment Blank	1	0	1	1	0	0	0
Trip Blank	1	0	0	0	0	0	0
Subtotal	**11**	**0**	**10**	**10**	**0**	**3[2]**	**3[2]**
Q3 TOTAL	**22**	**0**	**10**	**10**	**0**	**6[2]**	**6[2]**

Notes:

[1] Appendix IX parameters are listed in Code of Federal Regulations Title 40 Part 264. These analyses are conducted triennially (2021, 2024, 2027, 2030, …)

[2] Sample only collected if decision is made to switch on system from standby mode.

AS/SVE = air sparge/soil vapor extraction
DRO = diesel-range organics
EPA = U.S. Environmental Protection Agency
MS = matrix spike
MSD = matrix spike duplicate
Q3 = Third Quarter
RRO = residual-range organics
SVOC = semi-volatile organic compound
VOC = volatile organic compound

Table 5 Fourth Quarter (October) Analysis Schedule

ANALYSES	GROUNDWATER SAMPLES					AS/SVE VAPOR SAMPLES[2]	
	VOC (8260)	SVOC (8270)	DRO/RRO (AK102/103)	CHLORINATED PESTICIDES (8081)	APPENDIX IX[1]	VOC (TO-12 / EPA 25)	VOC (TO-15)
Site 3							
Primary	11	0	0	0	1	3[2]	3[2]
Duplicate	2	0	0	0	1	0	0
MS	1	0	0	0	1	0	0
MSD	1	0	0	0	1	0	0
Field Blank	1	0	0	0	1	0	0
Equipment Blank	1	0	0	0	1	0	0
Trip Blank	1	0	0	0	1	0	0
Subtotal	**18**	**0**	**0**	**0**	**6**	**3[2]**	**3[2]**
Site 6A							
Primary	7	7	0	0	0	0	0
Duplicate	1	1	0	0	0	0	0
MS	1	1	0	0	0	0	0
MSD	1	1	0	0	0	0	0
Field Blank	1	1	0	0	0	0	0
Equipment Blank	1	1	0	0	0	0	0
Trip Blank	1	0	0	0	0	0	0
Subtotal	**13**	**12**	**0**	**0**	**0**	**0**	**0**
Site 7A							
Primary	8	0	8	8	1	3[2]	3[2]
Duplicate	1	0	1	1	1	0	0
MS	1	0	1	1	1	0	0
MSD	1	0	1	1	1	0	0
Field Blank	1	0	1	1	1	0	0
Equipment Blank	1	0	1	1	1	0	0
Trip Blank	1	0	0	0	1	0	0
Subtotal	**14**	**0**	**13**	**13**	**6**	**3[2]**	**3[2]**
Q4 TOTAL	**45**	**12**	**13**	**13**	**12**	**6[2]**	**6[2]**

Notes:

[1] Appendix IX parameters are listed in Code of Federal Regulations Title 40 Part 264. These analyses are conducted triennially (2021, 2024, 2027, 2030, …)

[2] Sample only collected if decision is made to switch on system from standby mode.

AS/SVE = air sparge/soil vapor extraction
DRO = diesel-range organics
EPA = U.S. Environmental Protection Agency
MS = matrix spike
MSD = matrix spike duplicate
Q4 = Fourth Quarter
RRO = residual-range organics
SVOC = semi-volatile organic compound
VOC = volatile organic compound

This page intentionally blank

6.0 REPORTING

Reporting requirements for Sites 3 and 7A, which are currently in corrective action status, are in Part V of the RCRA permit. Site 6A is currently in detection monitoring status and the reporting requirements are in Part VIII of the RCRA permit.

This page intentionally blank

7.0 SCHEDULE

Quarterly sampling activities at Sites 3 and 7A occur in January, April, July, and October. Sampling events at 6A are on an annual basis and occur in October.

The schedule for Site 3, 6A, and 7A reporting is as follows:

- Contractor submits a draft report to USCG within 100 days following each quarterly sampling event.
- Contractor submits final report within 110 days following each quarterly sampling event.
- USCG submits final report to EPA within 120 days of completion of the sampling event.

Tables 6 through 9 summarize the sampling and gauging schedule for each of the three sites.

Table 6 First Quarter (January) Sampling Schedule

WELL IDENTIFICATION	SAMPLED	DTW ONLY
Site 3 – Laundry		
MW-03-003		
MW-03-007		
MW-03-010		
MW-03-011		
MW-03-013[1]	X	
MW-03-014		
MW-03-017		
MW-03-018		
MW-03-020		
MW-03-021		
MW-03-022	X	
MW-03-024		
MW-03-025		
MW-03-101D		
MW-03-104S		
MW-03-104D		
MW-03-106S		
MW-03-107S		
MW-03-107D		
MW-03-201		
MW-03-202	X	
MW-03-214		
MW-03-215		
MW-03-216		
MW-03-220		
MW-03-401		

Table 6 First Quarter (January) Sampling Schedule

WELL IDENTIFICATION	SAMPLED	DTW ONLY
MW-03-402D	X	
MW-03-403S		
MW-03-404		
MW-03-405		
MW-03-406D		
MW-03-407D		
MW-03-502S		
MW-03-502M	X	
MW-03-503D		
MW-03-508		
Site 7A – Barrel Storage Area No. 1		
MW-7A-003	X	
MW-7A-004	X	
MW-7A-005		
MW-7A-006		
MW-7A-007		
MW-7A-009		
MW-7A-010		
MW-7A-011	X	
MW-7A-012		
MW-7A-013[1]	X	
MW-7A-018	X	
MW-7A-019		
MW-7A-023		
MW-7A-024		

Notes:

[1] Designated for triennial Appendix IX analyses.

Yellow Shading = corrective action or compliance monitoring
Green Shading = effectiveness monitoring

DTW = depth to water

Table 7 Second Quarter (April) Sampling Schedule

WELL IDENTIFICATION	SAMPLED	DTW ONLY
Site 3 – Laundry		
MW-03-003	X	
MW-03-007		X
MW-03-010		X
MW-03-011		X
MW-03-013[1]	X	
MW-03-014		X
MW-03-017		X
MW-03-018	X	
MW-03-020		X
MW-03-021		X
MW-03-022	X	
MW-03-024		X
MW-03-025	X	
MW-03-101D		X
MW-03-104S		X
MW-03-104D		X
MW-03-106S		X
MW-03-107S	X	
MW-03-107D		X
MW-03-201		X
MW-03-202	X	
MW-03-214		X
MW-03-215		X
MW-03-216		X
MW-03-220		X
MW-03-401	X	
MW-03-402D	X	
MW-03-403S		X
MW-03-404		X
MW-03-405		X
MW-03-406D		X
MW-03-407D	X	
MW-03-502S		X
MW-03-502M	X	
MW-03-503D	X	
MW-03-508		X

Table 7 Second Quarter (April) Sampling Schedule

WELL IDENTIFICATION	SAMPLED	DTW ONLY
Site 7A – Barrel Storage Area No. 1		
MW-7A-003	X	
MW-7A-004	X	
MW-7A-005		X
MW-7A-006		X
MW-7A-007	X	
MW-7A-009		X
MW-7A-010		X
MW-7A-011	X	
MW-7A-012	X	
MW-7A-013[1]	X	
MW-7A-018	X	
MW-7A-019		X
MW-7A-023	X	
MW-7A-024	X	

Notes:

[1] Designated for triennial Appendix IX analyses.

Yellow Shading = corrective action or compliance monitoring
Green Shading = effectiveness monitoring

DTW = depth to water

Table 8 Third Quarter (July) Sampling Schedule

WELL IDENTIFICATION	SAMPLED	DTW ONLY
Site 3 – Laundry		
MW-03-003		
MW-03-007		
MW-03-010		
MW-03-011		
MW-03-013[1]	X	
MW-03-014		
MW-03-017		
MW-03-018		
MW-03-020		
MW-03-021		
MW-03-022	X	
MW-03-024		
MW-03-025		
MW-03-101D		
MW-03-104S		
MW-03-104D		
MW-03-106S		
MW-03-107S		
MW-03-107D		
MW-03-201		
MW-03-202	X	
MW-03-214		
MW-03-215		
MW-03-216		
MW-03-220		
MW-03-401		
MW-03-402D	X	
MW-03-403S		
MW-03-404		
MW-03-405		
MW-03-406D		
MW-03-407D		
MW-03-502S		
MW-03-502M	X	
MW-03-503D		
MW-03-508		

Table 8 Third Quarter (July) Sampling Schedule

WELL IDENTIFICATION	SAMPLED	DTW ONLY
Site 7A – Barrel Storage Area No. 1		
MW-7A-003	X	
MW-7A-004	X	
MW-7A-005		
MW-7A-006		
MW-7A-007		
MW-7A-009		
MW-7A-010		
MW-7A-011	X	
MW-7A-012		
MW-7A-013[1]	X	
MW-7A-018	X	
MW-7A-019		
MW-7A-023		
MW-7A-024		

Notes:

[1] Designated for triennial Appendix IX analyses.

Yellow Shading = corrective action or compliance monitoring
Green Shading = effectiveness monitoring

DTW = depth to water

Table 9 Fourth Quarter (October) Sampling Schedule

WELL IDENTIFICATION	SAMPLED	DTW ONLY
Site 3 – Laundry		
MW-03-003	X	
MW-03-007		X
MW-03-010		X
MW-03-011		X
MW-03-013[1]	X	
MW-03-014		X
MW-03-017		X
MW-03-018	X	
MW-03-020		X
MW-03-021		X
MW-03-022	X	
MW-03-024		X
MW-03-025	X	
MW-03-101D		X
MW-03-104S		X
MW-03-104D		X
MW-03-106S		X
MW-03-107S	X	
MW-03-107D		X
MW-03-201		X
MW-03-202	X	
MW-03-214		X
MW-03-215		X
MW-03-216		X
MW-03-220		X
MW-03-401	X	
MW-03-402D	X	
MW-03-403S		X
MW-03-404		X
MW-03-405		X
MW-03-406D		X
MW-03-407D	X	
MW-03-502S		X
MW-03-502M	X	
MW-03-503D	X	
MW-03-508		X

Table 9 Fourth Quarter (October) Sampling Schedule

WELL IDENTIFICATION	SAMPLED	DTW ONLY
Site 6A – MOGAS Storage Facility		
MW-6A-102		X
MW-6A-106		X
MW-6A-107	X	
MW-6A-108	X	
MW-6A-113		X
MW-6A-114		X
MW-6A-115		X
MW-6A-116	X	
MW-6A-117	X	
MW-6A-120	X	
MW-6A-121	X	
MW-6A-122	X	
MW-6A-123		X
MW-6A-124		X
MW-6A-125		X
Site 7A – Barrel Storage Area No. 1		
MW-7A-003	X	
MW-7A-004	X	
MW-7A-005		X
MW-7A-006		X
MW-7A-007	X	
MW-7A-009		X
MW-7A-010		X
MW-7A-011	X	
MW-7A-012	X	
MW-7A-013[1]	X	
MW-7A-018	X	
MW-7A-019		X
MW-7A-023	X	
MW-7A-024	X	

Notes:

[1] Designated for triennial Appendix IX analyses.

Blue Shading = detection monitoring
Yellow Shading = corrective action or compliance monitoring
Green Shading = effectiveness monitoring

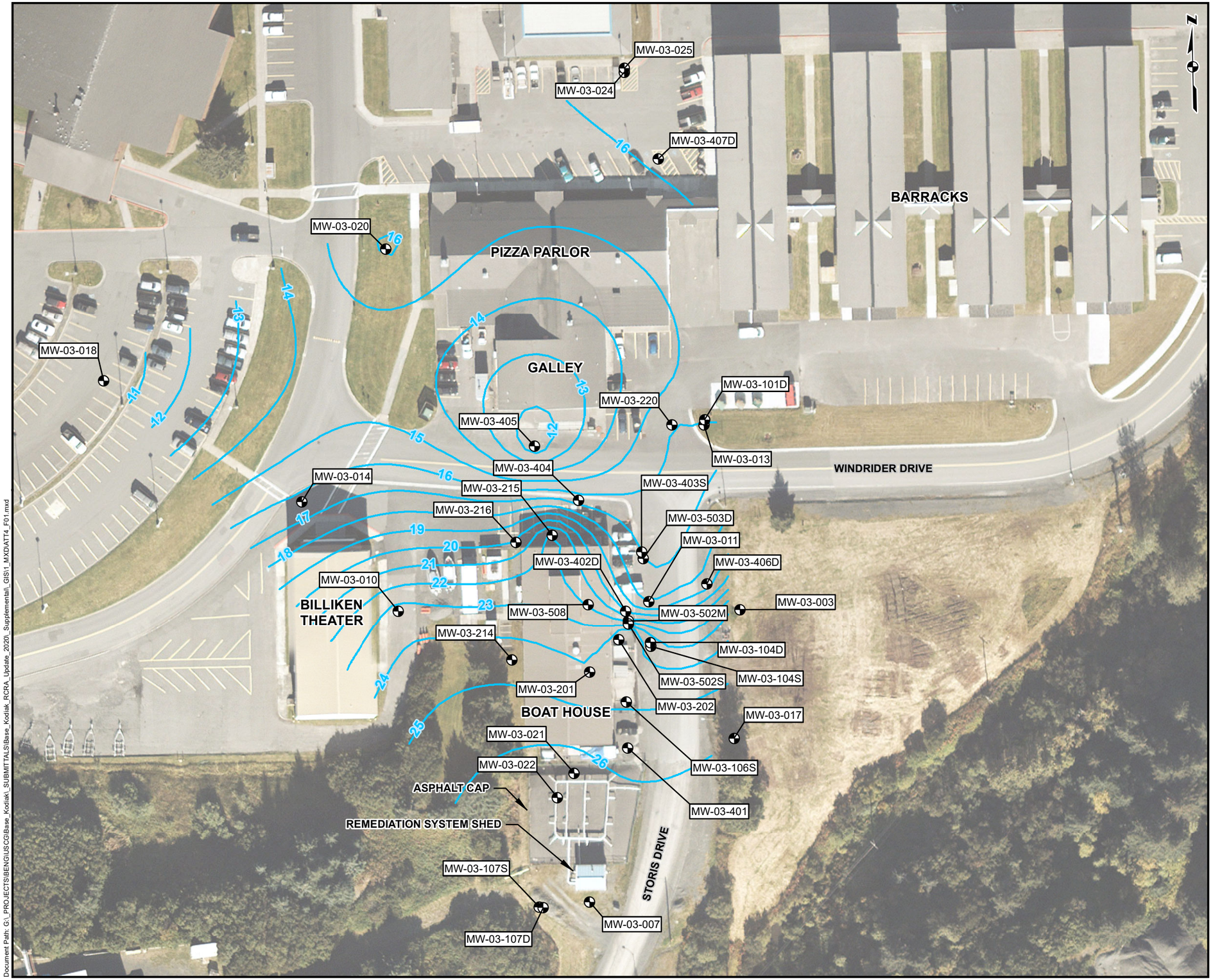
DTW = depth to water

1 INCH

APPENDIX A RCRA QUARTERLY SAMPLING AND ANALYSIS PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 3 – COAST GUARD LAUNDRY



Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT4_F01.mxd

Legend

- Monitoring Well
- Groundwater Elevation Contour (USFT)

Abbreviations

MLLW	Mean Lower Low Water
NOAA	National Oceanic and Atmospheric Administration
USFT	U.S. Survey Feet

Notes

1. Depth to groundwater and total depth measurements collected on May 19, 2020.
2. Groundwater elevation contours presented in USFT relative to MLLW from NOAA Tidal Benchmark 9457292.

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Monitoring well vertical survey conducted in May 2020 by Brice Engineering, LLC.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

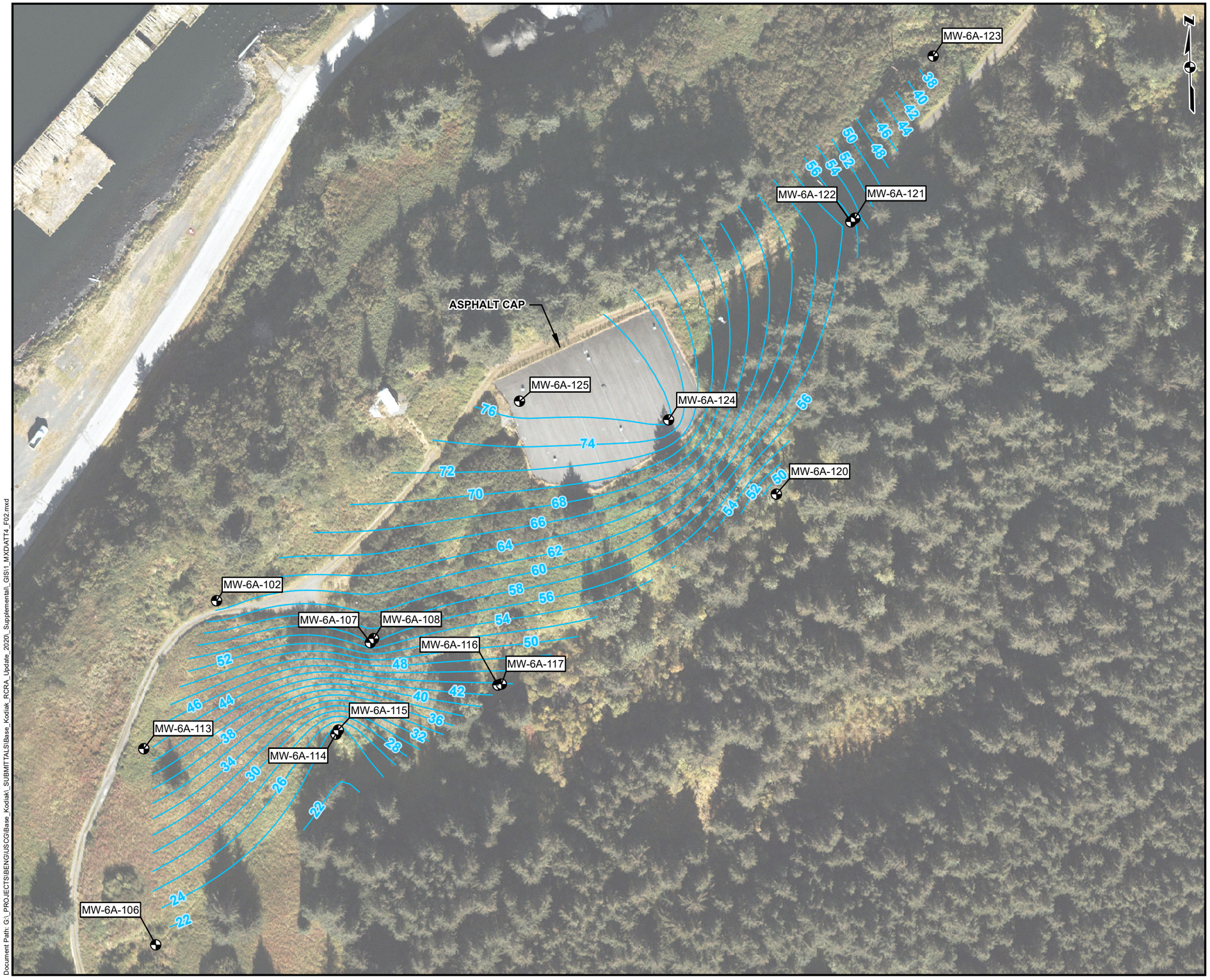
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: MLLW

70 35 0 70 140

SCALE IN FEET

PROJECT No.: 680402	DATE: 8/13/2020	FIGURE: 1
P.M.: CS	DRAWN: CMH	

1 INCH



Document Path: G:_PROJECTS\BEN\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT4_F02.mxd

APPENDIX A RCRA QUARTERLY SAMPLING AND ANALYSIS PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 6A – MOGAS

Legend

- Monitoring Well
- Groundwater Elevation Contour (USFT)

Abbreviations

MLLW	Mean Lower Low Water
NOAA	National Oceanic and Atmospheric Administration
USFT	U.S. Survey Feet

Notes

1. Depth to water and total depth measurements collected on May 22, 2020.
2. Groundwater elevation contours presented in USFT relative to MLLW from NOAA Tidal Benchmark 9457292.

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Monitoring well vertical survey conducted in May 2020 by Brice Engineering, LLC.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, U.S. SURVEY FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: MLLW

100 50 0 100 200

SCALE IN FEET

PROJECT No.: 680402	DATE: 8/13/2020	FIGURE: 2
P.M.: CS	DRAWN: CMH	

1 INCH

Document Path: G:_PROJECTS\BENG\USCGBase_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT4_F03.mxd

APPENDIX A RCRA QUARTERLY SAMPLING AND ANALYSIS PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 7A – BARREL STORAGE AREA NO. 1

Legend

- Monitoring Well
- Groundwater Elevation Contour (USFT)

Abbreviations

MLLW	Mean Lower Low Water
NOAA	National Oceanic and Atmospheric Administration
USFT	U.S. Survey Feet

Notes

1. Depth to water and total depth measurements collected on May 19, 2020.
2. Groundwater elevation contours presented in USFT relative to MLLW from NOAA Tidal Benchmark 9457292.

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Monitoring well vertical survey conducted in May 2020 by Brice Engineering, LLC.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, U.S. SURVEY FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: MLLW

50 25 0 50 100

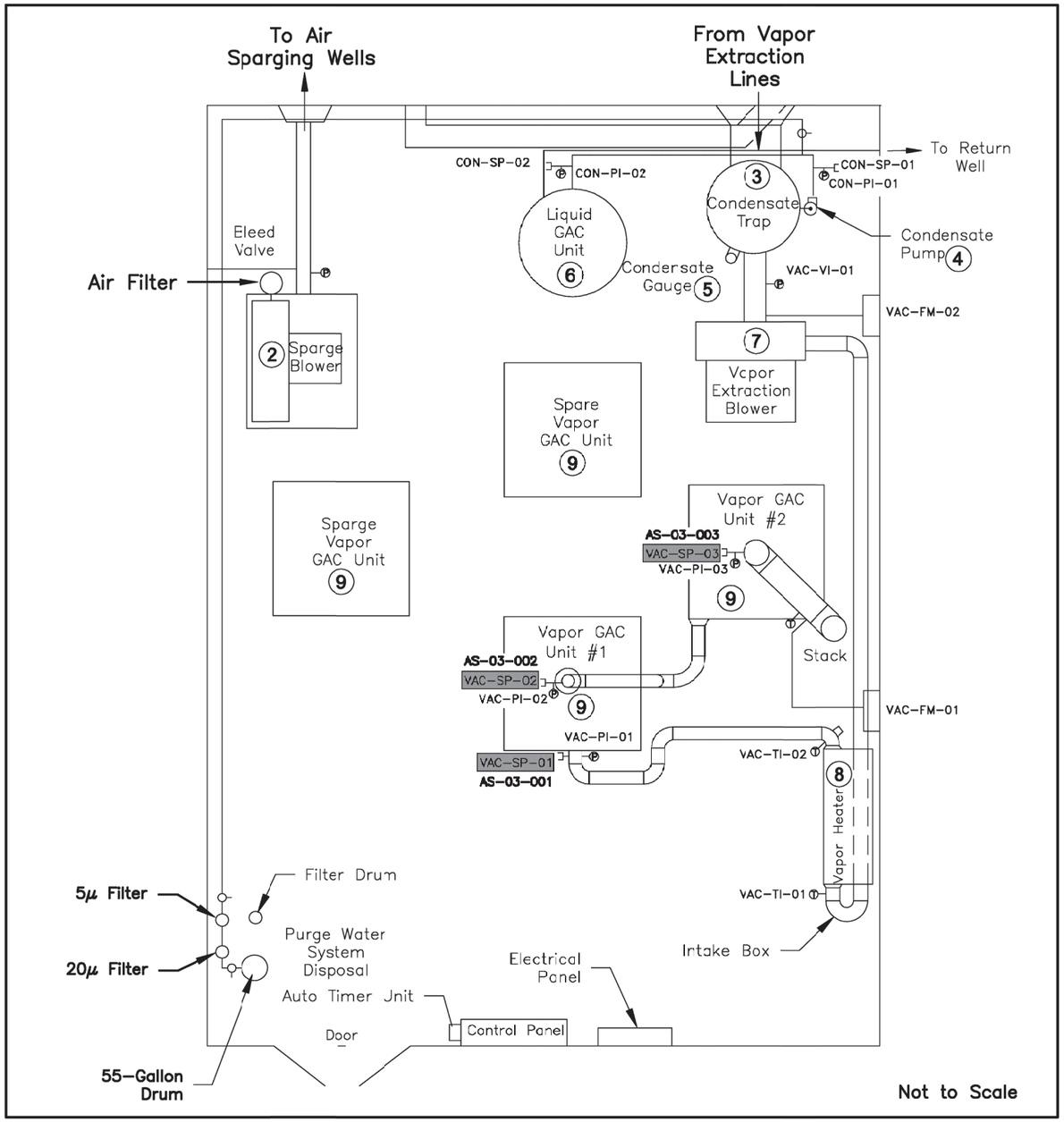
SCALE IN FEET

PROJECT No.: 680402	DATE: 8/13/2020	FIGURE: 3
P.M.: CS	DRAWN: CMH	

1 INCH

APPENDIX A RCRA QUARTERLY SAMPLING AND ANALYSIS PLAN
USCG BASE KODIAK, KODIAK, ALASKA

SITE 3 VAPOR SAMPLING LOCATIONS



- Backflow Preventer
- Ball Valve
- Flow Meter
- Heater
- Outlet
- Valve
- Pressure Gauge
- Pressure Sensor
- Sample Port
- Temperature
- Gauge Pump
- Rigid Piping
- Flexible Piping
- VAC-SP-03 Sample Port
- VAC-TI-01 Bleed Valve

PROJECT No.: 680402	DATE: 8/13/2020	FIGURE: 4
P.M.: CS	DRAWN: CMH	

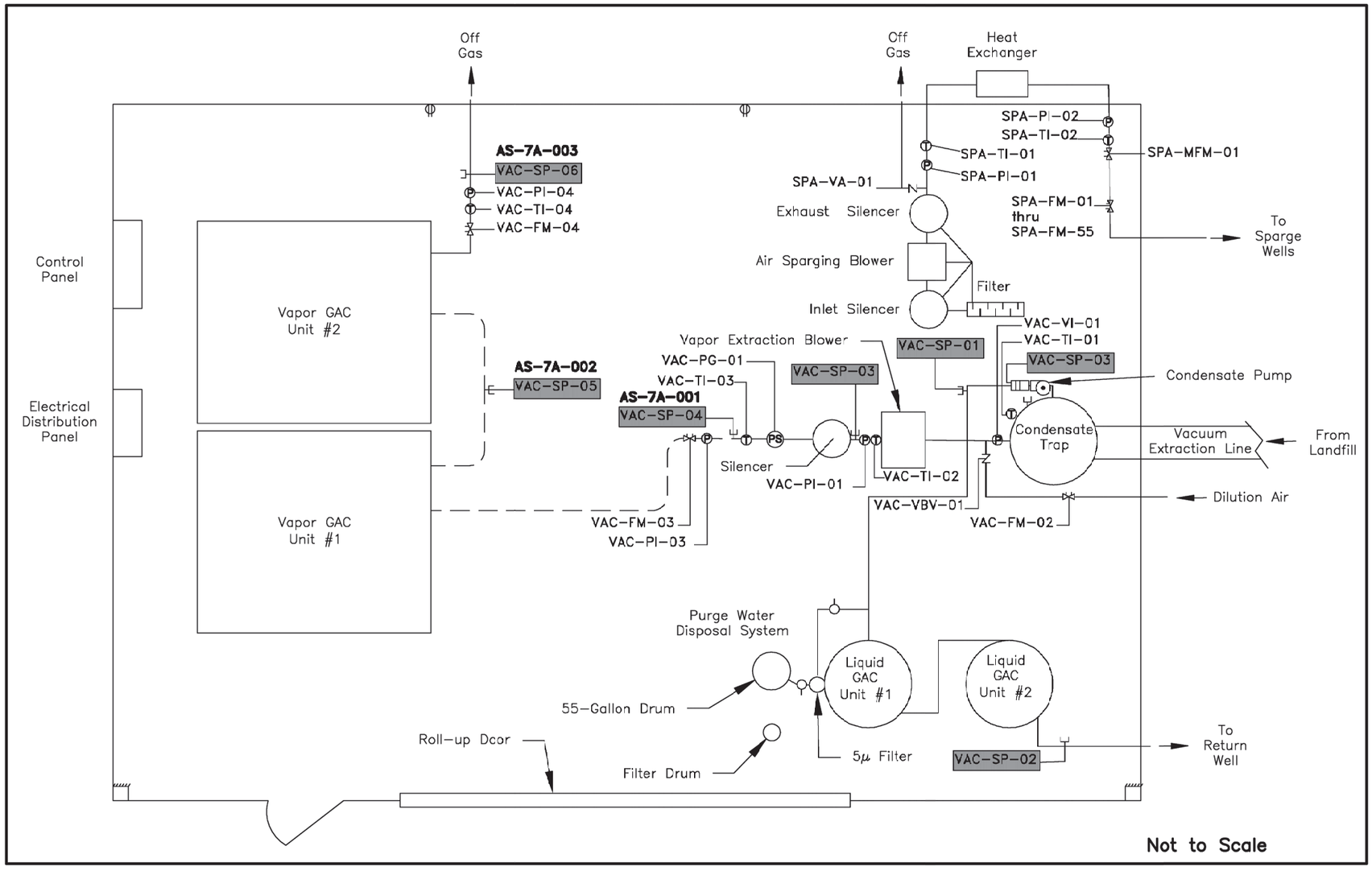
Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXDATT4_F04.mxd

1 INCH

APPENDIX A RCRA QUARTERLY SAMPLING AND ANALYSIS PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 7A VAPOR SAMPLING LOCATIONS



- Backflow Preventer
- Ball Valve
- Flow Meter
- Heater
- Outlet
- Valve
- Pressure Gauge
- Pressure Sensor
- Sample Port
- Temperature
- Gauge Pump
- Rigid Piping
- Flexible Piping
- VAC-SP-03 Sample Port
- VAC-TI-01 Bleed Valve

References

1. Base map prepared from drawing from Shannon & Wilson, INC. Entitled "Remediation Equipment Layout", dated December 2001.

PROJECT No.:	DATE:	FIGURE:
680402	8/13/2020	5
P.M.: CS	DRAWN: CMH	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\ATT4_F05.mxd

This page intentionally blank

Draft
Exhibit 1
Monitoring Well Inspection and Deficiency Reports

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

USCG SITE 3 (LAUNDRY) – POST CLOSURE INSPECTION CHECKLIST AND REPORT FORM
GROUNDWATER MONITORING WELLS QUARTERLY INSPECTION

WELL ID	WELL COVER			MONITORING WELL			BOLLARDS			
	Signs of Tampering	Lock Condition	Seals (Flushmount)	Indication of Frost Heave	Well ID	Downhole Obstruction	Damaged	Indication of Frost Heave	Secure in Ground	Visibility
MW-03-003										
MW-03-007										
MW-03-010										
MW-03-011										
MW-03-013										
MW-03-014										
MW-03-017										
MW-03-018										
MW-03-020										
MW-03-021										
MW-03-022										
MW-03-024										
MW-03-025										
MW-03-101D										
MW-03-104S										
MW-03-104D										
MW-03-106S										
MW-03-107D										
MW-03-107S										
MW-03-201										
MW-03-202										
MW-03-203										
MW-03-214										
MW-03-215										
MW-03-216										
MW-03-220										
MW-03-401										
MW-03-402D										
MW-03-403S										
MW-03-404										
MW-03-405										
MW-03-406D										
MW-03-407D										
MW-03-502S										
MW-03-502M										
MW-03-503D										
MW-03-508										

Notes:
If finding is unsatisfactory, fill out Groundwater Monitoring Well Deficiency Report for each unsatisfactory well.

Inspector's Signature: Date:

This page intentionally blank

USCG SITE 6A (MOGAS) – POST CLOSURE INSPECTION CHECKLIST AND REPORT FORM
GROUNDWATER MONITORING WELLS QUARTERLY INSPECTION

WELL ID	WELL COVER			MONITORING WELL			BOLLARDS			
	Signs of Tampering	Lock Condition	Seals (Flushmount)	Indication of Frost Heave	Well ID	Downhole Obstruction	Damaged	Indication of Frost Heave	Secure in Ground	Visibility
MW-6A-102										
MW-6A-106										
MW-6A-107										
MW-6A-108										
MW-6A-113										
MW-6A-114										
MW-6A-115										
MW-6A-116										
MW-6A-117										
MW-6A-120										
MW-6A-121										
MW-6A-122										
MW-6A-123										
MW-6A-124										
MW-6A-125										

Notes:
If finding is unsatisfactory, fill out Groundwater Monitoring Well Deficiency Report for each unsatisfactory well.

Inspector's Signature: Date:

This page intentionally blank

USCG SITE 7A (BARREL STORAGE) – POST CLOSURE INSPECTION CHECKLIST AND REPORT FORM
GROUNDWATER MONITORING WELLS QUARTERLY INSPECTION

WELL ID	WELL COVER			MONITORING WELL			BOLLARDS			
	Signs of Tampering	Lock Condition	Seals (Flushmount)	Indication of Frost Heave	Well ID	Downhole Obstruction	Damaged	Indication of Frost Heave	Secure in Ground	Visibility
MW-7A-003										
MW-7A-004										
MW-7A-005										
MW-7A-006										
MW-7A-007										
MW-7A-009										
MW-7A-010										
MW-7A-011										
MW-7A-012										
MW-7A-013										
MW-7A-018										
MW-7A-019										
MW-7A-023										
MW-7A-024										

Notes:
If finding is unsatisfactory, fill out Groundwater Monitoring Well Deficiency Report for each unsatisfactory well.

Inspector's Signature: Date:

This page intentionally blank

USCG MONITORING WELL DEFICIENCY REPORT

WELL ID		
ITEM	**FINDING**	**COMMENTS / ACTION TAKEN**
Well Cover: • Signs of tampering • Lock condition • Seals (flush mount)		
Monitoring Well: • Indication of frost heave • Well ID • Downhole obstructions		
Bollards: • Damaged • Indications of frost heave • Secure in ground • Visibility		

Inspector's Signature: Date:

This page intentionally blank

Draft
Exhibit 2

Example Groundwater Sample Form and Well Development Form

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

Groundwater Sample Form

PROJECT:	**SITE:**
PROJECT NUMBER:	**WELL ID:**

WATER COLUMN	
Total Depth of Well (feet)	Measurement Date
Depth to Water (feet BTOC)	Measurement Time
Column of Water (feet)	Pump Intake (feet BTOC)

PURGE INFORMATION	
Volume[1] per foot of Screen:	Total Volume Removed:
Column of Water in Well:	Purge Method:
Volume of Water in Well Casing:	

FIELD PARAMETERS

VOLUME REMOVED	TEMPERATURE [°C]	PH	CONDUCTIVITY [mS/cm]	TURBIDITY [NTU]	DO [mg/L]	ORP [mV]	ODOR	SHEEN

SAMPLE INFORMATION	
Sample Date:	Sample ID:
Sample Time:	Duplicate ID:
Sample Method:	Sampler:
Laboratory Analyses Requested:	
Comments:	

Notes:

[1] 2-inch Schedule 40 PVC: 0.17 gallons per lineal foot (0.64 liters per lineal foot)

Groundwater Sample Form

FIELD PARAMETERS (CONTINUED)								
VOLUME REMOVED	TEMPERATURE [°C]	PH	CONDUCTIVITY [mS/cm]	TURBIDITY [NTU]	DO [mg/L]	ORP [mV]	ODOR	SHEEN

Well Development Data Sheet

Project Name	Event	Well ID	Project Number
Weather Conditions	**PID Readings of Total VOCs (ppm)** Ambient _____ Breathing Zone _____ In Well _____	**Date**	**Developer Initials**

Well Information

Well Material / Size (in)	Drilling Water Added (gal)	As-Built TD of Casing (ft)	Borehole Diameter(in) / Gallons per linear foot (gal/ft)
PVC / 2 SS / 2 ___/___			3.75 / 0.286 4.5 / 0.362 6 / 0.555 8 / 0.898 (filter pack porosity = 0.3)
Depth to Product (ft TOC)	**Depth to GW (ft TOC)**	**Initial TD of Casing (ft)**	**Product Thickness (ft) and Volume Recovered (mL)**

Borehole Vol. (BV) water table well = (TD of casing – depth to water) * gal/ft; submerged well = (TD of casing – Depth Top Filter Pack *gal/ft

Min Purge Vol. = 2 * Added Water + 3 * BV Max Purge Vol. = 2 * Added Water + 10 * BV

BV = (ft – ft) * gal/ft = gal (* 3.785 L/gal = L)

Min Purge Vol. = 2 * gal + 3 * gal = gal (* 3.785 L/gal = L)

Max Purge Vol. = 2 * gal + 10 * gal = gal (* 3.785 L/gal = L)

Well Purging Information

Start Time	Finish Time	Final TD of Casing (ft)		Equipment Used for Development	
Color	**Odor**	**Sheen**	**Purged Dry**	**WQ Meters**	**Pump Intake Depth(ft btoc)**
	None Moderate Faint Strong	Yes No	Yes No		(during stabilization)

Purging reached: Stability Max Vol. | Purge water was: Treated Stored Other Note:

Time (HH:mm)	Volume (Gallons or Liters)		Acceptable Range to Demonstrate Stability						Water Level (feet btoc)
			± 3%	± 0.1	± 3%	± 10% or < 10	± 10%	± 10	
	Change	Total	Temperature [°C]	pH	Conductivity [mS/cm]	Turbidity [NTU]	DO [mg/L]	ORP [mV]	

Suggested Notation

"——" = not measured "✓"= stable "+" = rising "-" = falling "*" = all parameters stable ____ Additional observations on back

Well Development Data Sheet

Time (HH:mm)	Volume (Gallons or Liters)		Field Parameters (Continued)						Water Level (feet btoc)
	Change	Total	Temperature [°C]	pH	Conductivity [mS/cm]	Turbidity [NTU]	DO [mg/L]	ORP [mV]	

Suggested Notation

"——" = not measured "✓"= stable "+" = rising "-" = falling "*" = all parameters stable ____ Additional observations on back

Draft
Exhibit 3

VAPOR SAMPLE FORMS AND INSTRUCTIONS REMEDIATION SYSTEM MONITORING CHECKLIST

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

SITE 3 REMEDIATION SYSTEM MONITORING CHECKLIST

Date if Visit:_____ Visited By:_____

CONTROL Panel Alarms:	+ gas heater TAL	+ gas heater TA
	+ moisture separator high level	+ VES blower low pressure
Alarm Cause/ Action Taken:		

Timer Settings (enter time of day or cycle duration) - 7 Days a Week								
Unit	**On**	**Off**	**On**	**Off**	**On**	**Off**	**On**	**Off**
Vapor Extraction (P1)								
Air Sparging (P2)								

Location	Label Name	Parameter	Normal Operating Range	Reading	Units
AIR SPARGING SYSTEM					
Blower Exit	SPA-PI-01	Pressure	<15		psi
Flow Meters	SPA-FM-xx	Flow	2 to 20	See next page	cfm
VAPOR EXTRACTION SYSTEM					
Before Blower	VAC-VI-01	Vacuum	20 to 42		in H_2O
Before blower	VAC-FM-02	Flow	100 tp 1300		cfm
Condensate Guage	See Figure A-5	Level	0-10		Inches
Before Vapor Heater	VAC-TI-01	Temperature	<Ambient +30		°F
After Vapor Heater	VAC-TI-02	Temperature	<VAC-PI or 44+		°F
Before 1st Vapor GAC	VAC-PI-01	Pressure	<44		in H_2O
Before 2nd Vapor GAG	VAC-PI-02	Pressure	<(VAC-PI-01)		in H_2O
Stack, after carbon	VAC-PI-03	Pressure	>0		in H_2O
Stack, after carbon	VAC-TI-03	Temperature	<(VAC-TI-02)		°F
Stack, after carbon	VAC-FM-01	Total Flow	=(VAC-FM-2)		cfm

SITE 3 REMEDIATION SYSTEM MONITORING CHECKLIST

AIR SPARGING WELL FLOWRATES

Note: Air sparging flowmeters are labeled "SPA- FM-xx," where xx is the well number.

Well Number	Pressure Differential (inches H_2O)	Flow Rate (cfm)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		

NOTES (regarding any aspect of the system):

*When taking air sparging flowrates, connect the two tubes from the magnehelic gauge to the barbed fittings of the orifice plate on the sparge wells. If there is no initial reading on the gauge when the air sparging system is on, switch the tubes with each other on the barb fittings.

SITE 3 VAPOR SAMPLING FORM

Vapor Monitoring/Laboratory Sample Collection				
Location	**Label Name**	**Analysis**	**Sample No.**	**Date/Time Collected**
SVE Discharge, before carbon	VAC-SP-01	EPA Method TO-15		
SVE Discharge, after 1st GAC	VAC-SP-02	EPA Method TO-15		
SVE Discharge, after 2nd GAC (discharge stack)	VAC-SP-03	EPA Method TO-15		

SITE 7A REMEDIATION SYSTEM MONITORING CHECKLIST

Date if Visit:_____ Visited By:_____

CONTROL Panel Alarms:	+ high tank level	+ high discharge pressure
Alarm Cause/ Action Taken:		

Timer Settings (enter time of day or cycle duration) - 7 Days a Week								
Unit	**On**	**Off**	**On**	**Off**	**On**	**Off**	**On**	**Off**
Vapor Extraction (P2)								
Air Sparging (P1)								

Location	Label Name	Parameter	Normal Operating Range	Reading	Units
AIR SPARGING SYSTEM					
Blower Exit	SPA-TI-01	Temperature	< Ambient +110		°F
Blower Exit	SPA-PI-01	Pressure	<11		psi
Post Heat Exchanger	SPA-TI-02	Temperature	<120		°F
Post Heat Exchanger	SPA-PI-02	Pressure	>(SPA-PI-01)-2		pst
AS Manifold	SPA-MFM-01	Total Flow	25 to 650		cfm
Rotameters	SPA-FM-00	Flow	0 to 20	see next page	cfm
VAPOR EXTRACTION SYSTEM					
Before Blower	VAC-TI-01	Temperature	< Ambient		°F
Before blower	VAC-VI-01	Vacuum	40 to 190		in H_2O
Flow Meter	VAC-FM-02	Total Flow			gallons
After Blower	VAC-TI-02	Temperature	< Ambient +90		°F
After Blower	VAC-PI-01	Pressure	<190		in H_2O
After Blower	VAC-FM-03	Total Flow	>Dilution Flow + AS Total Flow		cfm
After Blower	VAC-TI-03	Temperature	<Ambient +90		°F
Dilution Inlet	VAC-FM-02	Total Flow	[Minimize]		cfm
Stack, after carbon	VAC-TI-04	Temperature	<Ambient +90		°F
Stack, after carbon	VAC-PI-04	Pressure	0 to 190		in H_2O
Stack, after carbon	VAC-FM-04	Total Flow	VAC-FM-03		cfm

Note: Refer to Section 5.0 if parameters are outside normal operating ranges. Normal operating ranges are estimated based on equipment specifications and historical measurements. Normal operating ranges may be changed after discussion with system engineer if appropriate.

SITE 7A REMEDIATION SYSTEM MONITORING CHECKLIST

AIR SPARGING WELL FLOWRATES

Note: Air sparging flowmeters are labeled "SPA- FM-xx," where xx is the well number.

Well Number	Flow Rate (cfm)	Well Number	Flow Rate (cfm)	Well Number	Flow Rate (cfm)
1		21		41	
2		22		42	
3		23		43	
4		24		44	
5		25		45	
6		26		46	
7		27		47	
8		28		48	
9		29		49	
10		30		50	
11		31		51	
12		32		52	
13		33		53	
14		34		54	
15		35		55	
16		36			
17		37			
18		38			
19		39			
20		40			

NOTES (regarding any aspect of the system):

SITE 7A VAPOR SAMPLING FORM

Vapor Monitoring/Laboratory Sample Collection				
Location	**Label Name**	**Analysis**	**Sample No.**	**Date/Time Collected**
Stack, before carbon	VAC-SP-04	EPA Method TO-15		
		EPA Method TO-12		
		ASTM Method D 3416		
Stack, after 1st GAC	VAC-SP-02	EPA Method TO-15		
		EPA Method TO-12		
		ASTM Method D 3416		
Stack, after 2nd GAC	VAC-SP-03	EPA Method TO-15		
		EPA Method TO-12		
		ASTM Method D 3416		

Draft
Exhibit 4
Asphalt Cover Checklist

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

USCG BASE KODIAK
SITE 3 - LAUNDRY ASPHALT COVER QUARTERLY CHECKLIST

ITEM	FINDING	COMMENT
Asphalt Cover: • Signs of settling or heave • Cracks or holes in cover • Signs of environmental damage due to wind, water, freezing/thaw cycle, UV exposure, oxidation, or intrusion by plants or animals • Signs of improper surface water drainage such as ponding.		
Drainage System: • Drains clear of sediment and other debris • Any other signs of failure		
Runon/Runoff Control: • Check cap underdrain for obstruction at underdrain cleanout • Check underdrain outfall for backup and debris • Signs of environmental damage or intrusion by plants or animals		
Protective Fence: • Indications of tampering • Lock and gate in good condition • Post secure in ground • Visibility (paint in good shape)		

Notes:

Inspector's Signature: Date:

This page intentionally blank

USCG BASE KODIAK
SITE 6A - MOGAS ASPHALT COVER CHECKLIST

ITEM	FINDING	COMMENT
Asphalt Cover: • Signs of settling or heave • Cracks or holes in cover • Signs of environmental damage due to wind, water, freezing/thaw cycle, UV exposure, oxidation, or intrusion by plants or animals • Signs of improper surface water drainage such as ponding.		
Drainage System: • Drains clear of sediment and other debris • Any other signs of failure		
Runon/Runoff Control: • Check cap underdrain for obstruction at underdrain cleanout • Check underdrain outfall for backup and debris • Signs of environmental damage or intrusion by plants or animals		
Protective Fence: • Indications of tampering • Lock and gate in good condition • Post secure in ground • Visibility (paint in good shape)		

Notes:

Inspector's Signature: Date:

This page intentionally blank

USCG BASE KODIAK
SITE 7A - BARREL STORAGE ASPHALT COVER QUARTERLY CHECKLIST

ITEM	FINDING	COMMENT
Asphalt Cover: • Signs of settling or heave • Cracks or holes in cover • Signs of environmental damage due to wind, water, freezing/thaw cycle, UV exposure, oxidation, or intrusion by plants or animals • Signs of improper surface water drainage such as ponding.		
Drainage System: • Drains clear of sediment and other debris • Any other signs of failure		
Runon/Runoff Control: • Check cap underdrain for obstruction at underdrain cleanout • Check underdrain outfall for backup and debris • Signs of environmental damage or intrusion by plants or animals		
Protective Fence: • Indications of tampering • Lock and gate in good condition • Post secure in ground • Visibility (paint in good shape)		

Notes:

Inspector's Signature: Date:

This page intentionally blank

Draft
Exhibit 5
Example Chain of Custody Form

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

Chain-of-Custody Report

Page of

Collection Organization: CoC No.: Cooler ID:

Project Name: Laboratory: Bill To: NPDL Number:

Field Sample ID	Location ID	Collection Date	Collection Time	Sampler	Qty	Container Type	Container Volume	Preservative	Matrix	Requested Analysis								QC	TAT	Notes

Special Instructions:

Cooler Temp: Temperature Blank:

Relinquish By: Relinquish By:

Signature/Printed Name Date/Time Signature/Printed Name Date/Time

Received By: Received By:

Signature/Printed Name Date/Time Signature/Printed Name Date/Time

This page intentionally blank

Draft
Exhibit 6
Field Standard Operating Procedures

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

1.0 DECONTAMINATION OF SAMPLING EQUIPMENT 1

1.1 Purpose 1
1.2 Scope 1
1.3 Requirements 1
1.4 Definitions 1
1.5 Responsibilities 1
1.5.1 Project Manager 1
1.5.2 Field Operations Leader 1
1.6 Equipment 1
1.7 Procedure 2
1.7.1 Decontamination 2
1.7.2 Requirements and Limitations 2
1.7.3 Quality Control Procedures for Decontamination 3

2.0 WELL DEVELOPMENT 5

2.1 Purpose 5
2.2 Scope 5
2.3 Requirements 5
2.4 Definitions 5
2.5 Responsibilities 5
2.5.1 Field Operations Leader 5
2.5.2 Field Geologist 6
2.6 Equipment 6
2.7 Procedure 6
2.7.1 Development 6
2.7.2 Groundwater Sampling 7
2.7.3 Surging 7
2.8 Attachments 7

3.0 WELL PURGING 9

3.1 Purpose 9
3.2 Scope 9
3.3 Requirements 9
3.4 Definitions 9
3.5 Responsibilities 9
3.5.1 Project Manager 9
3.5.2 Site Hydrogeologist or Geochemist 10
3.5.3 Site Geologist 10
3.6 Equipment 10
3.7 Procedure 10
3.7.1 General 10
3.7.2 Calculations of Well Volume 10
3.7.3 Specific Procedure for Well Purging 11
3.8 Attachments 12

TABLE OF CONTENTS (CONTINUED)

4.0 GROUNDWATER SAMPLING 13

4.1 Purpose 13
4.2 Scope 13
4.3 Requirements 13
4.4 Definitions 13
4.5 Responsibilities 13
4.5.1 Project Manager 13
4.5.2 Site Hydrogeologist or Geochemist 13
4.5.3 Site Geologist 14
4.6 Equipment 14
4.7 Procedure 15
4.7.1 General 15
4.7.2 Sampling Approach 15
4.7.3 Records 18
4.7.4 Chain-of-Custody 18
4.8 Attachments 18

1.0 DECONTAMINATION OF SAMPLING EQUIPMENT

Procedure No.: FP 1 Revision Date: August 2020

Project: Base Kodiak Post-Closure Monitoring

1.1 Purpose

The purpose of this procedure is to provide reference information on the proper decontamination of sampling equipment used to perform field investigations.

1.2 Scope

This procedure addresses decontamination of sampling equipment. Personnel decontamination guidelines are presented in the project-specific work plan.

1.3 Requirements

To ensure that chemical analysis results are reflective of the actual concentrations present at sampling locations, equipment used in sampling activities must be properly cleaned and decontaminated. This will minimize the potential for cross-contamination between sampling locations and the transfer of contamination offsite.

1.4 Definitions

Deionized Water - Volatile-free, ion-free, and organic-free water.

Detergent - Standard brand of non-phosphate, laboratory-grade detergent such as Alconox or Liquinox.

Tap or Potable Water - Water from an approved municipal water treatment system.

1.5 Responsibilities

1.5.1 Project Manager

The Project Manager is responsible for ensuring that decontamination procedures for all chemical sampling and field analytical equipment are programmed prior to the actual field effort and that personnel required to accomplish the task have been briefed and trained to execute the task.

1.5.2 Field Operations Leader

The Field Operations Leader is responsible for ensuring that project-specific plans and the implementation of field investigations are in compliance with this procedure.

1.6 Equipment

1. Disposable Nitrile or Equivalent Gloves
2. Laboratory-Grade, Non-Phosphate Detergent
3. Deionized Water

4. Scrub Brushes
5. Five- to 10-gallon Stainless Steel or Plastic Buckets

1.7 Procedure

1.7.1 Decontamination

Prior to the collection of samples, the equipment used to collect water, soil, sediment, and other samples will be decontaminated as follows:

- Wash and scrub with laboratory-grade, non-phosphate detergent (Alconox or Liquinox)
- Rinse with deionized water
- Air dry

NOTE: Disposal of all wastes generated during the field activities is described in the project-specific work plan.

1.7.2 Requirements and Limitations

1.7.2.1 Sampling Pumps

Most sampling pumps are normally low volume pumps (less than two gpm). These include various types of positive displacement pumps. Pumps that allow air or other gases to come in contact with the sample will not be used. If pumps are used for sampling more than one sampling point, they must be decontaminated between sample locations.

The procedures to be used for decontamination of sampling pumps are generally the same as those described in Section 1.7.1. Each of the liquid fractions is to be pumped through the system. The amount of pumping is dependent upon the size of the pump and the length of the intake and discharge hoses.

1.7.2.2 Filtering Equipment

One aspect of the sampling plan may involve the filtering of groundwater samples and subsequent preservation. Filtering, if required, will be done in the field as soon as the sample is obtained. The sample will be preserved immediately after filtration. Three basic filtration systems are most commonly used: the in-line disposal filter, the inert gas over-pressure filtration system, and the vacuum filtration system.

For the in-line filter, decontamination is not required since the filter cartridge is disposable; however, the cartridge must be disposed of in an approved receptacle, and the intake and discharge lines must still be decontaminated.

For the over-pressure and vacuum filtration systems, the portions of the apparatus which come in contact with the sample must be decontaminated depending on the analyses to be performed.

1.7.2.3 Water Level Indicators

The method for decontaminating water level indicators is as follows:

- Wash and scrub with laboratory-grade, non-phosphate detergent (Alconox or Liquinox)
- Rinse with deionized water
- Air dry or blot dry with a paper towel

Additional steps such as methanol rinsing and/or scrubbing are acceptable. If FS-6 or other heavy oils are present, the following decontamination procedure should be followed:

- Rinse with JP-5 to cut FS-6 or heavy oil (containerize all waste)
- Blot dry with paper towel
- Wash and scrub with laboratory-grade, non-phosphate detergent (Alconox or Liquinox)
- Rinse with deionized water
- Rinse with pesticide-grade methanol or isopropanol
- Rinse with pesticide-grade hexane (if analysis for pesticides is part of sampling plan)
- Rinse with deionized water
- Air dry

1.7.2.4 Probes

Probes (e.g., pH or specific ion electrodes, geophysical probes, multi-parameter probes, or thermometers) that come in direct contact with the sample will be decontaminated using the procedure described in Section 1.7.1. For probes which make no direct contact (e.g., OVA equipment) the probe will be wiped with a clean paper towel or cloth.

1.7.3 Quality Control Procedures for Decontamination

The effectiveness of field cleaning procedures shall be monitored by following quality assurance/quality control procedures outlined in the project-specific work plan.

This page intentionally blank

2.0 WELL DEVELOPMENT

Procedure No.: FP 2 Revision Date: August 2020

Project: Base Kodiak Post-Closure Monitoring

2.1 Purpose

The purpose of this procedure is to define the requirements for developing monitoring wells to increase permeability, remove fines, and ensure that a representative sample of groundwater is obtained from the aquifer.

2.2 Scope

This procedure applies to development of wells by either the bailing or pumping techniques. The development water will be stored in appropriate containers, analyzed, and handled in accordance with the project-specific work plan.

2.3 Requirements

The selection of the well development method shall be made by a hydrogeologist and is based on the drilling methods, well construction and installation details, and the characteristics of the formation in which the well is screened. Any equipment introduced into the well during development shall be decontaminated in accordance with Field Procedure FP 1.

Each monitoring well will be developed by bailing or pumping. Centrifugal pumps will generally be used to develop shallow wells with high yield. Submersible or positive displacement pumps will generally be used to develop deep wells of low to high yield. Equipment availability or other circumstances may occasion the use of a submersible or positive displacement pump to develop a shallow high-yield well or hand pumps and bailers to develop any well. Physical and chemical parameters including temperature, pH, specific conductance, and turbidity of the water will be measured during well development.

2.4 Definitions

Surging - Surging is a process in which a plunger-type device called a surge plunger or surge block is moved up and down within the well screen to force groundwater to alternately flow in and out through the sand pack. This back and forth movement of water facilitates removal of fines from the formation immediately adjacent to the well while preventing bridging (wedging) of sand grains.

2.5 Responsibilities

2.5.1 Field Operations Leader

The Field Operations Leader is responsible for ensuring that field personnel have been trained in the use of this procedure and for verifying that well development activities are performed in compliance with the contract.

2.5.2 Field Geologist

The Field Geologist is responsible for withdrawing sufficient water to clarify the well, and for performing physical measurements such as pH, temperature, specific conductance, and turbidity to ensure proper development. All data should be entered on the Well Development Log (Permit Attachment 4A, Appendix A).

2.6 Equipment

1. Pump
2. Pump Suction Line
3. Surging Equipment (as necessary)
4. Bailer
5. Bailer Line
6. Steel Retractable Engineer's Measuring Tape
7. Water Level Indicator
8. Water Quality Meter(s) (temperature, ph, specific conductance, and turbidity)
9. Drums or Mobile Tanks to Contain the Development Water
10. Field Logbook
11. Well Development Log

2.7 Procedure

2.7.1 Development

Development of wells will begin between 24 hours and seven days after installation. Water level will be measured initially and at the end of development. The next water level measurement is preferably recorded 24 hours later; however, it may be longer. The water level will be measured prior to purging and initial sampling, which generally occurs within a few days of well development. The development procedure includes:

- Open and check the condition of the well head. Check for organic vapors.
- Measure the water level in the well before development begins. Record the value to the nearest 0.01 foot on the Well Development Log.
- Measure the total depth of the well prior to development. Record the value to the nearest 0.01 foot on the Well Development Log.
- Prepare the equipment for developing the well. For screened intervals longer than 10 feet, develop the well in two to 3-foot intervals from bottom to top.
- Continue development until water appears to run clear or the turbidity stabilizes. A minimum of five well volumes plus three times any water used during the well installation shall be removed.
- After most of the sediment appears to have been removed from the well begin collecting samples for measurements of pH, temperature, specific conductance, and turbidity. Samples should be collected at intervals of at least one well casing volume.

- Development will be considered complete when:
  - three consecutive measurements of pH, temperature, and specific conductance are within 10 percent of each other, or
  - the well is purged dry.
- Should the recharge be so slow that the required volume cannot be removed in 24 hours, the water remains discolored, or excess sediment remains after the well pumps dry; contact the Field Operations Leader for guidance.
- Measure the total depth of the well after development. Record the value to the nearest 0.01 foot in the Well Development Log.
- The record of well development shall be submitted to the Field Operations Leader for QA/QC review and submittal to data management.

2.7.2 Groundwater Sampling

A pump or bailer will be lowered into the well. Water will be removed from the well at varying depths along the entire interval of the screen until the effluent begins to clear of suspended solids. A sample of the development water will be tested for turbidity, pH, temperature, and specific conductance. Measurement will be taken with an appropriate water quality meter calibrated in accordance with the manufacturer's instructions.

2.7.3 Surging

- A surge plunger (also called a surge block or swab) is approximately the same diameter as the well casing and is used to agitate the water.
- In formations with a low yield, a solid plunger is the most effective.
- In formations with a high yield, a valved surge plunger may be preferred, as they are designed to create greater inflow than outflow during surging.

2.8 Attachments

Well Development Form is located in Permit Attachment 4A, Appendix A.

This page intentionally blank

3.0 WELL PURGING

Procedure No.: FP 3 Revision Date: August 2020

Project: Base Kodiak Post-Closure Monitoring

3.1 Purpose

The purpose of this procedure is to provide general reference information on well purging techniques prior to the sampling of groundwater wells. The methods and equipment described are for the purging of water samples from the saturated zone of the substrata.

3.2 Scope

This procedure applies to purging water from relatively low volume wells. The site hydrogeologist, geochemist, and risk assessment personnel shall define the objective of the groundwater sampling program in the project-specific work plan.

3.3 Requirements

Methods for purging from completed wells include the use of pumps, bailers, and various types of samplers. The primary considerations in obtaining a representative sample of the groundwater are to avoid collection of stagnant (standing) water in the well and to avoid physical or chemical alteration of the water due to purging and sampling techniques. In a non-pumping well, there will be little or no vertical mixing of water in the well pipe or casing, and stratification will occur. The well water in the screened section will mix with the groundwater due to normal flow patterns, but the well water above the screened section will remain isolated and become stagnant.

3.4 Definitions

Bailer - A cylindrical section of polyethylene or Teflon® with a floating ball check-valve at the bottom. The bailer is submerged, the ball floats, and water enters from the bottom. As the bailer is raised, the ball settles on the bottom creating a seal, allowing retrieval of a quantity of trapped water.

Purge - An action that removes water from a well, commonly accomplished using a pump or bailer.

Surge - An action causing water to move rapidly in and out of the well screen thereby removing fine material from the surrounding aquifer.

3.5 Responsibilities

3.5.1 Project Manager

The Project Manager is responsible for reviewing the purging procedures used by the field crew and for performing in-field spot checks for proper purging procedures.

3.5.2 Site Hydrogeologist or Geochemist

The Site Hydrogeologist or Geochemist is responsible for selecting and detailing the specific well purging techniques and equipment to be used, documenting these in the Field Logbook, and properly briefing the site sampling personnel.

3.5.3 Site Geologist

The Site Geologist is primarily responsible for the proper well purging techniques. When appropriate, such responsibilities may be performed by other qualified personnel (engineers, field technicians). The Site Geologist will be responsible for purging of wells, performing necessary physical measurements and observations, and containment of purged water. The Site Geologist must record pertinent information including amount of water purged, pH, specific conductivity, redox potential, dissolved oxygen, temperature, and turbidity on the Groundwater Sampling Form, provided in Permit Attachment 4A, Appendix A.

3.6 Equipment

1. Teflon® tubing (or Teflon® lined tubing)
2. Pump
3. Graduated cylinder
4. Steel Retractable Engineer's Measuring Tape (Calibrated to 0.01 Foot)
5. Water Level Indicators
6. Swabbing Equipment (as necessary)
7. Water Quality Meter(s) (Temperature, pH, Specific Conductance, Turbidity, Dissolved Oxygen, and Oxidation-Reduction Potential)
8. Drums and Buckets to Contain the Purge Water
9. Groundwater Sampling Form
10. Field Logbook
11. Calculator

3.7 Procedure

3.7.1 General

The intention of well purging prior to sampling is to produce a sample representative of actual groundwater conditions. Stagnant water is removed from the monitoring well, causing it to be replaced by groundwater from the adjacent formation.

3.7.2 Calculations of Well Volume

To ensure that the proper volume of water has been removed from the well prior to sampling, it is first necessary to determine the volume of standing water in the well pipe. The volume can be easily calculated, and the calculations shall be entered on the Groundwater Sample Form:

1. Obtain information on well construction (location, casing, screens, etc.).
2. Determine well casing diameter.

3. Measure and record static water level (depth below ground level or top of casing reference point), using a decontaminated water level indicator.
4. Determine depth of well by sounding, using a clean, decontaminated weighted tape measure or water level indicator.
5. Calculate number of linear feet of static water (total depth or length of well pipe minus the depth to static water level).
6. Calculate the volume of water in the casing by one of the following methods.
   a.

$$V_c = \pi \left(\frac{d_i}{2}\right) 2(TD - H)$$
$$V_t = V_c \times 7.48$$

   Where:
   V_c = Volume of water in casing (cubic feet)
   V_t = Total volume (gallons)
   d_i = Inside diameter of casing (feet)
   TD = total depth of well (feet below top of casing)
   H = depth to water (feet below top of casing)
   b.
   For a 2-inch inside diameter well, multiply the well casing water column (TD-H), measured in feet, by 0.17 to obtain the well volume in gallons.
7. Determine the minimum number of gallons to be evacuated before sampling.

3.7.3 Specific Procedure for Well Purging

- Work crew members must use either new disposable gloves or decontaminated reusable gloves.
- If the relative degrees of contamination between wells is unknown or insignificant, a sampling sequence which facilitates sampling logistics may be followed. Where some wells are known or strongly suspected of being highly contaminated, these should be sampled last to reduce the risk of cross-contamination between wells.
- Using a water level indicator, measure the "depth to water" in the well from the top of the well casing.
- Calculate the volume of water in the well. Record this information on the groundwater sample form and calculate the volume of water required to be purged. Normally:
  - the well will be purged of three volumes of water, or
  - water quality parameters will be monitored until a minimum of three (minimum of four if using temperature as an indicator) of the parameters listed below stabilize, or
  - for low yield wells, the entire well casing is evacuated.
- All water quality parameters, except for turbidity, must be obtained using a flow- through-cell and turbidity measurements must be obtained before the water enters the flow-through-cell. Field parameter measurements will be recorded on a groundwater monitoring form.
- Monitoring wells will be purged using low-flow techniques, with the goal of minimum drawdown (< 0.3 feet) during purging. Measure the water level at each interval that the water

quality field parameters are measured and recorded on the groundwater monitoring form. Flow rate must be between 50 and 500 milliliters per minute.

- Water quality parameters are considered stable when three successive readings, collected 3 to 5 minutes apart, are within:
  - ± the lesser of 0.2°C or 3 percent (%) for temperature,
  - ± 0.1 for pH,
  - ± 3% for conductivity,
  - ± 10 mV for redox potential,
  - ± 10% for dissolved oxygen, and
  - ≤ 5 NTU or ± 10% for turbidity.
- A minimum of three (minimum of four if using temperature as an indicator) of these parameters must be monitored and recorded. Additional parameters may be measured as specified in the project-specific work plan. Record the field parameters on the Groundwater Sampling Form.
- If a low yield well purges dry, do not collect a sample until it has recharged to approximately 80% of its pre-purge volume.
- Record the total volume of water removed on the Groundwater Sampling Form.
- In general, chemical samples will be collected in accordance with FP 4 immediately after purging is complete.
- Whenever the receptor drum has become filled, the water shall be stored, analyzed, and disposed of in accordance with the project-specific work plan.
- If reusable equipment is used, decontaminate the equipment in accordance with FP 1 after purging and sampling are complete.

3.8 Attachments

Groundwater Sampling Form is located in Permit Attachment 4A, Appendix A.

4.0 GROUNDWATER SAMPLING

Procedure No.: FP 4 Revision Date: August 2020

Project: Base Kodiak Post-Closure Monitoring

4.1 Purpose

The purpose of this procedure is to obtain groundwater samples that are representative of the source from which they are taken and minimize sampler exposure to groundwater contaminants. The methods and equipment described are for the collection of water samples from the saturated zone of the substrata.

4.2 Scope

This procedure provides information on proper equipment and techniques for groundwater sampling. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described should be followed whenever applicable, noting that site-specific conditions and the project-specific work plan may require adjustments in methodology.

4.3 Requirements

Generally, wells should be sampled within three hours of purging. However, wells with poor recharge should be sampled within 24 hours of purging. If a well is low yield and purged dry, a sample should not be collected until it has recharged 80% of its pre-purge volume, when practical.

Many analytes require a preservative. Typically, the appropriate preservatives are already in the sample containers provided by the laboratory. Care should be taken while sampling to not spill the preservative or to overfill the sample container. All reusable sampling equipment must be decontaminated in accordance with Field Procedure FP 1, Decontamination of Sampling Equipment, before commencement of sampling.

4.4 Definitions

None.

4.5 Responsibilities

4.5.1 Project Manager

The Project manager is responsible for reviewing the sampling procedures used by the field crew and for performing in-field spot checks for proper sampling procedures.

4.5.2 Site Hydrogeologist or Geochemist

The Site Hydrogeologist or Geochemist is responsible for selecting and detailing the specific groundwater sampling techniques and equipment to be used, documenting these in the project-specific work plan, and properly briefing the site personnel.

4.5.3 Site Geologist

The Site Geologist is primarily responsible for the proper acquisition of the groundwater samples. When appropriate, such responsibilities may be performed by other qualified personnel (engineers, field technicians).

4.6 Equipment

Sample containers shall conform with EPA regulations for preservation of appropriate contaminants (see the project-specific work plan). Ideally, sample withdrawal equipment should be completely inert, economical, easily decontaminated or disposable, easily sterilized, able to operate at remote sites in the absence of power sources, and capable of delivering variable rates for well purging and sample collection. The following pieces of equipment may be needed to collect groundwater samples:

1. Sample Containers
2. Coolers for Sample Shipping and Cooling
3. Chemical Preservatives
4. Ice Packs or Ice
5. Appropriate Packing Cartons and Filler
6. Labels
7. Chain-of-Custody Documents
8. Water quality meter, such as a YSI or similar, equipped with a flow-through cell
9. Appropriate Keys (for Locked Wells)
10. Tape Measure
11. Water-Level Indicator
12. Appropriate Sampling Gloves
13. Field Sampling Logbooks
14. Groundwater Sampling Form
15. Scissors
16. Plastic Trash Bags
17. Indelible Marking Pens
18. Black, Permanent Ink Pens
19. Shallow-Well Pumps (centrifugal, bladder, positive displacement or peristaltic pumps where applicable)
20. Deep-Well Pumps (submersible pump and electrical power generating unit or bladder pump with compressed air source, where applicable)
21. Sample Tubing Such as Teflon®, Polyethylene and Polypropylene (tubing type shall be selected based on specific site requirements and must be chemically inert to groundwater being sampled)
22. Decontamination Supplies

4.7 Procedure

4.7.1 General

To be useful and accurate, a groundwater sample must be representative of the particular saturated zone of the substrata being sampled. The physical, chemical, and/or bacteriological integrity of the sample must be maintained from the time of sampling to the time of testing in order to keep any changes in water quality parameters to a minimum.

Purging wells prior to sampling includes the use of pumps, Teflon® tubing and a flow through cell. The procedure is described in FP 3 and will be used for purging wells prior to sampling. Purging is not required when sampling private supply wells. Water produced during purging shall be collected, stored, or treated and discharged as indicated in the project-specific work plan.

Stratification of contaminants may exist in the aquifer formation, either in terms of concentration gradients as a result of mixing and dispersion processes in a homogeneous layer, or due to layers of variable permeability into which a greater or lesser amount of the contaminant plume has flowed. Excessive pumping can dilute or increase the contaminant concentrations in the recovered sample compared to what is representative of the integrated water column at that point. This can result in the collection of a non-representative sample.

4.7.2 Sampling Approach

The sampling approach consisting of the following, is developed in the project-specific work plan and includes:

1. Background and objectives of sampling.
2. Brief description of area and waste characterization.
3. Identification of sampling locations, with map or sketch, and applicable well construction data (well size, depth, screened interval, reference elevation).
4. Sampling equipment to be used.
5. Assigned number, sequence, volumes, and types of samples. If the relative degrees of contamination between wells is unknown or insignificant, a sampling sequence which facilitates sampling logistics may be followed. Where some wells are known or strongly suspected of being highly contaminated, these should be sampled last to reduce the risk of cross-contamination between wells as a result of the sampling procedures.
6. Sample preservation requirements.
7. Working Schedule.

4.7.2.1 Sampling Methods

The collection of a groundwater sample is made up of the following steps.

1. Purge the well following the appropriate procedure (FP 3 Well Purging).
2. Fill out sample labels for each of the required sample containers and place labels onto the appropriate sample containers. The following information must be included on the sample label:
    a. site name
    b. sample number
    c. date and time of sample collection

d. printed initials of the sampler
e. sample preservative used
f. types of analyses to be performed.

If a sample is split with another party, sample labels with identical information should be attached to each of the sample containers.

3. When samples are collected for laboratory analysis, any device used to collect additional information, such as a flow-through cell, must be removed from the sample train before sampling. During laboratory analytical sample collection, do not use constricting devices on the sample tubing to reduce the flow rate because the constrictor will cause a pressure difference in the water column and a loss of VOCs and dissolved gasses. To ensure that groundwater samples are representative of actual conditions, samplers must work efficiently to minimize the loss of groundwater contaminants and the introduction of foreign contaminants. To prevent contamination of samples, the sample bottles should be opened only when receiving sample preservatives or groundwater samples and closed immediately afterwards. Sample bottles or other potentially contaminating objects should be held away from the well opening to prevent introduction of foreign contaminants into the well.

   Sample the wells least likely to be contaminated first. Collect water quality parameters and samples in the following order:

   a. In-field water quality measurements,
   b. Volatile organic compounds,
   c. Semi-volatile organic compounds,
   d. TOC,
   e. TOX,
   f. Total metals, and
   g. Dissolved metals.

   The sampler should quickly add the sample into the sample containers, while minimizing aeration and loss of volatile contaminants. When a sample bottle is filled, the bottle must be tightly capped as soon as possible.

4. Efficiency and care must be utilized to obtain representative samples for volatile organic analysis. Unnecessary delays or poor sampling technique will lead to loss of the volatile constituents from the sample. Prevent unnecessary stripping of volatile constituents from the sample by minimizing turbulence and aeration when extracting water from the well through the tubing and filling the sample container. Quickly fill the sample container until a positive meniscus is achieved above the rim of the container and cap the container immediately. Gently tap the sample container to dislodge any air bubbles and verify that no bubbles are present. If bubbles are detected, immediately uncap the sample, add additional sample from the tubing until a positive meniscus is re-established, immediately recap the sample and check the sample for bubbles. After the sample container has been opened twice, the sampling process must start over with a new sampling container. Repeat this step until the volatile organics sample contains no bubbles and all required samples are obtained.
5. Water samples should typically not be filtered prior to analysis. If filtering is approved by ADEC in a site-specific work plan, both filtered and non-filtered samples will need to be collected and

analyzed so the effects (bias) of the filtering process on the contaminant concentrations can be evaluated.

6. After sample collection, promptly place the samples in a chilled cooler. Samples that will be stored overnight prior to shipping should be kept at between 0 and 6 degrees Celsius.
7. Record all sampling information on the Groundwater Sampling Form.
8. Decontaminate all reusable sample equipment.
9. Prepare the samples for shipment in accordance with procedures specified in the Quality Assurance Project Plan (QAPP; Permit Attachment 4A, Appendix B).

4.7.2.2 Collection of Split Samples or Field Duplicates

Whenever field duplicates are collected or samples are split with another organization the additional samples for identical analyses will be collected along with the original sample (i.e., containers for all volatile organic analyses will be filled first and together, all semi-volatiles together and in proper sequence, and so forth until all sample parameters are in the proper containers).

4.7.2.3 Sample Containers, Preservation, and Volume Requirements

Sample container materials, preservation techniques, and volume requirements depend on the type and concentration of the contaminant and on the type of analysis to be performed. The project-specific work plan describes the sample container, preservation, and volume requirements for the targeted analytes.

4.7.2.4 Field Filtration

If field filtering is required by the analytical method, it must be approved by ADEC in the site-specific work plan. The recommended method is through the use of a disposable in-line filtration module (2.0 micron filter for metals and 0.30 micron filter for gross alpha/gross beta) using the pressure provided by the pumping device for its operation. Filters must be certified as "clean." Both filtered and non-filtered samples will need to be collected and analyzed so the effects (bias) of the filtering process on the contaminant concentrations can be evaluated.

Samples for organic analyses must never be filtered.

4.7.2.5 Handling and Transporting Samples

After collection, samples should be handled as little as possible. It is preferable to use self-contained "chemical" ice (e.g., "gel ice") to reduce the risk of contamination. All sample containers should be enclosed in plastic bags or cans to prevent cross-contamination.

Samples should be secured in the cooler to prevent movement of sample containers and possible breakage. Sample packing and transportation requirements are described in the QAPP (Permit Attachment 4A, Appendix B) and requirements for chilling samples are described in the project-specific work plan.

4.7.2.6 Sample Holding Times

Holding times, allowed time between sample collection and analysis for routine samples, are given in the project-specific work plan.

4.7.3 Records

Records will be maintained for each sample that is taken. The Groundwater Sampling Form (Permit Attachment 4A, Appendix A) will be used to record the following information:

- Sample identification (site name, location, project number; sample name/number and location; sample type and matrix; time and date; sampler's identity).
- Sample source.
- Field observations and measurements (appearance; field chemistry; sampling method).
- Sample disposition (analyses to be run and preservatives added).
- Additional remarks (e.g., sampled in conjunction with state, county, local regulatory authorities; samples for specific conductance value only; sampled for key indicator; etc.).

4.7.4 Chain-of-Custody

Proper chain-of-custody procedures play a crucial role in data gathering. The requirements for a correct chain-of-custody are specified in the QAPP (Permit Attachment 4A, Appendix B).

4.8 Attachments

Groundwater Sampling Form is located in Permit Attachment 4A, Appendix A.

Draft
Exhibit 7
Vapor Intrusion Monitoring Plan

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 INTRODUCTION **1**

1.1 Site Location and Description 1
1.2 Vapor Monitoring History 1
1.3 Regulatory Framework 3
1.4 Indoor/Crawlspace Air Screening Levels 3
1.5 Indoor/Crawlspace Air Sampling Method Selection 7

2.0 INDOOR/CRAWLSPACE AIR SAMPLING **9**

2.1 Sampling Schedule 9
2.2 Sampling Locations 9
2.3 Sampling Procedures 9

3.0 VAPOR INTRUSION MITIGATION SYSTEM OPERATIONS AND MAINTENANCE **11**

3.1 Quarterly VIMS Inspections 11
3.2 Air Flow/Differential Pressure Measurements 11
3.2.1 Air Flow 11
3.2.2 Differential Pressure 11

4.0 SAMPLE CUSTODY, PACKAGING, AND SHIPMENT **13**

4.1 Analytical Methods and Sample Containers 13
4.2 Labeling Requirements 13
4.3 Chain-of-Custody and Shipping 13
4.4 Field Quality Control Samples 14

5.0 QUALITY ASSURANCE **15**

5.1 Data Entry and Management 15
5.2 Data Reduction, Validation, and Reporting 16
5.3 Internal Quality Control Checks 16
5.4 Data Quality Indicators 16
5.5 Corrective Action 16
5.6 Performance and System Audits 17
5.7 Quality Assurance Reports to Management 17
5.8 Data Entry and Management 17

6.0 REFERENCES **19**

TABLE OF CONTENTS (CONTINUED)

TABLES

Table 1 Site 3 Indoor/Crawlspace Air Screening Levels 5
Table 2 Sampling Locations and Analyses 9
Table 3 Required Analyses 13
Table 4 Field QC Summary 14
Table 5 Measurement Performance Criteria – Volatiles 15

FIGURES

Figure 1 Galley/Pizza Parlor Air Flow Measurements
Figure 2 Barracks 1 Air Flow Measurements
Figure 3 Vapor Monitoring Sample Locations

ATTACHMENTS

Attachment 1 Standard Operating Procedures
Attachment 2 Relevant Quality Assurance Project Plan Worksheets
Attachment 3 Laboratory Accreditations

ACRONYMS AND ABBREVIATIONS

µg/m^3	micrograms per cubic meter
ADEC	Alaska Department of Environmental Conservation
Ahtna	Ahtna Environmental, Inc.
ATSDR	Agency for Toxic Substances and Disease Registry
Beacon	Beacon Environmental Services, Inc.
CoC	chain-of-custody
COC	contaminant of concern
DoD	U.S. Department of Defense
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
GAC	granular activated carbon
HWMU	Hazardous Waste Management Unit
ID	identification
LCS	laboratory control samples
LOD	laboratory control samples
LOQ	limit of quantitation
MRL	minimum risk level
MS	matrix spike
MSD	matrix spike duplicate
MWR	Morale, Welfare, and Recreation
NA	not applicable
NEFAP	TNI National Environmental Field Activities Program
NELAP	National Environmental Laboratory Accreditation Program
OSWER	Office of Solid Waste and Emergency Response
PCE	tetrachloroethene
Phase III	remediation pilot study
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SOP	standard operating procedure
TCE	trichloroethene
TNI	the NELAC Institute
USCG	U.S. Coast Guard
VI	vapor intrusion
VIMS	vapor intrusion mitigation system
VISL	vapor intrusion screening level
VOC	volatile organic compound

This page intentionally blank

1.0 INTRODUCTION

This work plan has been prepared for the U.S. Coast Guard (USCG) at the USCG Base Kodiak, Alaska, Site 3. The objective of this work plan is to outline the procedures and methods for performing (1) annual indoor and crawlspace air sampling and (2) quarterly inspections of the existing vapor intrusion mitigation systems (VIMS) at three buildings at Site 3 – the Galley/Pizza Parlor, Barracks 1, and the Morale, Welfare, and Recreation (MWR) Boathouse.

1.1 Site Location and Description

Site 3 is located on the Nyman Peninsula, south of the tarmac at Base Kodiak and near the recreation center, approximately 300 feet southeast of Inner Womens Bay. The former laundry is an 8,800-square-foot, one-story building with a subgrade crawl space beneath the floor of the northern portion of the building. The floor construction in the southern portion of the building is concrete slab on grade. The laundry was closed in 1999 and the facility is currently used as the MWR Boathouse. The building is currently used to store and maintain boats and recreational gear that base personnel can rent. The area is accessible by car and is located at the intersection of Windrider Drive and Boathouse Drive.

Land use in the area is varied and includes paved parking areas, two paved rights-of-way, vegetated ground, storage areas, an AS/SVE remediation system, and the base galley and barracks.

1.2 Vapor Monitoring History

In October 2007, as part of a supplemental site characterization, indoor air samples were collected and analyzed from the basements of Barracks 1 and the Pizza Parlor/ Galley. Tetrachloroethene (PCE) and trichloroethene (TCE) were detected in the samples collected from both buildings. In April and May 2008, subsequent indoor air sampling confirmed the presence of these compounds as well as 1,2-dichloroethane, benzene, cis-1,2-dichloroethene, and vinyl chloride. In May 2008, air samples were collected from nine nearby buildings, a transformer vault, and several outdoor locations. Elevated levels of volatile organic compounds (VOCs) were found in seven buildings and the transformer vault (HDR 2008).

Vapor sample analytical results were initially compared with Agency for Toxic Substances and Disease Registry (ATSDR) minimum risk levels (MRLs) and with screening criteria established by the U.S. Environmental Protection Agency's (EPA) *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* dated November 2002. Vapor sample analytical results were further screened against calculated site-specific screening concentrations for compounds that exceeded initial screening. The conclusions of this study were:

- Contaminants of concern (COCs) were not detected in occupied spaces at the Billiken Theater, the PAC building, or the Recreation Center. Contaminants of concern were also not detected in the transformer vault, the Billiken Theater steam utilidor, or the Recreation Center mechanical room, indicating that vapor intrusion (VI) is not occurring through these spaces.
- COCs were detected in the Barracks at concentrations above the site-specific comparison values for residents.
- COCs were detected in the Galley, Pizza Parlor, and MWR Boathouse above site-specific comparison values for workers and patrons.

- COCs were detected in the MWR Boathouse and Pizza Parlor crawl spaces and in the Galley and Barracks mechanical rooms, indicating that VI is occurring in these spaces. Concentrations were below comparison values for industrial workers.

In 2008, VIMSs were installed at Barracks 1, the Pizza Parlor/Galley, and the MWR Boathouse at Site 3. The purpose of the VIMS is to prevent contaminant vapors from migrating into the occupied/occupiable spaces of the buildings at concentrations above target levels. The VIMSs consist of ventilation and vapor barrier components. The ventilation component consists of ducting and blowers installed to create a negative pressure in the crawlspaces/mechanical rooms with respect to the occupied spaces of buildings. Air extracted from the crawlspaces/mechanical rooms is exhausted through granular activated carbon (GAC) filters prior to discharge to the atmosphere (Northwind, Inc. 2009).To compliment the ventilation component of the VIMS, vapor barriers in the crawlspaces/mechanical rooms of these buildings were installed and floor penetrations were sealed.

Subsequent to the VIMS installations, indoor and crawlspace air sampling for Site 3 volatile COCs (Table 1) was conducted at the Barracks 1, Barracks 2, Pizza Parlor/Galley, and MWR Boathouse in 2009, 2014, and 2015. Air sample results were compared to Alaska Department of Environmental Conservation (ADEC) guidance target levels (ADEC 2017a) and TCE results were compared to the short-term targets discussed in the EPA Region 10 memorandum (EPA 2012). In general, contaminant concentrations were either non-detect or below the applicable target level. The exception was the Galley Mechanical Room where TCE concentrations consistently exceeded the 3-week average for women of child-bearing age target level of 8.4 micrograms per cubic meter ($\mu g/m^3$).

A remediation pilot study (Phase III) was implemented during and after utility upgrade work in 2016; it included removing contaminated soil using large-diameter auger techniques for offsite disposal, and backfilling many of the boreholes with amended sand (Ahtna Environmental, Inc. [Ahtna] 2019). The amended sand contained Daramend (a product consisting of inorganic carbon particles and zero valent iron particles, from Peroxychem) and was intended to act as a partial, permeable, reactive barrier to create reducing conditions in groundwater. The induced reducing conditions are anticipated to degrade chloroethenes in the upgradient groundwater plume as groundwater flows through the treatment zone. The Phase III activities included evaluations of treatment effectiveness.

Vapor monitoring in the Barracks, Galley, Pizza Parlor, and ambient outside air was performed weekly in October 2016 during the Phase III excavation efforts to monitor for potential VI impacts during Phase III activities. The first sampling event was approximately 1 week after excavation activities started and continued for 3 weeks.

The weekly vapor sampling conducted during the Phase III field activities showed results that differed from previous vapor data collected from the sample locations. Higher contaminant concentrations were seen in the Pizza Parlor crawlspace than in previous sampling events. The higher concentrations in this location exceeded the concentrations in the ambient air sample collected at a location that was closer to the excavation and, therefore, were not likely the result of the Phase III activities. It is possible that the higher concentrations were a result of seasonal fluctuation in vapor concentrations.

Contaminants were also detected in indoor air in Barracks 1 and 2, which differed from previous sampling events where they were not detected. The magnitude of the concentrations (0.26 to 12 $\mu g/m^3$ for PCE and non-detect to 0.46 $\mu g/m^3$ for TCE), and the fact that the outdoor ambient air sample had similar concentrations (non-detect to 32 $\mu g/m^3$ for PCE and non-detect to 1.3 $\mu g/m^3$ for TCE), suggests that these indoor air detections were the result of Phase III construction activities. The concentrations were below

ADEC indoor air target levels and were expected to reduce to non-detectable concentrations once the Phase III activities were completed.

In February and October 2020, indoor/crawlspace air samples were collected via 24-hour SUMMA canister samples. In February 2020, PCE was detected above the ADEC commercial target level in all samples collected in the Boathouse. Measured PCE concentrations were 81 µg/m^3 (retail area), 160 µg/m^3 (main floor shop area), and 150 µg/m^3 (crawlspace). No other analytes were detected above commercial target levels. It is uncertain if the PCE concentrations measured in Boathouse samples are attributable to VI or if indoor/background sources contributed to the detections. The results of the October 2020 sampling event were not available at the time this work plan was published.

1.3 Regulatory Framework

Site 3 is a Hazardous Waste Management Unit (HWMU) regulated under Base Kodiak Resource Conservation and Recovery Act (RCRA) Permit AK9690330742, administered by EPA Region 10. The site was closed as an HWMU in 1994 and is subject to post-closure inspections, groundwater monitoring, and corrective action. The post-closure period began in 1995 and will continue for a minimum of 30 years (to 2025). The RCRA Permit was issued February 2011 and was last revised in October 2019.

ADEC also has jurisdiction over Site 3 as a contaminated site to ensure that there are not unacceptable exposures to human health and the environment. The process of reporting a spill and conducting a cleanup is governed by Title 18 of Alaska Administrative Code of regulations, Chapter 75. The RCRA Permit requires Site 3 to be managed in accordance with all applicable state regulatory standards.

The VI regulatory framework includes:

- *Vapor Intrusion Guidance for Contaminated Sites* (ADEC 2017a)
- *Additional Information about Exposure to TCE* (ADEC 2017b)
- Office of Solid Waste and Emergency Response *(OSWER) Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (EPA 2015)
- EPA Region 10 *Office of Environmental Assessment, Recommendations Regarding Trichloroethylene Toxicity in Human Health Risk Assessments* (EPA 2012).

1.4 Indoor/Crawlspace Air Screening Levels

Air sample results collected from Site 3 will be compared to target levels from Appendix D of the 2017 ADEC VI Guidance (ADEC 2017a) shown in Table 1. In general, ADEC's target levels are based on a carcinogenic target risk of 10^{-5} or a non-cancer hazard index of 1, whichever is more stringent. Some of ADEC's target levels (e.g., PCE) are based on the ATSDR MRLs (ADEC 2017a).

Indoor air results from the Barracks 1 are compared to residential target levels. Indoor air results from the Boat House, Galley, and Pizza Parlor are compared to commercial target levels. Crawlspace air results are evaluated against target levels, but not directly compared to target levels for the following reasons:

- Crawlspace samples have a corresponding indoor air sample in the overlying occupied space, eliminating the need to assume a crawlspace-to-indoor air attenuation factor.
- Crawlspaces at USCG Base Kodiak are classified as confined spaces; therefore, residential or commercial occupation of the crawlspaces does not occur.

For reference, Table 1 also includes EPA Vapor Intrusion Screening Levels (VISLs) (EPA 2020) and ATSDR Inhalation MRLs (ADEC 2017a).

Table 1 Site 3 Indoor/Crawlspace Air Screening Levels

COMPOUND	FOR COMPARISON		FOR REFERENCE			
	ADEC TARGET LEVEL RESIDENTIAL INDOOR AIR[1] (µg/m³)	ADEC TARGET LEVEL COMMERCIAL INDOOR AIR[1] (µg/m³)	EPA VISL COMMERCIAL INDOOR AIR[1] (µg/m³)	ATSDR MINIMAL RISK LEVEL ACUTE INHALATION (µg/m³)	ATSDR MINIMAL RISK LEVEL INTERMEDIATE INHALATION (µg/m³)	ATSDR MINIMAL RISK LEVEL CHRONIC INHALATION (µg/m³)
PCE	41	41	175	41	41	41
TCE	2.0	2.2	8.8	NA	2.2	2.2
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	790	790	NA	790	790	NA
1,1-Dichloroethene	79	79	880	NA	79	NA
Vinyl Chloride	1.7	28	28	1,300	77	NA

Notes:

[1] ADEC target levels and EPA screening levels are based on a carcinogenic target risk of 10^{-5} or a non-cancer hazard index of 1.0, whichever is more stringent.

µg/m³ = micrograms per cubic meter
ADEC = Alaska Department of Environmental Conservation
ATSDR = Agency for Toxic Substances and Disease Registry
EPA = U.S. Environmental Protection Agency
NA = not applicable
PCE = tetrachloroethene
TCE = trichloroethene
VISL = Vapor Intrusion Screening Level (EPA 2020)

This page intentionally blank

1.5 Indoor/Crawlspace Air Sampling Method Selection

Beginning in October 2021, indoor air and crawlspace samples will be collected using long-term (approximately 30-day) passive sampling methods. Previous sampling methods employed at Site 3 during the Phase III activities (Ahtna 2019) include 24-hour samples collected using SUMMA canisters, and longer-term 30-day samples collected using Waterloo Membrane Samplers (Ahtna 2019). To determine the sampling method moving forward, USCG evaluated available sampling technologies that meet the following objectives specific to Site 3:

1. Follow EPA analytical methods.
2. Are offered by commercial laboratories accredited by the U.S. Department of Defense (DoD) and the State of Alaska.
3. Allow collection of samples for approximately 30 days. The sampling period of approximately 30 days was selected to follow EPA and ADEC guidance of a longer sample collection period to yield a more reliable basis for estimating short- and long-term time-average exposures.
4. Provide reliable quantification of the Site 3 air analytes to the screening levels presented in Table 1.

The long-term passive air sampling technology offered by Beacon Environmental Services, Inc. (Beacon) meets the four objectives outlined above. An evaluation of the Beacon technology relative to the four objectives is provided below.

Regarding the four performance criteria:

1. **Follow EPA analytical methods**: Beacon uses EPA Method TO-17 to analyze samples collected using passive devices following their Standard Operating Procedure (SOP) 7 (Attachment 1 of Exhibit 7). Relevant Unified Federal Policy worksheets (Worksheets #12, #15, #19, #21, #23, #24, #25, #26 and 27, #28, and #30) are in included in Attachment 2 of Exhibit 7 for this sampling method, device, and laboratory.
2. **Offered by commercial laboratories accredited by the DoD and the State of Utah**: Beacon's accreditations are included in Attachment 3 of Exhibit 7. Beacon has met the DoD Environmental Laboratory Accreditation Program (NELAP) and the TNI National Environmental Field Activities Program (NEFAP) requirements for this method. Beacon is an ADEC Contaminated Sites Program approved laboratory, and is also accredited to ISO/IEC 17025:2017 and DoD Quality Systems Manual version 5.3 for Environmental Laboratories.
3. **Allow collection of samples for approximately 30 days:** Beacon has demonstrated that uptake rates are linear over a 30-day duration through a third-party study.
4. **Provide reliable quantification of the Site 3 indoor air analytes to below residential screening levels**: The quantification limits for Beacon's devices are well below the Site 3 screening levels (Table 1) (Attachment 2 of Exhibit 7, Worksheet #15).

This page intentionally blank

2.0 INDOOR/CRAWLSPACE AIR SAMPLING

This section discusses the field activities for indoor/crawlspace air sampling.

2.1 Sampling Schedule

Indoor and crawlspace air samples will be collected annually from nine locations at Site 3. Annual indoor/crawlspace air sampling will coincide with regular fourth quarter RCRA monitoring event activities performed in October, which marks the beginning of the heating season.

2.2 Sampling Locations

Indoor air/crawlspace sampling locations were chosen based on the highest concentrations detected from the January 2015 and November 2016 sample results. Nine locations will be sampled, and a duplicate will be collected from one of these locations, at the discretion of the field team (typically set in the location with the highest concentration during the previous sampling event). Locations are listed in the following table and shown in Figure 3. All vapor samples will be submitted for VOC analysis via EPA Method TO-17.

Table 2 Sampling Locations and Analyses

SAMPLE ID	SAMPLE LOCATION	COLLECTION METHOD	ANALYTE / METHOD	FREQUENCY OF SAMPLES
AS-03-B10MS	Barracks 1 Squad Bay Music Room	~30-day passive-diffusion	VOCs[1]/TO-17	Annual
AS-03-GL1KT	Galley Kitchen	~30-day passive-diffusion	VOCs[1]/TO-17	Annual
AS-03-GL0MR	Galley Basement Mechanical Room	~30-day passive-diffusion	VOCs[1]/TO-17	Annual
AS-03-PP1KT	Pizza Parlor Kitchen	~30-day passive-diffusion	VOCs[1]/TO-17	Annual
AS-03-PPUT	Pizza Parlor Crawlspace	~30-day passive-diffusion	VOCs[1]/TO-17	Annual
AS-03-GLAMB	Galley Loading Dock	~30-day passive-diffusion	VOCs[1]/TO-17	Annual
AS-03-BH1	Boathouse Main Floor	~30-day passive-diffusion	VOCs[1]/TO-17	Annual
AS-03-BH2	Boathouse Retail Area	~30-day passive-diffusion	VOCs[1]/TO-17	Annual
AS-03-BHUT	Boathouse Subfloor Crawlspace	~30-day passive-diffusion	VOCs[1]/TO-17	Annual

Notes:

[1] Site 3 COCs to be reported include PCE, TCE, cis-1,2-Dichloroethene, trans-1,2-Dichloroethene, 1,1-Dichloroethene, and vinyl chloride.

ID = identification

2.3 Sampling Procedures

Prior to performing each annual sampling event, building occupants will be contacted and instructed to refrain from using items such as aerosol and plug-in air fresheners, cologne, perfume, hair spray, spray paint, solvent cleaners, glue, cigarettes, storage of recently dry-cleaned items, etc. within 48 hours prior to and during the sampling event that may interfere with the sample analytical results. Specifically, staff at the Galley and the Pizza Parlor will be requested to refrain from cleaning during the sampling event, and MWR Boathouse staff will be requested to refrain from cleaning or maintaining boats/engines inside the building for two days before and during the sampling event. Building occupants will be provided a list

of these prohibited items and activities in advance of the sampling to ensure that the requested protocol will be maintained.

On the day of sampling, an abbreviated building survey will be conducted to assess the potential for background sources of chlorinated ethenes. Identified background sources suspected of containing COCs will be temporarily relocated to a location agreed to by the building manager. At least 24 hours will lapse between relocation of potential background sources and indoor air sampling.

During the building survey, the location for an indoor air sample will be evaluated. The locations should be in areas minimally influenced by sources of air flow (i.e., not near doors, windows, heating/cooling vents and returns) and moisture (i.e., not near stove tops, ovens, hot water faucets). The passive-diffusion samplers will be deployed in the breathing zone at each location (3 to 5 feet above the floor level where occupants are normally seated or working). “Do Not Disturb” notices will be posted with each sample tube during the sampling period.

Details regarding sample deployment and retrieval are provided in the SOP included in Attachment 1 of Exhibit 7. The sampling process entails un-screwing and removing the cap from the tube, placing a protective screen over the end of the tube, and hanging the tube from a small length of flexible wire or string. The tube should then be suspended at the desired location so air is free to move around it from all directions. Each crawlspace vapor sample will be collected by hanging the tube using wire or string into the vertical center of the crawlspace. The tube serial number, date and time of deployment, and indoor temperature should be recorded. Following a deployment of approximately 30 days, the tubes will be retrieved, and the date and time recorded. The tubes will be placed in a padded envelope or small box and returned to the laboratory for analysis.

The samples will be maintained under chain-of-custody (CoC) procedures from sample collection to analysis. Beacon will analyze the samples for site VOCs using EPA Method TO-17.

3.0 VAPOR INTRUSION MITIGATION SYSTEM OPERATIONS AND MAINTENANCE

This section discusses the field activities that will be performed associated with the VIMS.

3.1 Quarterly VIMS Inspections

Each VIMS is inspected quarterly to make sure it meets the operating criteria specified in the operations and maintenance manual (Northwind, Inc. 2009). Specifically, the following tasks will be completed quarterly:

- The vapor barriers in the Pizza Parlor/Galley crawlspace will be inspected for holes/tears.
- A visual inspection of the Boathouse crawlspace vapor barrier will be performed from the crawlspace access hatch.
- GAC filters will be inspected.
- Exhaust fans will be visually inspected for motor/bearing temperature, noise, vibration, and fastener tightness.
- Heat recovery units will be inspected to verify proper fan operation and condensate drainage.
- Unit heaters will be inspected for proper operation.

VIMS inspections will take place prior to collecting differential pressure and air flow measurements. VIMS inspection observations will be recorded in the field logbook.

3.2 Air Flow/Differential Pressure Measurements

Air flow and differential measurements will be collected quarterly to ensure the systems are meeting the objectives outlined in the operations and maintenance manual (Northwind, Inc. 2009)

3.2.1 Air Flow

Air flow measurements will be collected quarterly from the Pizza Parlor/Galley and Barracks 1 VIMS ducting. There are also two air flow measurement locations on the Boathouse VIMS at the crawlspace inlet and exhaust fan outlet, but accessing these locations has not been possible for several years due to crawlspace flooding. Figures 1 and 2 display air flow measurement locations at the Pizza Parlor/Galley and Barracks 1, respectively. Flow rates will be collected from five points on the ducting for the Pizza Parlor/Galley VIMS (Figure 1) and four points for the Barracks 1 VIMS (Figure 2). Flow rates will be recorded in the field logbook.

3.2.2 Differential Pressure

Differential pressure will be measured quarterly between the Galley/Galley basement, Boathouse/ Boathouse crawlspace, and Barracks 1/Barracks 1 basement. Two methods will be used to measure differential pressure, depending on the effective operation of the VIMS. At buildings where VIMS inspections, air flow measurements, and indoor air sampling indicate that the VIMS are operating as designed and effectively mitigating VI, differential pressure will be measured as a single point in time using a handheld device. Single-point differential pressure values and the corresponding interpreted air flow direction will be recorded in the field logbook. At buildings where inspections/measurements indicate VIMS are NOT effectively mitigating VI, differential pressure will be recorded over a longer time period

using a differential pressure logger (e.g., an Ominguard differential pressure monitor). When the data logger is used, measurements will be collected for a duration of at least 24 hours and up to 30 days. The chosen duration will be case-specific and left to the discretion of the project stakeholders (i.e., USCG, EPA, and ADEC). Following the measurement period, pressure readings will be downloaded from the data logger, data will be presented graphically using a moving-average trend line that is appropriate for the collection period, and the graphs and interpretations will be included in the quarterly report. Based on the results, the report will also recommend a location for the next deployment of the differential pressure logger.

4.0 SAMPLE CUSTODY, PACKAGING, AND SHIPMENT

4.1 Analytical Methods and Sample Containers

All vapor samples will undergo analysis for vinyl chloride, 1,1-dichloroethene, trans-1,2-dichloroethene, cis-1,2-dichloroethene, TCE, and PCE. Sample tubes will be submitted for analysis of EPA Method TO-17. The laboratory will report the analyte list of VOCs under this method on standard turn-around-time basis. Requested analyte reporting limits are provided in Attachment B.

Table 3 Required Analyses

ANALYTE / ANALYTICAL GROUP	MATRIX	METHOD / SOP	CONTAINER(S) [NUMBER, SIZE, AND TYPE PER SAMPLE]	PRESERVATION REQUIREMENTS	ANALYTICAL HOLDING TIME
VOC	Air	EPA TO-17/ SOP 7	Sorbent tube	None	30 days

Notes:
SOP = standard operating procedure
VOC = volatile organic compound

4.2 Labeling Requirements

Samples will be labeled and packaged as described in Attachment 4A, Appendix A and the manufacturer's instructions. The following information will be recorded on sample labels:

- Sample ID
- Date and time of collection
- Name of person collecting the sample
- Analysis required

The naming convention for samples consists of the following elements in this order: matrix (AS for air), site number (03), air sampling location designation, sample sequence (01 for primary; 02 for duplicate samples), and sampling phase (to be determined at the time of sampling). For example:

- AS-03-B11LG-01-XXX = primary VI sample at Barracks 1, First Floor Lounge

4.3 Chain-of-Custody and Shipping

All samples will be tracked using standard CoC procedures. An example COC form is included as Exhibit 5 of Attachment 4A, Appendix A. A CoC will be filled out and accompany each cooler shipped. The CoC will also be scanned and emailed to the laboratory and project manager.

Within 5 days of collection, samples will be shipped to Beacon.

Pack sample containers as follows:

- Put the completed CoC in a plastic bag and place inside the master shipping container.
- Secure shipping container with strapping tape and attach an address label (and if applicable the FedEx shipping label) to the container as well as appropriate handling labels.
- Place signed custody seals over the top and bottom of each shipping container.

- Transport the shipping containers to the appropriate shipping facility adjacent to the Kodiak State Airport.

After the courier picks up the coolers, fax or email all of the CoCs and airway bills for the shipment to the laboratory and project manager.

4.4 Field Quality Control Samples

A single field duplicate will be collected from one of the nine sampling locations, at the discretion of the field team and submitted for analysis of EPA Method TO-17. A field duplicate will be collected during each sampling event. A single trip blank will accompany the sample tubes in transit from the laboratory to the site, and from the site back to the laboratory. While samples are deployed, the trip blank will remain in the project field trailer. The trip blank will remain capped during this entire duration.

Table 4 Field QC Summary

MATRIX	ANALYTE / ANALYTICAL GROUP	FIELD SAMPLES	FIELD DUPLICATES	MS	MSD	FIELD BLANKS	TRIP BLANKS	TEMP BLANK
Air, sample tube	VOCs	9 samples	1 duplicate	0	0	2	1	NA

Notes:
MS = matrix spike
MSD = matrix spike duplicate
NA = not applicable
VOC = volatile organic compound

5.0 QUALITY ASSURANCE

Field quality control (QC) measures are implemented to ensure that the analytical data are of sufficient quality to support meets project data quality objectives (DQOs). The following sections describe the quality assurance (QA) objectives and qualitative data evaluation criteria that will be used to verify acceptability of field and chemical analytical data acquired in support of this project.

5.1 Data Entry and Management

Data quality will be evaluated based on the precision, accuracy, representativeness, completeness, comparability, and sensitivity of data. These parameters are discussed in ADEC's *Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling Technical Memorandum* (ADEC 2017c).

Table 5 establishes the minimum performance specifications that the instruments and methods (procedures) must meet to ensure that collected data will satisfy the DQOs are outlined in the SOPs included in Appendix B.

Table 5 Measurement Performance Criteria – Volatiles

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field Replicates	RPD ≤ 30% when constituents are detected in both samples greater than the sample-specific LOQ
Overall Accuracy/Bias (contamination)	Blanks (Method Blank, Trip Blank, Field Blank)	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. Sample results will be qualified if contamination is detected above the DL in the associated method blank.
Analytical Accuracy/Bias (laboratory)	LCS	Laboratory limits for % Recovery (R) based on DoD QSM 5.3 Table C-43 Method TO-15.
Analytical Precision (laboratory)	LCS Replicate	RPD ≤ 30%
Accuracy	Surrogates	Laboratory specified limits: 70-130%[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Samples must be extracted and analyzed within holding times (30 days to analysis)
Sensitivity	Evaluate laboratory LODs and LOQs against project DQOs	LOD for non-detect results less than the project action limit
Completeness	Number of valid (usable or non-rejected) results versus the total number of results	85% minimum completeness goal

Notes:

[1] Analytical method TO-17 does not require surrogates but are used by Beacon for internal purposes.

> = greater than
≤ = less than or equal to
% = percent
DL = detection limit
LCS = laboratory control sample
LOD = limit of detection
LOQ = limit of quantitation
MS/MSD = matrix spike / matrix spike duplicate
QC = quality control
RPD = relative percent difference

5.2 Data Reduction, Validation, and Reporting

Beacon will consolidate all laboratory analyses and results specified into a Level II Laboratory Data Report. Laboratory Data Reports will be presented in electronic copy deliverables. All statements and data provided in the Laboratory Data Reports shall be in conformance with provisions set forth by the Beacon Quality Assurance Program Plan and the National Environmental Laboratory Accreditation Conference, unless noted otherwise.

5.3 Internal Quality Control Checks

Laboratory QC checks shall include at a minimum method blanks, laboratory control samples (LCSs) and surrogate spikes.

To verify the data quality parameters, the following items shall be reviewed.

- Preservation and technical holding times
- Initial and continuing calibration
- Laboratory blanks
- Field and laboratory duplicates
- Surrogates
- LCSs
- Detection and quantitation limits

The laboratory will report to the method detection limit. Qualified data will be flagged appropriately and discussed in the case narrative of the Laboratory Data Report.

5.4 Data Quality Indicators

The following data QC indicators are measured to assess the state of control that prevails at the time of sample analysis:

- Target analytes are measured in method blanks to help identify and eliminate potential contamination sources in a sample batch.
- LCSs and LCS duplicate recoveries are measured and relative percent differences (RPDs) between recoveries are calculated to determine if corrective action must be taken.
- RPDs are calculated between field duplicate and primary sample results to assess sources of variability arising from the field sampling protocol and distribution of target analytes within the sample matrix. Duplicate samples are submitted to the laboratory "blind" to assess the laboratory's precision.
- Surrogate recoveries are calculated as indicators of laboratory accuracy and data quality.

5.5 Corrective Action

Laboratory corrective actions for most analytical procedures include correcting the problem, then re-preparing and reanalyzing the sample.

In other laboratory and field situations that require corrective action, individuals directly involved in the situation will use their best judgment to address the problem.

A corrective action report will be maintained by both the field manager and the laboratory. Data uncertainty and possible limiting factors of its applicability as it applies to the site will be reviewed in the final report for this release investigation and monitoring project.

5.6 Performance and System Audits

Annual audits of laboratory equipment are conducted by Beacon's Laboratory Quality Assurance Officers in accordance with the lab QA/QC Program maintained by Beacon. A copy of the QC Manual that outlines this program is available upon request from the laboratory.

5.7 Quality Assurance Reports to Management

All laboratory data will be maintained at the laboratory and available upon request. Complete documentation of sample preparation and analysis will be maintained. Any deviations from these procedures will be discussed in the final report for the project. The project chemist will conduct a data QA assessment in accordance with ADEC's *Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling Technical Memorandum* (ADEC 2017c). The project chemist will also complete an ADEC Laboratory Data Review Checklist for each laboratory data package. The data QA assessment and checklist(s) will be included in the final report.

5.8 Data Entry and Management

All original laboratory data will be provided to the USCG's database contractor for incorporation into the USCG Base Kodiak chemical database.

This page intentionally blank

6.0 REFERENCES

Ahtna Environmental, Inc (Ahtna). 2019 (October*). Draft Pilot Treatment Study Report Site 3, Laundry*. USCG Base Kodiak, Alaska.

Alaska Department of Environmental Conservation (ADEC). 2014. *Fact Sheet Additional Information about Exposure to TCE.* Division of Spill Prevention and Response. Contaminated Sites Program. January 8.

ADEC. 2017a. *Vapor Intrusion Guidance for Contaminated Sites.* State of Alaska Department of Environmental Conservation, Division of Spill Prevention and Response Contaminated Sites Program. November.

ADEC. 2017b*. Additional Information about Exposure to TCE*. November.

ADEC. 2017c. *Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling Technical Memorandum*. March.

Beacon Environmental, Inc. (Beacon). 2020a. *Standard Operating Procedure for Gas Chromatograph/Mass Spectrometer Sample Analysis for Packed Tubes by EPA Methods TO-17 and TO-15*. Revision 13. June.

Beacon. 2020b. *Standard Operating Procedures for the Collection and Return Shipment of Axial Type Passive Diffusion Samplers*. Revision 5. June.

HDR. 2008. *Comprehensive Vapor Intrusion Investigation near Site 3 – Laundry, ISC Kodiak.* June.

McAlary, Todd. 2014. *Development of More Cost-Effective Methods for Long-Term Monitoring of Soil Vapor Intrusion to Indoor Air Using Quantitative Passive Diffusive-Adsorptive Sampling*. ESTCP Project ER-200830. July.

Northwind, Inc. 2009. *Operations and Maintenance Manual, Space VOC Ventilation Systems for Barracks 1, Building 3 (Pizza Parlor/ Galley), and the Boathouse.* Integrated Support Command. Kodiak, Alaska. January.

U.S. Environmental Protection Agency (EPA). 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils*. November.

EPA. 2012. *OEA Recommendations Regarding Trichloroethylene Toxicity in Human Health Risk Assessments*. United States Environmental Protection Agency Region 10. December.

EPA. 2015. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.* Office of Solid Waste and Emergency Response. June.

EPA. 2020. *Vapor Intrusion Screening Levels (VISL) Calculator.* https://epa-visl.ornl.gov/cgi-bin/visl_search. Accessed September 22, 2020.

This page intentionally blank

LADDER FROM LOADING DOCK TO CRAWLSPACE

"M6" KEY

GAC

PIZZA PARLOR VENTILATION FAN ROOM

3

4

2

5

1

OUTDOOR STEPS TO PIZZA PARLOR LOADING DOCK

LEGEND:

1) SMALL HOLE IN DUCT AT CEILING ACCESSED WITH LADDER

2) 12" PORT ACCESSED FROM CRAWL SPACE

3) 12" PORT ACCESSED FROM CRAWL SPACE

4) 8" PORT AT EYE LEVEL IN FAN ROOM

5) 12" EXHAUST PORT FROM GAC

TRANSFORMER ROOM

SWITCHGEAR ROOM

BASE KODIAK SO02 RCRA PERMIT

KODIAK, ALASKA

GALLEY/PIZZA PARLOR AIRFLOW MEASUREMENTS

DATE: SEPTEMBER 2020

P.M.: C.S.

DRAWN: K.T.

FIGURE: 1

STAIRS TO FIRST FLOOR HALL

MUSIC ROOM

"M6" KEY

MECHANICAL ROOM

3

4

HEAT EXCHANGER

1

2

EACH SAMPLE POINT = SMALL HOLE IN DUCT

LEGEND:

1) SUPPLY TO CRAWLSPACE

2) RETURN FROM CRAWL SPACE

3) EXHAUST TO OUTSIDE

4) OUTSIDE SUPPLY

BASE KODIAK SO02 RCRA PERMIT

KODIAK, ALASKA

BARRACKS 1 AIRFLOW MEASUREMENTS

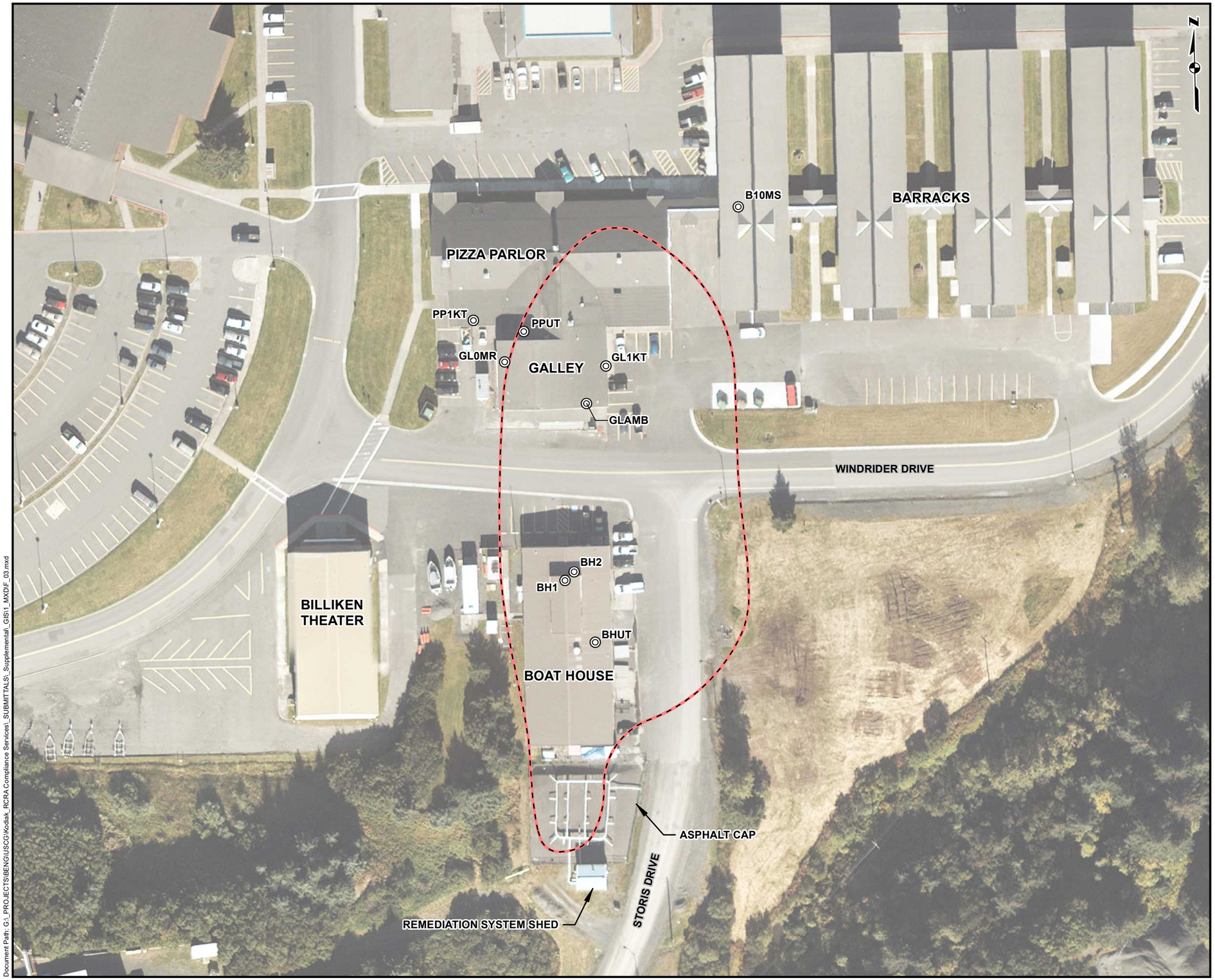
DATE: SEPTEMBER 2020

P.M.: C.S.

DRAWN: K.T.

FIGURE: 2

1 INCH



Document Path: G:_PROJECTS\BENG\USCG\Kodiak_RCRA Compliance Services_SUBMITTALS_Supplemental_GIS\1_MXD\F_03.mxd

BASE KODIAK SO02 RCRA PERMIT

USCG BASE KODIAK, KODIAK, ALASKA

VAPOR MONITORING SAMPLE LOCATIONS

Legend

- Air Sample Location
- Approximate area of groundwater contamination greater than Groundwater Protection Standards selection

Chemistry Notes

1. Groundwater Protection Standards are defined in RCRA Permit Condition V.F.1.

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

70 35 0 70 140

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	9/24/2020	3
P.M.: CS	DRAWN: KT	

This page intentionally blank

ATTACHMENT 1
STANDARD OPERATING PROCEDURES

This page intentionally blank

Title: GC/MS Sample Analysis for Packed Tubes by EPA Methods TO-17 and TO-15	**SOP No. 7 Rev. 13** **Page 1 of 38**
Reviewers: Peter Kelly Digitally signed by Peter B. Kelly DN: cn=Peter B. Kelly, o, ou, email=petebkelly@gmail.com, c=US Date: 2020.05.27 14:37:54 -04'00'	**Control #:** 1
Final Approval: Steve Thornley IDENTRUST 2020.05.27 13:01:05-04'00'	**Date Approved**: 05/27/2020 **Date Reviewed:** 5/22/2020

GC/MS Sample Analysis for Packed Tubes by EPA Methods TO-17 and TO-15

TABLE OF CONTENTS

1 REVISION HISTORY 2
2 IDENTIFICATION OF THE TEST METHOD 3
3 APPLICABLE MATRICES 3
4 DETECTION LIMITS 3
5 SCOPE AND APPLICATION 3
6 SUMMARY OF THE TEST METHOD 4
7 RESPONSIBILITIES 4
8 DEFINITIONS 4
9 INTERFERENCES 8
10 SAFETY 8
11 EQUIPMENT AND SUPPLIES 9
12 REAGENTS AND STANDARDS 9
13 SAMPLE COLLECTION, PRESERVATION, SHIPMENT AND RECEIPT 11
14 QUALITY CONTROL (INCLUDING ACCEPTANCE CRITERIA) 11
15 CALIBRATION AND STANDARDIZATION 13
16 MARKES AUTO SAMPLER SEQUENCES 15
17 GC ANALYSIS PROCEDURE 22
18 DATA ANALYSIS 28
19 METHOD PERFORMANCE 28
20 POLLUTION PREVENTION 28
21 DATA ASSESSMENT AND ACCEPTANCE CRITERIA 29
22 CORRECTIVE ACTIONS 29
23 CONTINGENCIES FOR HANDLING OUT-OF-CONTROL DATA 29
24 WASTE MANAGEMENT 30

25 REFERENCES 30
26 EQUIPMENT/INSTRUMENT MAINTENANCE 31
27 COMPUTER HARDWARE AND SOFTWARE 31
28 TROUBLESHOOTING 31
29 APPENDIX A: SOP ANNUAL REVIEW 37
30 APPENDIX B: READ AND UNDERSTOOD 38

1 REVISION HISTORY

Version 7/01

- Added instructions on file naming to discern between analyses on the same day performed on different instruments.

Version 7/02

- Updated method 8260B to C

Version 7/03

- Updated instrument inventory, standard making schedule, proper purging gas

Version 7/04

- Updated format to conform with requirements of DoD Quality System Manual and added TO-15 requirements
- Major sequential updates for sections 15 and 16, small edits to section 17

Version 7/05

- Added nomenclature for the test method.
- Section 4: Added LOD/LOQ information
- Section 15: Added step 15.3, providing information of saving the method
- Section 16.1.3: Added information on DoD requirements for QA/QC samples
- Section 17.2.3: Added requirements for documenting failure of surrogates.
- Section 20: Added requirements for flagging surrogates that fail to meet criteria.
- Section 20: Added information on coding QA/QC samples that fail to meet criteria and documenting manual integrations.
- Section 22: Added information on corrective actions for surrogates.

Section 13.8: Added a paragraph to describe how to purge carboxen or carbon molecular sieve sample tubes

Version 7/06 Section 16.1.3 Revised requirements for DOD batch size

Version 7/07 Added information on source of calibration/calibration verification standards and concentrations to Section 15.1.

Version 7/08 Added information on select ion monitoring mode (SIM) of compounds on the target list to Section 6 h. and updates due to DoD QSM ELAP Rev. 5

Version 7/09 Added Appendix A describing Summa Canister and Tedlar bag sample collection.

Version 7/10 Added Appendix B describing FIKE three bed glass tube internal standard and surrogate loading Agilent method requirements & thermal desorption method development.

Version 7/11 Definition of initial calibration updated. Sections 13.8, 15.1, 15.1.8, 16.1.1, 16.1.3, 16.1.4, 16.1.5.2, 16.2.6, 16.2.7, 17.3, sections 20, 22 updated, add 15.2.7

Version 7/12 Edit section 2 to Add Beacon sampler, edit section 3 to be more inclusive

Version 7/13 Added table of contents, fixed paragraph numbering, updated reagents and standard section, updated Markes procedures, procedural updates for Element LIMS, added Appendix A & B

2 IDENTIFICATION OF THE TEST METHOD

This SOP describes a sorbent tube/thermal desorption/gas chromatographic based method.

Sample analyses are performed at Beacon Environmental in-house laboratory using the Markes International thermal desorption instrument, which uses the patented Diff-Lok® caps to provide accurate and reliable data. Markes International instruments have been designed by scientists who developed EPA Method TO-17 – the official method for analysis of adsorbent tubes. This SOP also complies with the requirements in U.S. EPA Method TO-15 that are applicable to solid sorbent samplers, whether passive or active sampling with BeSure samplers or packed tubes.

3 APPLICABLE MATRICES

EPA Methods TO-17 and TO-15 uses absorbent samplers to capture air samples.

4 DETECTION LIMITS

For method detection limits, limits of detection, limit of quantitation, performance tests and other method performance data see folder “C:\BEACON\GCMS\cal mdl lod loq pt dup\mdl.” LOD/LOQ studies are performed quarterly, and the most recent results are available in the cal mdl lod loq pt dup\initial calibration folder.

5 SCOPE AND APPLICATION

Air samples will be desorbed, using the Markes International thermal desorption instrument, and the resulting sample is directly injected into the gas chromatograph for separation, and detected by the MS. This SOP is specific for U.S. EPA method TO-17.

Analytes targeted by this method include Volatile Organic Compounds and semi-volatile organic compounds.

6 SUMMARY OF THE TEST METHOD

a. Analysis by thermal desorption-gas chromatography/mass spectrometry following established EPA method TO-17/TO-15.

b. Analytical results based on 5-point initial calibration.

c. Internal standards and surrogates included with each analysis.

d. 24-hour bromofluorobenzene tunes.

e. 24-hour continuing calibration checks.

f. Method blanks.

g. Duplicate field samples.

h. The mass spectrometer is tuned to meet BFB TO-17) or DFTPP (8270D) and run in full scan 35-270 (volatiles) or 35-500 (semivolatiles) when targeting the standard list at the standard range or run in select ion monitoring mode when targeting samples with concentrations an order of magnitude below that.

7 RESPONSIBILITIES

7.1 LABORATORY DIRECTOR:

- Responsible for the technical operation of the laboratory.
- Provides supervision to all laboratory personnel to ensure adherence to lab-documented procedures.
    - Maintain material used for analysis

7.2 ANALYST

- Responsible for sample receipt.
- Responsible for any sample preparation required.
- Responsible for sample analysis in accordance with this SOP.

7.3 QUALITY MANAGER:

- Responsible for the quality system and its implementation.
- Provides final decision on all laboratory policy and/or resources.

8 DEFINITIONS

8.1 DEFINITIONS

- Analytes – target compounds within the method
- Aliquot –a portion removed from the solute
- Initial Calibration Verification – using a solution from a second source standard to check response with initial calibration at the mid-point, this is also the Laboratory Control Sample

- Continuing Calibration – also calibration verification or calibration check with same mid-point standard as than the one used for initial calibration
- Dynamic Dilution – performed using a special method that collects a split of the sample while dumping/or collecting the split. Typically done after the primary analysis of a sample that identifies the sample as needing a dilution after any low concentration analytes have been identified during the primary analysis.
- Initial Calibration – a multiple point calibration of varied masses ranging from 2.5 to 200 nanograms per injection
- Laboratory Control Samples – a second source standard also called calibration verification
- Method Blank – an injection from a blank tube, spiked only with internal standards and surrogate compounds
- Packed Tube – normally stainless steel, 3.5 inches long, 0.25 inches in outside diameter, containing adsorbent, can have more than one adsorbent.
- P

Percent Difference (%D). Calculate the percent difference in the RRF of the daily RRF 24-hour) compared to the mean RRF in the most recent initial calibration. Calculate the %D for each target compound using the following equation:

$$\%D = \frac{RRF_c - \overline{RRF_i}}{\overline{RRF_i}} \times 100$$

where: RRF_c = RRF of the compound in the continuing calibration standard.
$\overline{RRF_i}$ = Mean RRF of the compound in the most recent initial calibration.

f
ference –

- Relative Response Factor - $RRF = A_x C_{is} / A_{is} C_x$

Where:
- RRF = Relative response factor.
- A_x = Area of the primary ion for the compound to be measured, counts.
- A_{is} = Area of the primary ion for the internal standard, counts.
- C_{is} = Mass of internal standard spiking mixture,
- C_x = Mass of the compound in the calibration standard

- %Relative Standard Deviation – Using the RRFs from the initial calibration, calculate the %RSD for all the target compounds using the following equations

$$\%RSD = [(SD_{RRF})/(RRF)] * 100$$

$$SD_{RRF} = \sqrt{\sum_{i=1}^{N} \frac{((RRF_i - \overline{RRF})^2)}{N-1}}$$

Where: SD_{RRF} = Standard deviation of initial response factors (per compound).
RRF_i = Relative response factor at a concentration level i.
$\overline{RRF}$ = mean of initial relative response factors (per compound).

- **Relative Retention Times (RRT)**. Calculate the RRTs for each target compound over the initial calibration range using the following equation:

$$RRT = RT_c/RT_{is}$$

Where: RT_c = Retention time of the target compound, seconds
RT_{is} = Retention time of the internal standard, seconds.

- **Mean of the Relative Retention Times (RRT)**. Calculate the mean of the relative retention times (RRT) for each analyte target compound over the initial calibration range using the following equation:

$$\overline{RRT} = \sum_{i=1}^{n} \frac{RRT}{n}$$

Where: $\overline{RRT}$ = Mean relative retention time for the target compound for each initial calibration standard.
RRT = Relative retention time for the target compound at each calibration level.

- Surrogate – compounds that are not normally seen in samples that behave like the target analytes. These compounds are monitored to determine if the sample injection had some problem, along with the internal standards, they offer an additional level of monitoring control.

8.2 ACRONYMS

- BFB – Bromofluorobenzene
- cal – calibration
- CCV – Continuing Calibration Verification
- COC – Chain of Custody
- CC – Continuing Calibration
- U.S. EPA – U. S. Environmental Protection Agency
- FedEx – Federal Express
- GC-MS – Gas Chromatography / Mass Spectrometry

- He - Helium
- ICV – Initial Calibration Verification
- ISTD – Internal Standard
- LCS – Laboratory control sample
- LFB – Laboratory fortified blank
- MDL – Method Detection Limit
- min - minute
- ml – milliliter
- ng – Nanogram
- ng/µL – Nanogram per micro liter
- PE – Performance Evaluation
- PPE – Personnel Protective Equipment
- psi – pounds per square inch
- QA – Quality Assurance
- QC – Quality Control
- RF – Response Factor
- RFF – Relative Response Factor
- RPD – Relative percent difference
- RSD – Relative Standard Deviation
- SD – Standard Deviation
- SIM- Select Ion Monitoring
- SOP – Standard Operating Procedure
- SPCC-CCC – System Performance Check and Calibration Check
- SURR – Surrogate
- TO – Total Organics
- UHP – Ultra High Purity
- µL – micro liter
- UPS – United Parcel Service

9 INTERFERENCES

9.1 MINIMIZING ARTIFACT INTERFERENCE

9.2 The following information is summarized from reference 24.5, EPA TO-17.

9.2.1 Stringent tube conditioning (see SOP 16) is required for this method. Careful tube capping and storage procedures are essential for minimizing artifacts. System and sorbent tube conditioning must be carried out using more stringent conditions of temperature, gas flow and time than those required for sample analysis.

9.2.2 A reasonable objective is to reduce artifacts to 10% or less of individual analyte masses retained during sampling.

9.2.3 Given that most ambient air monitoring in carried out in areas of poor air quality, for example, in urban, indoor and factory fence line environments where VOC concentrations are typically above 1 ppb, the mass of each analyte retained will range from about 5 to 10 µg in most monitoring situations. Even when monitoring 'ultraclean' environments, analyte masses retained will usually exceed 0.1 ng.

9.2.4 Typical artifact levels for ¼ inch O.D. levels range from 0.01 ng and 0.1 ng for carbonaceous sorbents and Tenax® respectively. Artifact levels for Chromosorb® Century series and other porous polymer sorbents is around 10 ng. However, these types of sorbents can still be used for air monitoring at low ppb levels if selective or mass spectrometer detectors are used or if the blank profile of the tube demonstrates that none of the sorbent artifacts interfere analytically with the compounds of interest.

9.2.5 Hydrophobic sorbents can minimize the interference of water. Tenax® and CarboTrap™ are examples of hydrophobic tubes, but it is still essential that the tube temperature is not lower than the ambient temperature during sampling, otherwise, condensation will occur, regardless of how hydrophobic the sorbent. All tubes are purged of moisture prior to spiking with internal standards and surrogates followed by analysis.

10 SAFETY

10.1 REQUIRED PPE

- Safety Glasses
- Gloves

10.2 SAFETY PRACTICES

General safety practices are to be observed, including good housekeeping, proper usage of solvents, and proper training on the use of the analytical instrumentation.

11 EQUIPMENT AND SUPPLIES

- Agilent 7890-5975C GC/MS with ChemStation Software
- Markes AutoSecure Thermal Desorption System with Recollection or TD-100 or TD-100 xr
- Markes TC-20 Tube Conditioner
- Stop Watch
- Diff-Lok® Caps
- Sample Spiking Rig
- Manila Folders
- Packed Tubes: Dual Bed, Carbopack X, Chromosrob-106, ChloroSorber
- 0.5µL Micro syringe

12 REAGENTS AND STANDARDS

- Stock Standards, Traceable to national standard

The liquid standard must have a concentration so that an injection of 0.5 µl of the solution introduces the same mass of target analyte that is within the calibration range. Standards must be stored at 6°C or less or discarded there is a degradation in standard responses.

12.1 Calibration Stock Standards:

Concentration (ug/ml)	Absolute Standards Part Number
5	99080
10	97253
20	97254
50	97255
100	97256
200	97257
400	97258
800	64090
1200	64091
1600	64092
2000	64093

- Calibration: Spike with 0.5ul of each standard
- CCV/LCS: 0.5ul of 100ng calibration standard = 50ng true value

12.2 Second Source Stock Standard:

Concentration (ug/ml)	Absolute Standards Part Number
100	97270

- 0.5ul of 100ng = 50ng true value

12.3 Internal Standards/Surrogates Standard:

12.3.1 Stock

Concentration (ug/ml)	Absolute Standards Part Number
2000	92026

12.3.2 Working ISTD/SURR Standard:

Stock Conc. (ug/ml)	Amount Stock (ul)	Final Volume (ul)	Working Conc. (ng)
2000	100	1000	200

- Diluted with methanol

12.4 BFB:

Concentration (ug/ml)	Absolute Standards Part Number
2500	19167
Or	
2000	20002

- Methanol, HPLC grade or equivalent
- Carrier Gases

  Use inert, 99.999 percent or higher purity helium as a carrier gas. Oxygen and organic filters must be installed in the carrier lines supplying the analytical system according to the manufacturer's instructions. Keep records of filter and oxygen scrubber replacement.

13 SAMPLE COLLECTION, PRESERVATION, SHIPMENT AND RECEIPT

13.1 See the latest revision of SOP 14 and SOP 65.

13.2 Samples are analyzed in the order they are received. TO-17 has a holding time of 30 days from the time of sample collection, if held at 4°C. Samples are normally analyzed within five days of receipt and held at ambient temperatures to minimize the exposure to freons present in all refrigerators.

13.3 Once samples have been properly documented as received, they must be purged prior to analysis. Using the TC-20, insert the tubes, 20 at a time into the tube holder sampling end first. This step is to minimize the effects of matrix effect (humidity from the site).

13.4 After this purge is complete stage the samplers in the Ultra holding trays for spiking with internal standards and surrogates.

14 QUALITY CONTROL (INCLUDING ACCEPTANCE CRITERIA)

14.1 Quality Acceptance Criteria for Method

14.1.1 BFB: loaded with 0.5µL BFB standard solution (2500ng/µL) placed in auto sampler tray and loaded into the Markes autosampler and configured to desorb with the BFB specific method (the method is designed to deliver 24.5 ng to the column)

Mass	Ion Abundance Criteria[1]
50	8.0 to 40.0 Percent of m/e 95
75	30.0 to 66.0 Percent of m/e 95
95	Base Peak, 100 Percent Relative Abundance
96	5.0 to 9.0 Percent of m/e 95 (See note)
173	Less than 2.0 Percent of m/e 174
174	50.0 to 120.0 Percent of m/e 95
175	4.0 to 9.0 Percent of m/e 174
176	93.0 to 101.0 Percent of m/e 174
177	5.0 to 9.0 Percent of m/e 176

[1]All ion abundances must be normalized to m/z 95, the nominal base peak, even though the ion abundance of m/z 174 may be up to 120 percent that of m/z 95.

14.1.2 TO17 QC Table

QA/QC Sample	Criteria	Comments
Method Blank/Laboratory Blank	The blank should not contain any target analyte at a concentration greater than its quantitation level (above reporting limit, or detection limit or three times the MDL depending on quality objectives) and should not contain additional compounds with elution characteristics and mass spectral features that would interfere with identification and measurement of a method analyte.	DoD requirements: the method blanks is considered contaminated if the concentration of any target analyte exceeds ½ the LOQ and is greater than 1/10th the regulatory limit, whichever is greater, or if the concentration of any common laboratory contaminant in the blank exceeds the LOQ.
Samples	Within the linear calibration range (10-200 ng)	
Internal Standard	Within 40% of the IS areas on the CCV/Daily Calibration run for the sample group	Spiked at 100 ng
CCV	< 30% Difference	Per batch
Initial Calibration		Calibration range of 2.5 to 1,000 ng
Initial Calibration	< 30% RSD	calculated %RSD for the RRF for each compound in the calibration table
Surrogates	< 30% Difference	Spiked at 100 ng (50 ng for CC and LCS samples), failed surrogates (if reportable) Q flagged (or code supplied by client)
LCS, second source, when required	< 30% Difference	Peak areas must be $\pm$40% of the most recent calibration
Daily continuing calibration	< 30% Difference	Peak areas must be $\pm$40% of the most recent calibration

14.1.3 Quality control samples must be processed in the same manner as the actual samples. They must be analyzed and reported with their associated field samples.

14.1.4 If QC results are outside method-specified or project-specified criteria, they will be recorded in the corrective action log and corrective action will be taken to correct the problem and to prevent incorrect results from being reported.

14.1.5 Reportable quality control samples (as required by a specific customer or contract) are appropriately date quality coded and discussed in the report narrative.

14.1.6 If manual integrations are performed, identify the samples and analytes for which manual integration occurred in the case narrative or analytical report, including the cause and justification for the integration. Both the original and manually integrated chromatograms are also documented with the analyst's signature, the date and the reason for the manual integration.

15 CALIBRATION AND STANDARDIZATION

15.1 Spiking Calibration Standards:

Note: See the latest revision of SOP 46, 'Quality Control Evaluations' for calibration and calibration verification general requirements.

15.1.1 Calibration (and calibration verification) standards are purchased commercially, from Absolute Standards (see section 12.1)

15.1.2 Calibration sequence:

Element Name	Stock	Stock Conc. (ug/ml)	Amount Spiked (ul)	Final Concentration (ng)
SEQ-TUN1	20002	2000	0.2	---
SEQ-CAL1	99080	5	0.5	2.5
SEQ-CAL2	97253	10	0.5	5
SEQ-CAL3	97254	20	0.5	10
SEQ-CAL4	97255	50	0.5	25
SEQ-CAL5	97256	100	0.5	50
SEQ-CAL6	97257	200	0.5	100
SEQ-CAL7	97258	400	0.5	200
SEQ-CAL8	64090	800	0.5	400
SEQ-CAL9	64091	1200	0.5	600
SEQ-CALA	64092	1600	0.5	800

SEQ-CALB	64093	2000	0.5	1000
SEQ-ICV1	97270	100	0.5	50
SEQ-ICB1	ISTD/SURR Sub-Stock	200	0.5	100
DL	99080	5	0.5	2.5
LOD	97253	10	0.5	5
LOD	97253	10	0.5	5
LOD	97253	10	0.5	5
LOD	97253	10	0.5	5
LOQ	97254	20	0.5	10
LOQ	97254	20	0.5	10
LOQ	97254	20	0.5	10
LOQ	97254	20	0.5	10

15.1.3 Attach tube to the “Sample Spiking Rig”

15.1.4 Finger-tighten the tube until ”snug”

15.1.5 Draw 0.5µL aliquot from appropriate standard

15.1.6 Inject aliquot through loading rig injection port onto the face of the retaining gauze of the tube

15.1.7 Purge aliquot into packed tube for at least 30 seconds and keep the time consistent using stopwatch with alarm (this step has been successful with purge times up to 5 minutes, 30 seconds is adequate). The gas flow should be set to 40 $^{ml}/_{min}$ and verified with a glass ball rotameter (this is equivalent to 90ml/min of Hydrogen).

15.1.8 Attach Diff-Lok® caps

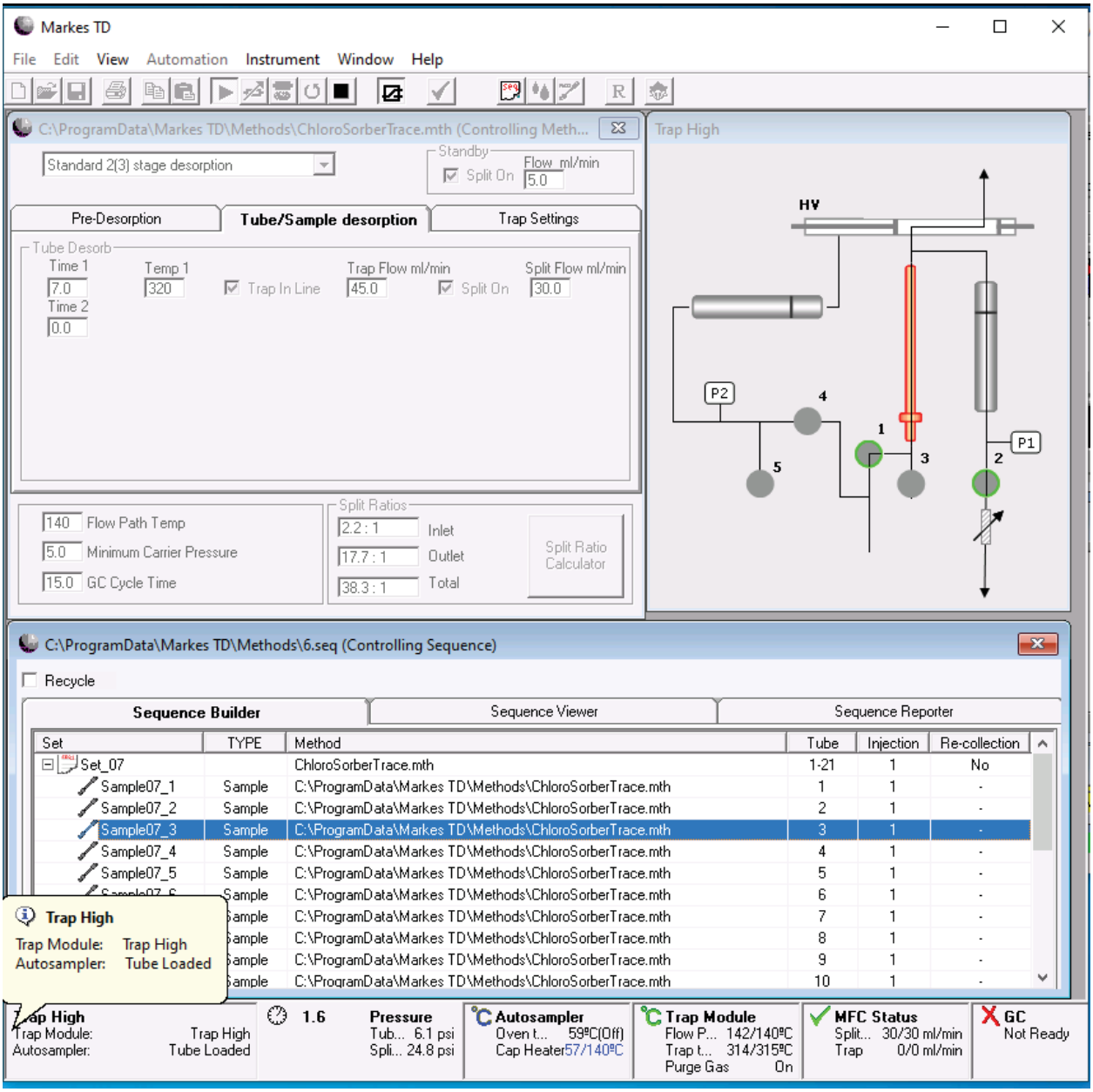
15.1.9 Place in Auto Sampler tray in appropriate sequential position with the grooved end on the right side of the tray for analysis

15.1.10 Once all the QA/QC and field sample tubes have been loaded with the appropriate solution and all blanks and field samples have been loaded with ISTD/SURR standard, create auto sampler sequence as described below.

15.1.11 See latest revision of SOP 59, ‘Calibrations in Element’

16 MARKES AUTO SAMPLER SEQUENCES

16.1 Markes TD-100

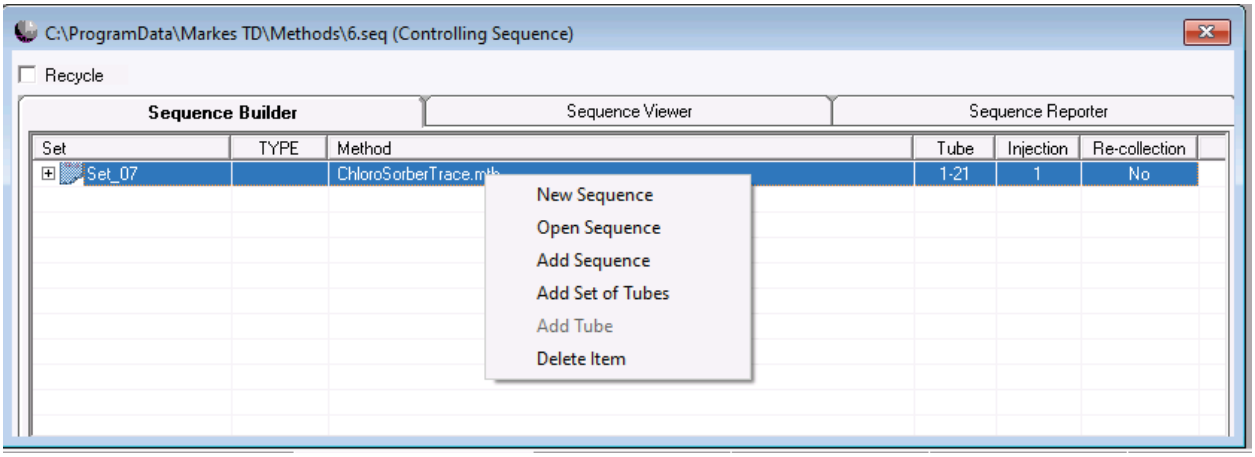


16.2 Delete old sequence.

16.2.1 Click on sequence to highlight

16.2.2 Right-Click

16.2.3 Select ‘Delete Item’

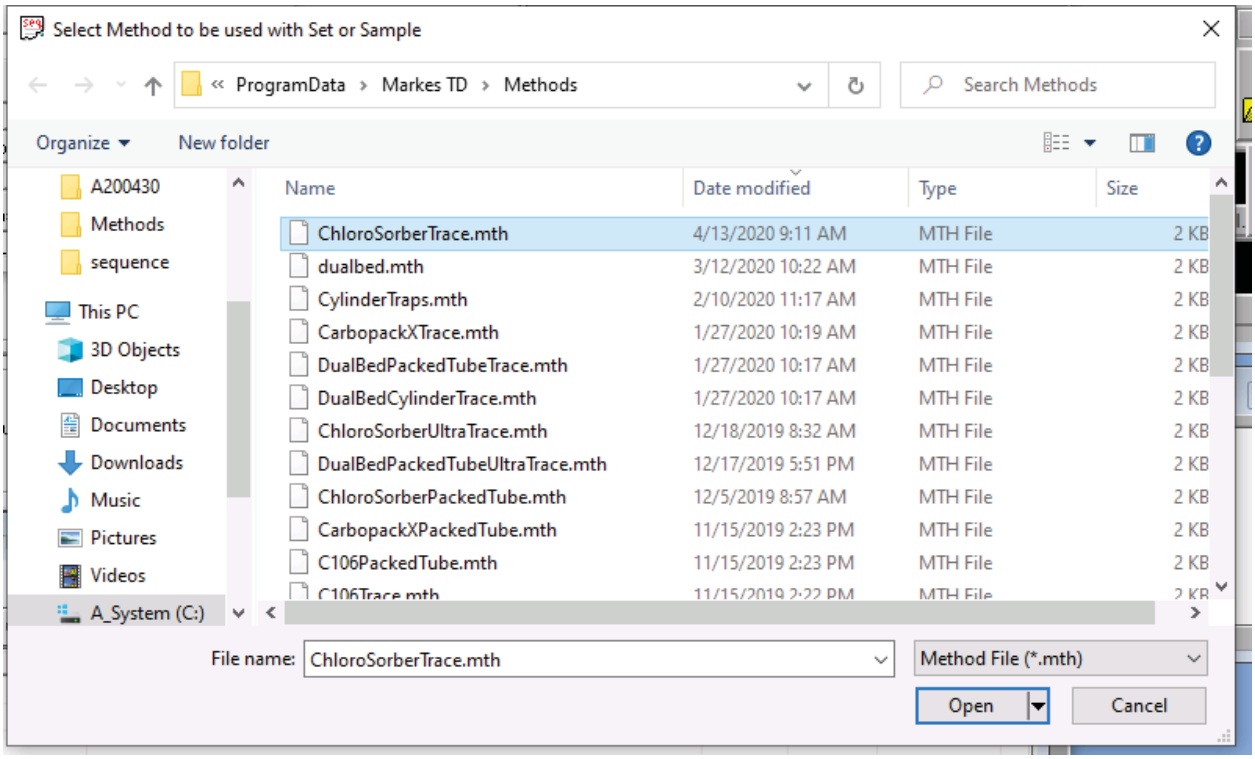


16.3 Add New Sequence.

16.3.1 Right click in the “Controlling Sequence” window.

16.3.2 Select ‘Add Set of Tubes’.

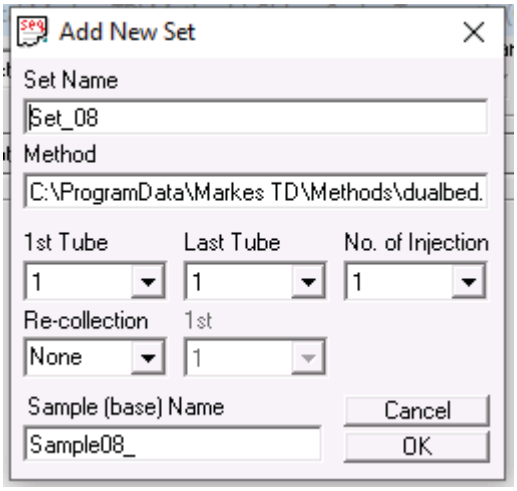
16.3.3 Select Method



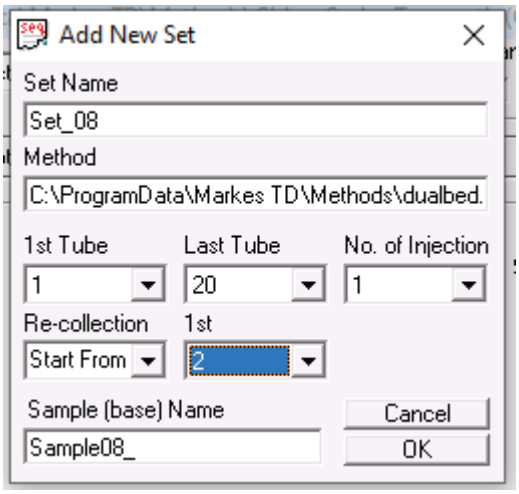
Sampler Type	Markes Method
Dual Bed Tube	dualbed.mth
Carbopack X Tube	CarbopackXPackedTube.mth
ChloroSorber (Ultra Trace Level)	ChloroSorberUltraTrace.mth
ChloroSorber (Trace Level)	ChloroSorberTrace.mth
Chromosorb 106 Tube	C106PackedTube.mth
Beacon Sampler	CylinderTraps.mth
Fike Tube	dualbed.mth

16.3.4 Select starting tube number in '1st Tube' field.

16.3.5 Select last tube in 'Last Tube' field.

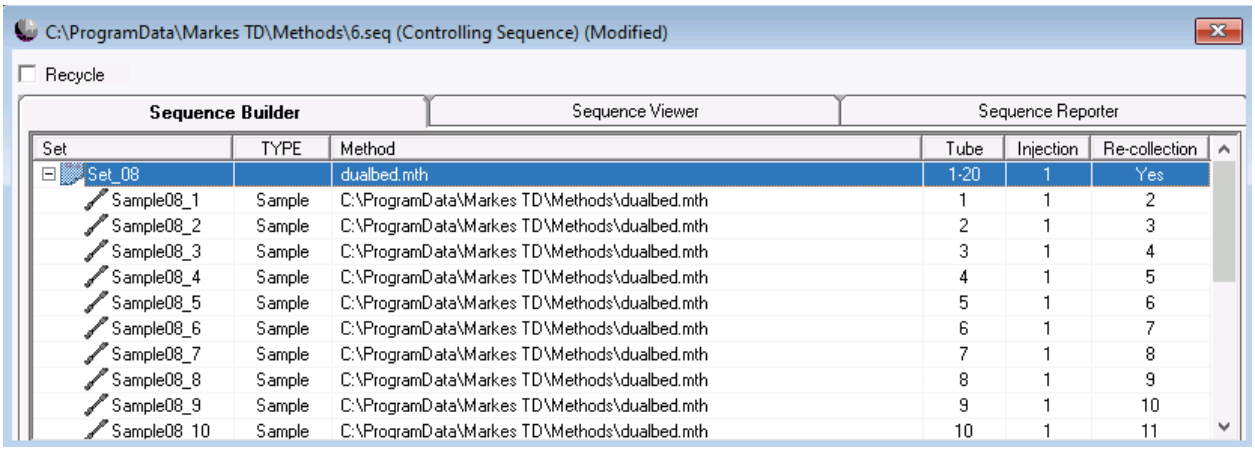


16.3.6 If recollection is needed, select 'Start From' in the 'Re-collection' field and the starting tube number in the '1st' field.



16.3.7 Click 'OK"

16.3.8 Expand the sequence list by clicking on the '+'



Set	TYPE	Method	Tube	Injection	Re-collection
Set_08		dualbed.mth	1-20	1	Yes
Sample08_1	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	1	1	2
Sample08_2	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	2	1	3
Sample08_3	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	3	1	4
Sample08_4	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	4	1	5
Sample08_5	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	5	1	6
Sample08_6	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	6	1	7
Sample08_7	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	7	1	8
Sample08_8	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	8	1	9
Sample08_9	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	9	1	10
Sample08_10	Sample	C:\ProgramData\Markes TD\Methods\dualbed.mth	10	1	11

16.3.9 Clean up the sequence.

16.3.10 Save sequence.

16.3.11 Load trays with tubes and click play button to start.

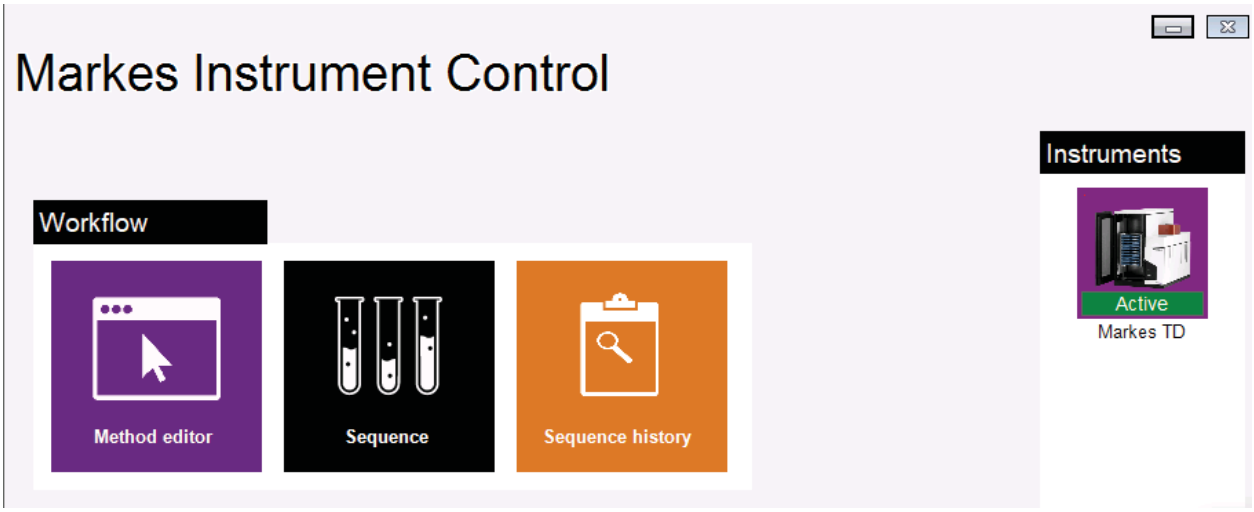
Note: If sequence goes beyond position 100, a second sequence must be added for positions 1 onward.

Note: The Tune is always run with ‘dualbed’ method.

Note: Can have multiple methods in same sequence:

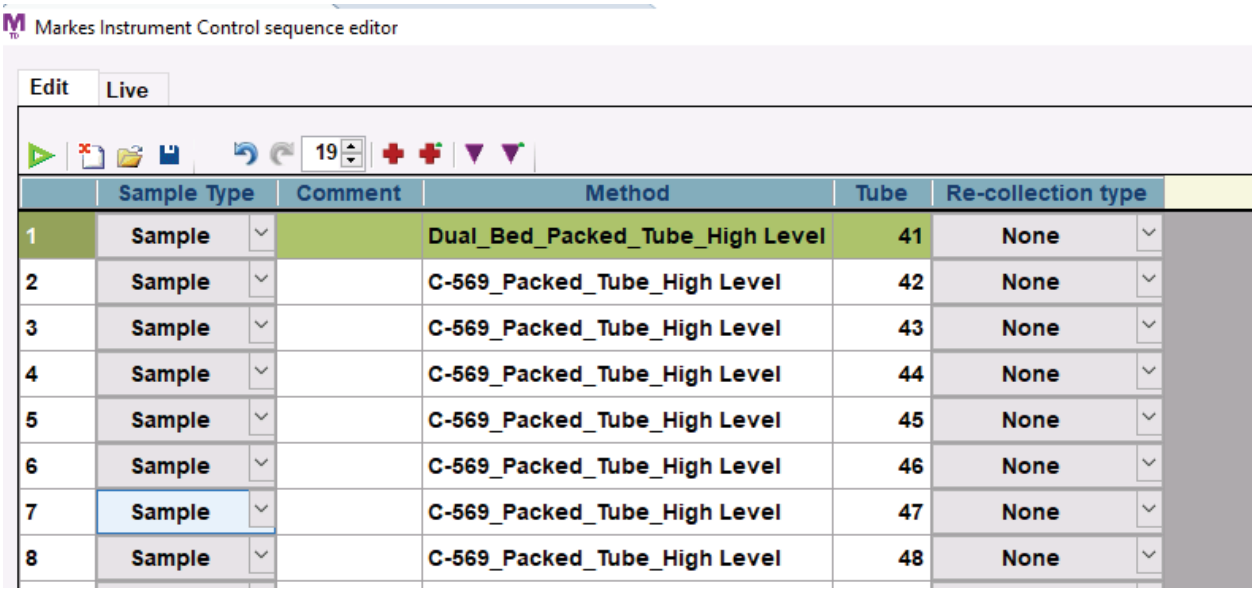
- Double-click in ‘Method’ field in sequence.
- Select new method from list.

16.4 Markes TD100-xr



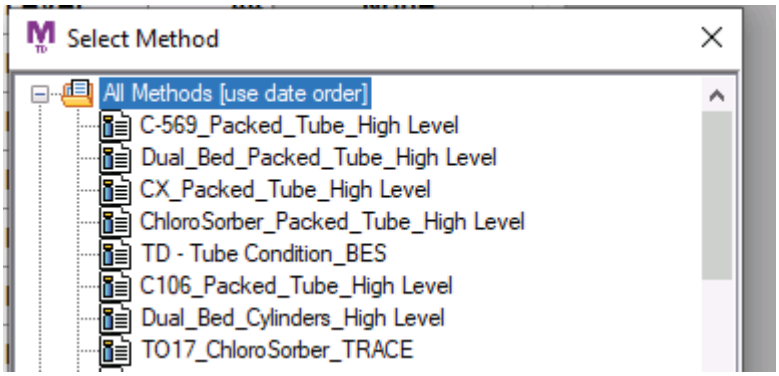
16.4.1 To create a sequence, click on ‘Sequence’ button.

16.4.2 Go to ‘Edit’ tab.



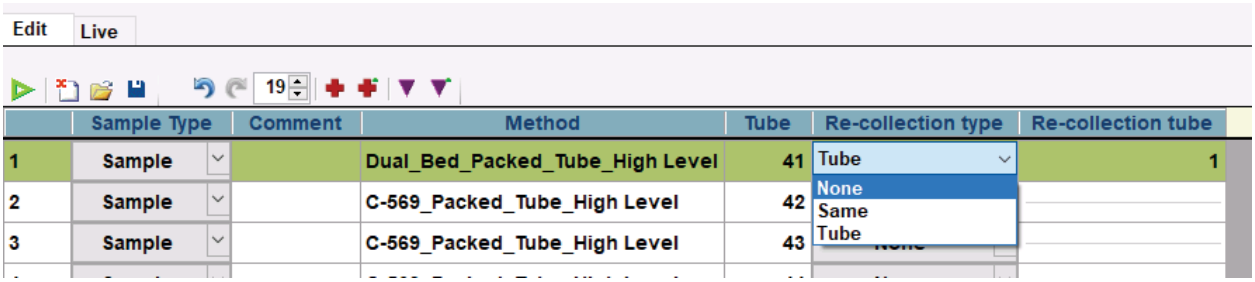
	Sample Type	Comment	Method	Tube	Re-collection type
1	Sample		Dual_Bed_Packed_Tube_High Level	41	None
2	Sample		C-569_Packed_Tube_High Level	42	None
3	Sample		C-569_Packed_Tube_High Level	43	None
4	Sample		C-569_Packed_Tube_High Level	44	None
5	Sample		C-569_Packed_Tube_High Level	45	None
6	Sample		C-569_Packed_Tube_High Level	46	None
7	Sample		C-569_Packed_Tube_High Level	47	None
8	Sample		C-569_Packed_Tube_High Level	48	None

- Select appropriate method by double clicking the method name (Analyze BFB Tune with ‘Dual_Bed_Packed_Tube_High_Level’ method).

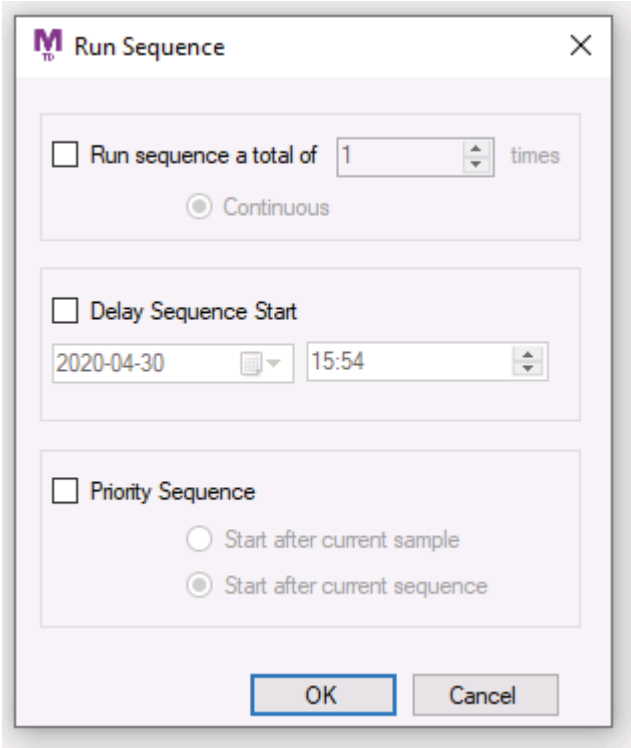


Sampler Type	Markes Method
Dual Bed Tube	Dual_Bed_Packed_Tube_High_Level
Carbopack X Tube	CX_Packed_Tube_High_Level
ChloroSorber (normal level)	ChloroSorbeer_Packed_Tube_High_Level
ChloroSorber (trace level)	TO17_ChloroSorber_TRACE
Chromosorb 106 Tube	C106_Packed_Tube_High_level
Beacon Sampler	Dual_Bed_Cylinders_High_Level
Fike Tube	Dual_Bed_Cylinders_High_Level

- Update tube number
- If sample needs recollection change Re-collection type to ‘Tube’ and update recollection tube number.



- When sequence is correct and trays are loaded press the play button.
- The software will validate the sequence and if acceptable a window will open to start run.



- Click ‘OK’ to start.

17 GC ANALYSIS PROCEDURE

17.1 Purge Samples

17.1.1 Use the Markes TC-20 to condition sorbent packed tubes; up to 20 packed tubes can be purged at a time on each unit.

17.1.2 Turn on the Ultra High Purity (UHP) Hydrogen so that flow is 100ml/min.

17.1.3 Loosen and remove the brass storage caps from the sampling tube.

17.1.4 Attach tubes to the purging manifold (sampling end first).

17.1.5 Purge samples 60 minutes with manifold in the holding rack, tubes vertically beneath manifold.

Note: ChloroSorber tubes require at least a 2-hour purge.

Note: Wet samples will require additional purge time.

Note: See SOP 16, 'Packing and Conditioning TO-17 Sampling Tubes' for additional information on purging samples.

17.1.6 After purging is complete, remove the purged tubes from the TC-20 one at a time and place Diff-Lok® caps on tubes (Deactivated on the grooved end) and stage them in analytical/sequential order in the autosampler trays.

17.1.7 USING DIFF-LOK® CAPS

- End of the tube with a groove is the sampling end De-activated silica-lined Diff-Lok® cap (blue or rainbow colored) will be placed on sampling/grooved end
- Opposite end place stainless steel cap
- When Dry Purge complete, attach the Diff-Lok® caps to the tube appropriately.
- Always check if O-ring replacement is necessary.
- Place the tube in the correct tray position with the sampling end facing the right side of the tray

17.2 Spiking Standards and Samples

17.2.1 Load samples in spiking rig and spike accordingly:

Element Name	Stock	Stock Conc. (ug/ml)	Amount Spiked (ul)	Final Concentration (ng)
SEQ-TUN1	20002	2000	0.2	---
Batch-BS1	97256	100	0.5	50
Batch-BLK1	92026(*)	200	0.5	100 (ISTD/SURR)
SEQ-ICV1	97270	100	0.5	50

Sample 1-20	92026(*)	200	0.5(1)	100 (ISTD/SURR)
SEQ-CCV1	97256	100	0.5	50

*10-fold Dilution of 92026 (see section 12.3)

(1)**Note:** When analyzing dilutions, see dilution work sheet for correct spike amounts.

17.2.2 Purge spiked samples for 30 seconds in spiking rig.

17.2.3 Load spiked tubes into Markes sample tube loading tray, in analytical order.

17.3 Chemstation Sequence

17.3.1 Electronic audit trail functions are available, via the ChemStation software, for the GC/MSD, and must be in use at all times, and the associated data must be retained. The Markes system does not have an electronic audit trail, but electronic records document the operation of these systems, and can be accessed from the path >*Network/ChemStation/UnityChem/Reports* for ChemStation and the equivalent path for ChemStation2, Chemstion 3. Chemstation 4 has text files describing the Markes sequence saved to the data hard drive.

17.3.2 Create new sequence in Excel to later transfer to ChemStation consisting of:

Standard/Sample	**Comments**
SEQ-TUN1	Bromofluorobenzene (BFB) Tune
Batch-BS1	LCS, Primary Source
Batch-BLK1	Lab Blank, Spiked with ISTD/SURR
SEQ-ICV1	LCSD, Second Source
Sample 1-20	<=20 samples per batch
SEQ-CCV1	

17.3.3 See latest revision of SOP 58, 'Batches and Bench Sheets in Element' and SOP 61, 'Sequences in Element'.

Note: Make sure the dilution factor is the first item in the comment column.

17.3.4 Start position numbering with the next available tube tray.

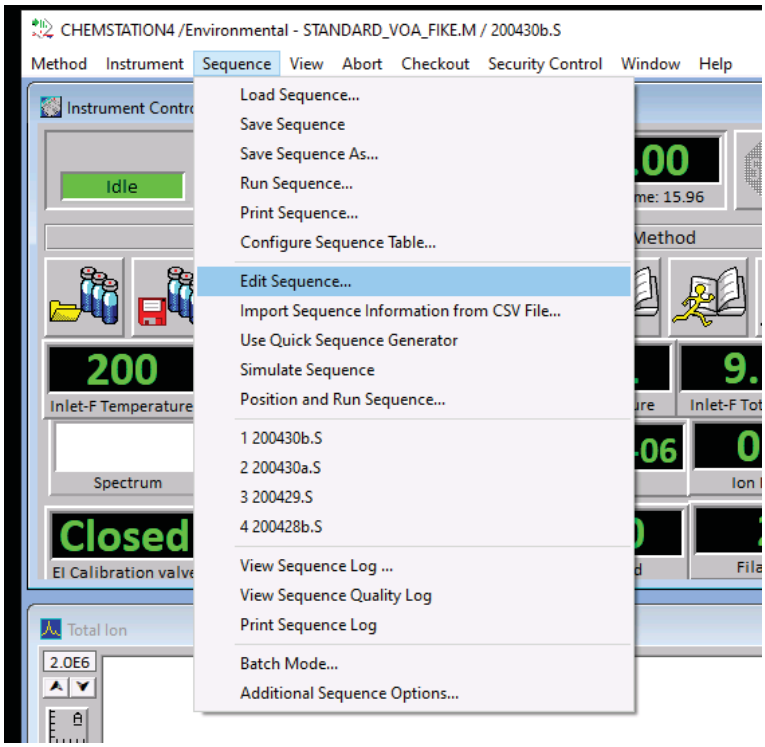
17.3.5 Paste in the ‘LabNumber’ and ‘SxName’ columns from the Excel sheet created in Element (see SOP 61, ‘Sequences in Element’) into the instrument sequence excel sheet.

17.3.6 Update ‘Data File ID’ using the format: instrument Letter date (ISO format) file number (i.e. K20043001).

17.3.7 Save Excel sheet.

17.3.8 Copy Excel sequence into Chemstation Sequence

- Edit Sequence



Data Path: D:\DATA\2020\04\K200428B Browse... Method Path: C:\MSDCHEM\1\METHODS

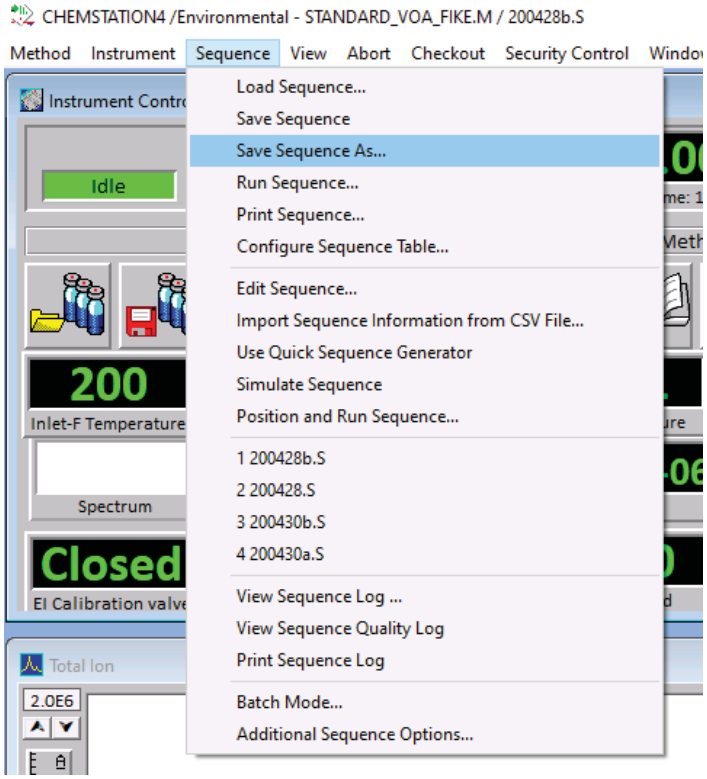
	Type	Vial	Sample	Method / Keyword	Data File	Comment / KeywordString	Multiplie
1	BFB	61	SEQ-TUN1	STANDARD_VOA	K20042812	Dual Bed	1.0
2	Blank	62	SEQ-ICB1	STANDARD_VOA	K20042813	C-569	1.0
3	Calibration	63	SEQ-CAL1	STANDARD_VOA	K20042814	C-569	1.0
4	Calibration	64	SEQ-CAL2	STANDARD_VOA	K20042815	C-569	1.0
5	Calibration	65	SEQ-CAL3	STANDARD_VOA	K20042816	C-569	1.0
6	Calibration	66	SEQ-CAL4	STANDARD_VOA	K20042817	C-569	1.0
7	Calibration	67	SEQ-CAL5	STANDARD_VOA	K20042818	C-569	1.0
8	Calibration	68	SEQ-CAL6	STANDARD_VOA	K20042819	C-569	1.0
9	Calibration	69	SEQ-CAL7	STANDARD_VOA	K20042820	C-569	1.0
10	Calibration	70	SEQ-CAL8	STANDARD_VOA	K20042821	C-569	1.0
11	Calibration	71	SEQ-CAL9	STANDARD_VOA	K20042822	C-569	1.0
12	Calibration	72	SEQ-CALA	STANDARD_VOA	K20042823	C-569	1.0
13	Calibration	73	SEQ-CALB	STANDARD_VOA	K20042824	C-569	1.0
14	Blank	74	Sys Blank	STANDARD_VOA	K20042825	Empty Tube	1.0
15	Blank	75	Sys Blank	STANDARD_VOA	K20042826	Empty Tube	1.0
16	Blank	76	Sys Blank	STANDARD_VOA	K20042827	Empty Tube	1.0
17	DailyCal	77	SEQ-ICV1	STANDARD_VOA	K20042828	C-569	1.0
18	Blank	78	SEQ-ICB1	STANDARD_VOA	K20042829	C-569	1.0
19	Sample	79	2.5ng	STANDARD_VOA	K20042830	C-569	1.0
20	Sample	80	LOD 5ng	STANDARD_VOA	K20042831	C-569	1.0
21	Sample	81	LOD 5ng	STANDARD_VOA	K20042832	C-569	1.0
22	Sample	82	LOD 5ng	STANDARD_VOA	K20042833	C-569	1.0
23	Sample	83	LOD 5ng	STANDARD_VOA	K20042834	C-569	1.0
24	Sample	84	LOQ 10ng	STANDARD_VOA	K20042835	C-569	1.0
25							

- Add or remove rows as needed by high-lighting row and right-clicking.
- To enable pasting into the Chemstation sequence, cut the contents of the entire column.
- Copy the columns from the Excel sequence, one at a time, and paste into the Chemstation sequence.

17.3.9 Select location for data files to be saved: Click 'Browse…' button and create folder for instrument and data.

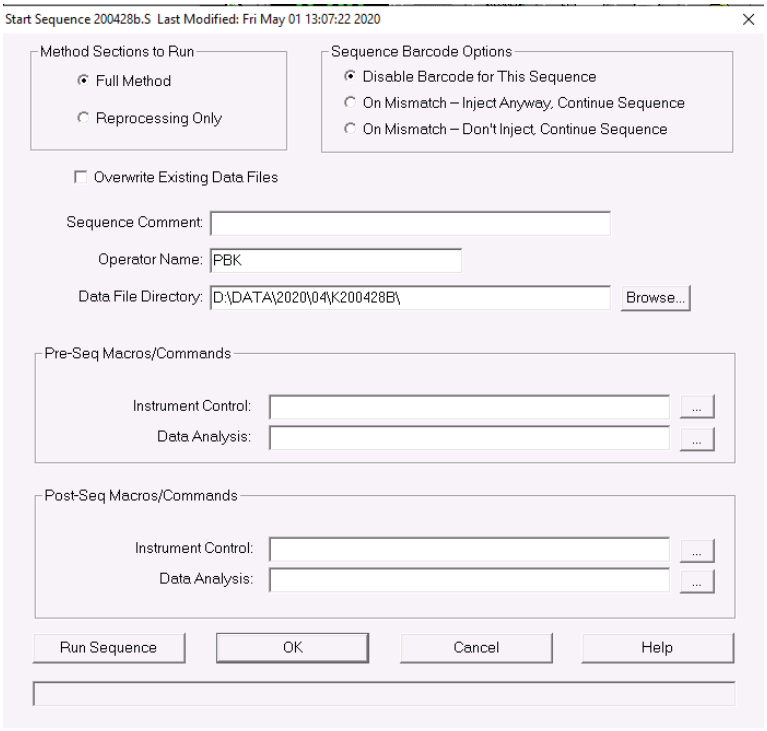
17.3.10 When completed click 'OK"

17.3.11 Save new sequence as instrument date (ISO format) (i.e. K200430)



17.3.12 Run Sequence:

- Verify that Chemstation sequence is queued and ready for analysis
- Sequence > Run Sequence…



- Verify operator name and data file directory are correct and click ‘Run Sequence’.
- Verify and start sequence on the Markes Software.
- Upon completion of the sequences, check the Markes software for any discrepancies in the sequence such as missed injections or leaks.
- Note the tube number and corresponding sample if a re-analysis and/or an o-ring replacement must be performed on sequence sheet printed from Element.

18 DATA ANALYSIS

18.1 File Management

18.1.1 Copy data from ChemStation computer to \\beaconGCMS\data\year\month

18.1.2 Put new data into the proper year month and date directory, create directory if necessary.

- Folder nomenclature remains the same as the sequence of the copied data files.

18.1.3 Analysis of TO-17 acquisition method is performed with the most recent calibration's analysis method

18.2 Quantitation Review

18.2.1 Team effort performed by Analyst, Laboratory Director, and Quality Manager see latest revision of SOP 17, 'Analytical Data Review' and SOP 62, 'Data Entry and Review in Element'.

18.2.2 After quantitation, generate pdf to include:

- ISTD Summary Report
- Tune
- Continuing Calibration Evaluation
- Raw Data for QC and Samples in Analysis Order

18.2.3 Save pdf into the appropriate job folder in the Lab Data\Quant Sheet section.

18.2.4 Pdf name should include the Element sequence number and instrument data folder name.

19 METHOD PERFORMANCE

See Section 4 for method performance information**.**

20 POLLUTION PREVENTION

Thermal desorption of air samples produces very little pollution, as sample preparation is kept to a minimum, vapor traps are used on the outlet of the gas chromatograph, and much of the sample introduced to the gas chromatograph is recollected. Small quantities of solvent are used to prepare the calibration standards and quality control standards, and all solvents used are disposed of in accordance with local, state and federal regulations.

21 DATA ASSESSMENT AND ACCEPTANCE CRITERIA

21.1 See sections 14 and 23

22

22 CORRECTIVE ACTIONS

22.1 Corrective action will be initiated when quality control criteria are not met. Refer to SOP-41 for the corrective action process.

23 CONTINGENCIES FOR HANDLING OUT-OF-CONTROL DATA

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Multi-point initial Calibration	Quarterly	RSD < 30%, or alternative model for more than five point calibration	Remake standard, rerun, or clean system then retune and recalibrate, evaluate
2nd source calibration verification, CALV	Quarterly	< 30% Difference	Remake standard, rerun, or clean system then retune and recalibrate
LCS / Calibration Verification	Prior to analysis	< 30% Difference	Remake standard, rerun, or clean system then retune and recalibrate
Internal Standards (IS)	All analysis requires internal standards	Within 40% of the IS areas on the CCV run for the sample group	Review for co-elution or masking, re-run if possible, other-wise discuss in report
Method Blank / Laboratory Blank	Prior to analysis, daily	No compounds detected above the LOQ, or Contract required reporting limit	Clean system with bake out, rerun method blank until system clean, retune and recalibrate
LCSD for all analytes	Prior to analysis, daily	70-130% recovery (DoD: use DoD LCS limits)	Remake standard, rerun, or clean system then retune and recalibrate
Surrogate Spike	Not required for TO-17, but used for internal purposes	70-130 % recovery (DoD, use DoD LCS limits)	For QA and field samples, correct the problem, then re-prepare all failed samples for failed surrogates, if sufficient sample is available. If obvious chromatographic interference with the surrogate is present, re-analysis may not be necessary. If data can not be reanalyzed, flag data and discuss in report if contracted to report surrogates
MDL study	Annually		

LOD/LOQ study	Quarterly		
BFB tuning[1]	Prior to analysis	Mass Ion Abundance[1] 50 8-40% of m/e 95 75 30-66% of m/e 95 95 base peak, 100% 96 5-9% of m/e 95 173 <2.0% of m/e 174 174 50-120% of m/e 95 175 4-9% of m/e 174 176 93-101% of m/e 174 177 5-9% of m/e 176	Clean the mass spectrometer, re-tune, recalibrate.
Limit of quantification (LOQ) and Limit of detection (LOD) demonstrations	Quarterly	LOQ is the lowest point on the curve, LOD is the lowest standard made where detectable amounts can be resolved above the base line.	Document and use these values for limits of reportable data.
Field Sample Duplicates	As required by contract	When comparing quantitative results, calculate relative percent difference (RPD) between the two samples. For the purpose of calculating correspondences, all non-detections should be assigned, as a baseline value, the CRQL for the specific contaminant. The RPD limit is 30%.	Flag failed duplicates. Discuss in report

[1]All ion abundance must be normalized to m/z 95, the nominal base peak, even though the ion abundance of m/z 174 may be up to 120% of that of m/z 95.

24 WASTE MANAGEMENT

24.1 Waste is minimized whenever possible, and recycling is used for glassware, paper and other recyclable items.

25 REFERENCES

17.2 Agilent 6890-5973 GC/MS with ChemStation Manual
17.3 Markes AutoSecure Thermal Desorption System with Recollection Manual
17.4 SOP 14, ‘Sample Receipt Storage Tracking and Disposition’
17.5 SOP 16, ‘Packing and Conditioning TO-17 Sampling Tubes’
17.6 SOP 17, ‘Analytical Data Review’
17.7 SOP 46, ‘Quality Control Evaluations’

17.8 SOP 62, 'Data Entry and Review in Element'
17.9 SOP 58, 'Batches and Bench Sheets in Element'
17.10 SOP 59, 'Calibrations in Element'
17.11 SOP 61, 'Sequences in Element'
17.12 SOP 65, 'Sample Receiving and Log-in in Element'
17.13 EPA Method TO-17, Determination of Volatile Organic Compounds in Ambient Air using Active Sampling onto Sorbent Tubes, Center for Environmental Research Information, Office of Research and Development, US Environmental Protection Agency, January 1999
17.14 EPA Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially Prepared-Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS), Second Edition, 1999.

26 EQUIPMENT/INSTRUMENT MAINTENANCE

26.1 All equipment and instruments are maintained in accordance with the manufacturer's recommendations, modified as necessary and appropriate based on the number of and type of samples analyzed.

27 COMPUTER HARDWARE AND SOFTWARE

27.1 This method uses Agilent ChemStation software to operate the GC/MSD and Markes International software to operate the Markes equipment.

28 TROUBLESHOOTING

28.1 Section 23 summarizes basic troubleshooting for this method. More advanced troubleshooting procedures can be found in the manufacturer's manuals for the Agilent gas chromatograph, mass selective detector, Markes AutoSecure Thermal Desorption System with Recollection and Markes TC-20.

Appendix A
Transferring samples to Packed tubes from Summa Canisters or Tedlar Bags

1.0 Summa Canister

Summa Canisters are pressurized, and the VASTVAS (Volumetric air sample transfer value apparatus and syringe) is used to transfer a sample from the Summa Canister to a packed tube. Figure 1, below, is a photograph of the VASTVAS.

A packed sorbent tube is attached to the free end of the VASTVAS. The sampling end of the tube is attached to the Summa Canister fitting usuing an appropriately sized Teflon® fitting, and the Summa cannister valve is incrementally opened. The needle valve is then opened, and the pressure in the syringe monitored. When the syringe indicates approximately 50 mL, the Summa Cannister valve is closed, and the pressure allowed to equilibrate. Once equilibrium is reached, the needle valve is closed,. Volume is recorded, or this procedure can be repeated until sufficient sample is collected on the packed sorbent tube. Record the final volume collected on the chain of custody form.

2.0 Tedlar Bags

Tedlar bags are not pressurized, and to sample from these systems, a low flow sampling pump is attached to the non-sampling end of the packed sorbent tube by tubing, and the sampling end of the tube is attached to the Tedlar bag via an appropriately sized Teflon® fitting. Measure the pump flow and sampling time to determine the volume of sample collected on the packed sorbent tube. Record pump flow and sampling time on the chain of custody form.

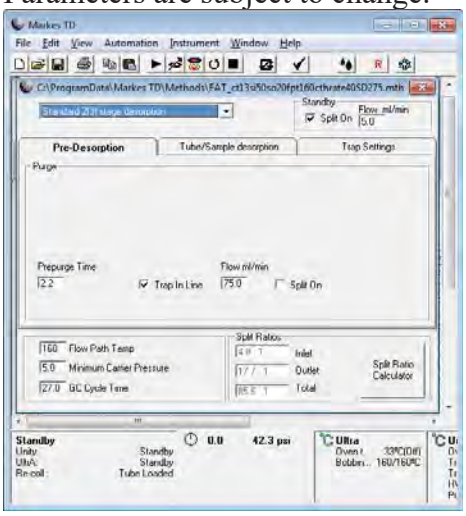
Appendix B
Performing analysis on three-bed-glass tube (~115 mm x ~6.35 mm o.d.)

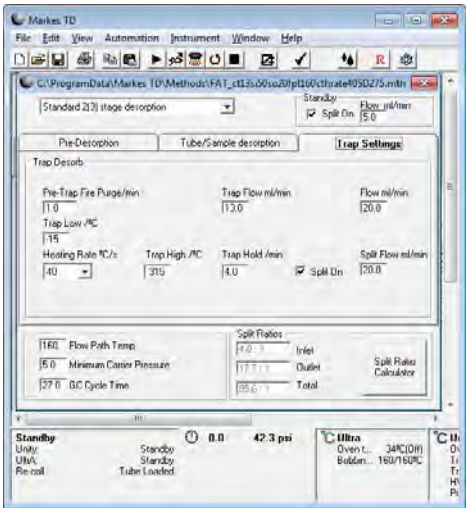
The Markes TD system must be configured for manual tube desorption with a tube heater that can accommodate the longer glass tube. The Markes TD system must be powered off to perform the manual reconfiguration. If the Markes TD system is not powered off parts will short out and will require replacement, breaking the system until parts can be ordered, delivered, and replaced.

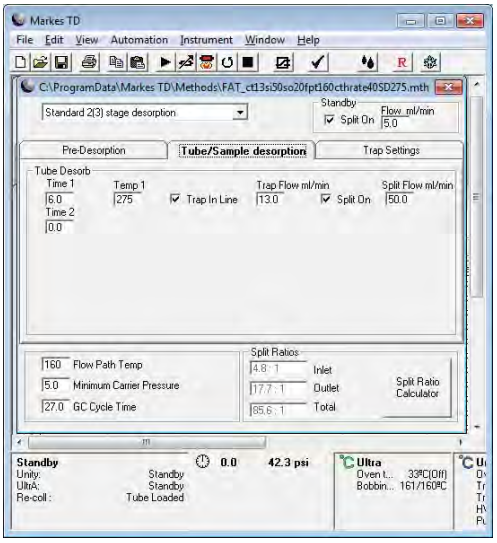
The 0.5 µL internal standards and surrogate injection is deposited into the glass wool of the numbered side of the glass tube. Notice, this side is where the tenax-gr bed is.

Immediately after spiking the glass tube, purge the spike into the tenax-gr bed for 0.5 minutes with Hydrogen. Immediately insert the sample tube into the Markes TD Unity once the spike/purge is completed.

Parameters are subject to change.

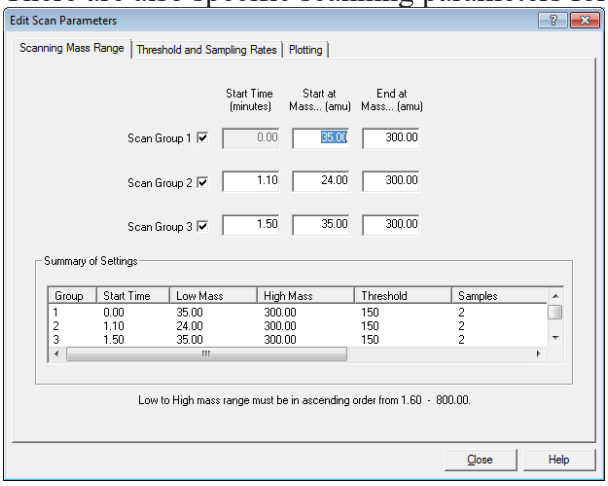




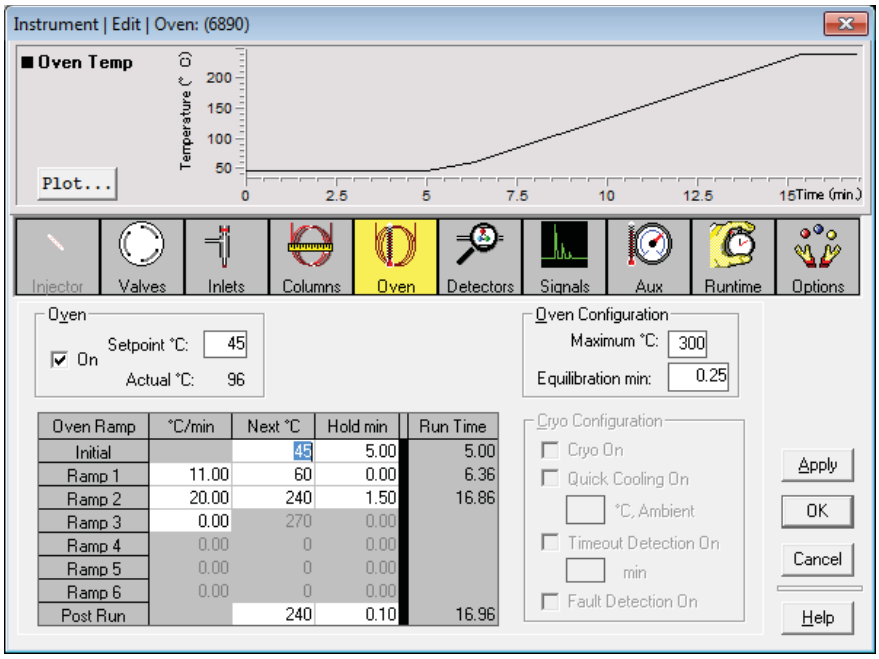


The tube desorption Temp1 is 275.

There are also specific scanning parameters for the FIKE method.



The oven program and the column are the standard ones used for 8260C/TO17 methods.



29 APPENDIX A: SOP ANNUAL REVIEW

The following document(s) has been reviewed as part of the annual review process:

Document	Rev. #	Reviewed by	Reviewed Date	Change needed?

30 APPENDIX B: READ AND UNDERSTOOD

I have read, and understand this revision of SOP 7, 'GC/MS Sample Analysis for Packed Tubes by EPA Methods TO-17 and TO-15, and agree to comply with the requirements within this document.

Employee	Signature	Date
Harry O'Neill	Digitally signed by Harry St. A. O'Neill DN: cn=Harry St. A. O'Neill, o=Beacon Environmental Services, Inc., ou, email=Harry.ONeill@Beacon-usa.com, c=US Date: 2020.06.10 11:18:01 -04'00'	
Ryan Schneider	Ryan W. Schneider Digitally signed by Ryan W. Schneider Date: 2020.06.02 12:21:58 -04'00'	
Ken Ifeacho	Kenny Ifeacho Digitally signed by Kenny Ifeacho DN: cn=Kenny Ifeacho, o=Beacon Environmental Services, ou=Laboratory, email=kenny.ifeacho@beacon-usa.com, c=US Date: 2020.06.02 13:44:04 -04'00'	
Chris Worrell	Christopher Worrell 2020.06.11 10:52:49 -04'00'	
Pete Kelly	Digitally signed by Peter B. Kelly DN: cn=Peter B. Kelly, o, ou, email=petebkelly@gmail.com, c=US Date: 2020.06.02 13:31:07 -04'00'	
Allison Felter	Digitally signed by Allison Felter DN: cn=Allison Felter, o=Beacon Environmental Services, ou, email=allison.felter@beacon-usa.com, c=US Date: 2020.06.02 13:17:29 -04'00'	
Steve Thornley	IDENTRUST 2020.05.28 14:42:02-04'00	

Beacon Environmental

Proprietary Information **Controlled Document**

Title: Standard Operating Procedures for the Collection and Return Shipment of Axial Type Passive Diffusion Samplers	**SOP No. 11 Rev.:** 05 Page 1 of 8
Reviewers: Ryan Schneider Ryan W. Schneider Digitally signed by Ryan W. Schneider Date: 2020.06.02 09:38:05 -04'00'	**Control #:** 1
Final Approval: Steve Thornley Steven C. Thornley IDENTRUST 2020.05.27 13:09:25-04'00'	**Date Approved**: 06/02/2020 Date Reviewed: 5/22/2020

Standard Operating Procedures for the

Collection and Return Shipment of Axial Type Passive Diffusion Samplers

Table of Contents

1. REVISION HISTORY (FOR REVISION .01 OR HIGHER) 1
2. PURPOSE 2
3. SCOPE 2
4. REQUIREMENTS 2
5. BACKGROUND 2
6. RELATED FORMS 2
7. ACRONYMS / DEFINITIONS 3
8. HEALTH AND SAFETY 3
9. MATERIALS AND EQUIPMENT 3
10. PRIOR TO FIELDWORK 3
11. SAMPLER COLLECTION 4
12. RETURN SHIPMENT/DELIVERY 6
13. APPENDIX A: SOP ANNUAL REVIEW 7
14. APPENDIX B: READ AND UNDERSTOOD 8

1. REVISION HISTORY (For Revision .01 or higher)

Rev. 02	Sections 7.1 and 7.2: Added (as needed) Section 8.2: Added watch (or means to measure time) Section 10.1.3: Added "Don nitrile gloves" Sections 10.1.4 and 10.1.5: Reversed the order of these sections Section 10.1.8: Moved "Close field kit and…" to first line of paragraph
Rev 03	Section 8.2: Added NIST traceable thermometer
Rev-04	Section 8.2: Removed requirement for NIST traceable thermometer. Section 10.1.6: Clarified purpose of temperature reading. Section 10.2.3: Clarified purpose of temperature reading.
Rev 05	Updated related forms (chain of custody records) Added TOC, fixed numbering

2. PURPOSE

This document provides a description of the process of collecting indoor air and ambient air samples using axial type passive diffusion samplers that consist of 6 mm o.d. by 89 mm long stainless steel tubes packed with a single bed of adsorbent. The following documents provide the user with guidance on sorbent selection, uptake rates for sorbents and associated target compounds, and the required time for sample collection.

> ASTM Standard D6196 *Standard Practice for Selection of Sorbents, Sampling, and Thermal Desorption Analysis Procedures for Volatile Organic Compounds in Air*
>
> ISO/IEC 16017-2 *Indoor, ambient and workplace air -- Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography -- Part 2: Diffusive sampling*
>
> ASTM D6306-10 *Standard Guide for Placement and Use of Diffusion Controlled Passive Monitors for Gaseous Pollutants in Indoor Air*

This SOP will provide the necessary steps for safely and successfully deploying and retrieving passive diffusion samplers indoors as well as outdoors, and the return shipment procedures to Beacon's laboratory or another laboratory for analyses.

3. SCOPE

This document is a guidance document and there are conditions which may arise that necessitate small variances from the steps listed. In those situations the field technician's professional judgment and field sampling plan are to be used and may supersede this document. Deviations from these SOPs are to be noted on the field notes.

4. REQUIREMENTS

4.1. All parties have been trained and have the proper equipment
4.2. Sampling equipment is in good working order
4.3. Hazards are identified and removed prior to sample collection

5. BACKGROUND

Axial type passive diffusion samplers consist of a stainless steel tube that is 6 mm o.d. by 89 mm long, packed with a single adsorbent, and capped on both ends with brass Swagelok™ caps during storage and transport. For sample collection, the brass Swagelok™ cap on the sampling end of the tube is removed to allow gas to diffuse into the tube.

> **Note:** Only one adsorbent can be packed in the tube when sampling in the passive mode. This is different than collecting samples using these tubes with pumps where two or more adsorbents can be packed in the tube and a volume of air is pulled over the sorbent beds.

There are three phases to the collection of passive diffusion samples: starting sample collection, ending sample collection, and shipping the samplers.

6. RELATED FORMS

6.1. Field Sampling Plan/Work Plan

6.2. Chain of Custody
6.3. Field Sampling Log

7. ACRONYMS / DEFINITIONS

7.1. ACRONYMS
- PPE – Personal Protective Equipment
- PDS – Passive Diffusion Sampler
- SOPs – Standard Operating Procedures

7.2. DEFINITIONS
- Sorbent tube – axial type passive diffusion sampler

8. Health and safety

8.1. PERSONAL PROTECTIVE EQUIPMENT (as needed)
- Safety Glasses
- Nitrile Gloves
- Steel-Toe Boots
- Hearing Protection (when working near industrial machinery)
- Hard Hats (if overhead dangers present)
- Additional PPE (appropriate to the hazards present and in accordance with Site Safety and Health Plans)

8.2. SAFETY (as needed)
- Safety Cones
- High Visibility Clothing
- Radio/Phone Communication

9. MATERIALS AND EQUIPMENT

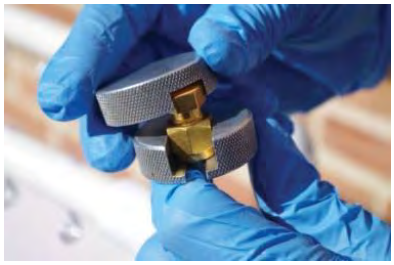
9.1. MATERIALS
- Ballpoint pen
- Roll of wire or string to suspend samplers
- Resealable Individual Sampler Bags
- Resealable Cap Storage Bag
- Resealable Return Shipment Bags

9.2. EQUIPMENT
- BESURE Sample Collection Kit™
- Diagonal wire cutters
- Set of disc wrenches or two adjustable wrenches
- Watch or other means of measuring time

10. PRIOR TO FIELDWORK

Before mobilization to the field, check the contents of the Kit against the packing list to verify item counts. The sorbent tubes are thermally conditioned prior to shipment; therefore, the tubes inventory check should be conducted without opening the plastic bags. Trip Blanks, if provided, are to remain sealed throughout the sample collection event and returned to the laboratory unopened.

Review the Site Safety and Health Plan (SSHP) and meet with Beacon's Safety Manager to discuss site hazards and determine what PPE is required to complete the work safely. Perform a vehicle, equipment,



and tool check to make sure all is in proper working condition. Strict adherence to Beacon's Health and Safety Program must be followed at all times.

11. SAMPLER COLLECTION

11.1. START SAMPLE COLLECTION:

11.1.1. At each survey point, take an individual re-sealable sampler bag containing a passive diffusion sampler (PDS) from the Kit. Using a ball-point pen, note on the Chain-of-Custody the tube ID number (etched on the side of the tube) and sampling location ID. Next, confirm the tube ID matches the ID recorded on the re-sealable bag's label and additionally record on the label the location ID. Do not use sharpies or other markers to record information because of the potential for contaminating the sorbent.

11.1.2. Determine the location and sampling height where the PDS will be collected and the amount of wire/string required to suspend the sampler. Using the wire cutters, cut the required length of wire string from the roll. Samples typically are collected in the breathing zone, which is generally considered to be 91 to 152 cm above the floor. However, at a minimum, the sample location should be at least 20 cm below the ceiling (and not near lighting or air vents), 50 cm above the floor, and 15 cm from a wall so as not be obstructed from air flow.

11.1.3. Don nitrile gloves. Remove a PDS from an individual sampler bag and wrap the end of the wire (or tie the end of the string) around the brass cap without the orange sticker. Using disc wrenches or small adjustable wrenches, loosen the brass cap with the ***orange sticker*** on the other side of the tube and slide the cap off the tube. This is the sampling end of the tube, which has one or more grooved rings near the end of the tube. **[Note:** ***A sample may only be collected from this end of the tube.***]

.

11.1.4. Hang the PDS with the wire/string so that the open end faces downward (see picture to right).

11.1.5. Place the removed brass cap in the original individual sampler bag that has the location ID noted on its label, store this bag with cap in the designated Cap Storage Bag, and place it back in the Kit

11.1.6. On the Chain of Custody record for that sample location the date and time of emplacement (to nearest minute). Also record other relevant information as available, including temperature (to be used as general information during data review.).

11.1.7. On the Field Sampling Log, note the position of the PDS with detail, including sampling height from the floor, distance from wall(s), ceiling height, proximity to HVAC vents, any potential sources of organic compounds that may be in the air, etc.

11.1.8. Close the field kit and move to next location and repeat steps 10.1.1-10.1.7 until all PSG Samplers have been deployed.

11.2. END SAMPLE COLLECTION:

11.2.1. At each location, match the tube ID recorded on the individual sampler bag label to the tube ID etched on the side of the tube to verify the PDS is placed in the correct sampler bag. Take the brass cap (with orange sticker) out of the bag and place it on top of the bag for easy access.

11.2.2. Retrieve the PDS and slide the brass cap onto the end of the tube until the tube comes to a stop against the plug. Next, finger-tighten the cap and then use the disc wrenches or adjustable wrenches to tighten the brass cap on the packed tube. Tighten the cap an additional 1/8th to 1/4 turn to ensure tightness. (You may not be able to achieve a full 1/4 turn, but you should not be able to slide the caps off when properly tightened.) Also, be careful not to over-tighten — crimping the end of the tube will prevent a proper seal.

11.2.3. Remove the wire or string from the other end of the tube and store the wire in the bottom compartment of the Kit for later disposal. Place the sealed PDS into its labeled bag, once again verifying the ID on the tube and sample location matches that on the bag. On the Chain-of-Custody record, note the date and time the sampling ended for that tube and other relevant information as available, including temperature (to be used as general information during data review.).

11.2.4. Place the individual sampler bag containing the PDS into the larger "Return Shipment Bag."

11.2.5. Repeat steps 10.2.1 through 10.2.4 until all passive diffusion samplers have been collected, sealed, and bagged.

12. RETURN SHIPMENT/DELIVERY

12.1. CHAIN OF CUSTODY

12.1.1. Following sample collection, verify that the sample collection information is complete on the Chain-of-Custody Record for each sample location.

12.1.2. Next, complete the sections of the Chain-of-Custody noting (i) the name and contact phone number of the person submitting the samples, (ii) the analytical method being requested, (iii) the expected turn-around time for reporting data, (iv) the unique number of the custody seal that will be used (see below), (v) any special instructions, and (vi) the signature and date of person relinquishing samples.

12.1.3. The Chain-of-Custody Record is to be returned to the laboratory with the samples. If possible, retain photocopies for your record.

12.2. SHIPMENT

12.2.1. Verify that all individually bagged passive diffusion samplers are stored in the Return Shipment Bag, which contains an adsorbent pak. Seal the Return Shipment Bag and place it in the upper tray of the Field Kit. Dispose of the used wire and/or string. Place the disc wrenches (if used) in their original bag and stow the disc wrenches in the upper tray of the Kit.

12.2.2. Securely package the tubes and other items in the Kit using bubble wrap if necessary. Seal the Kit using a provided tug-tight custody seal that has a unique ID (that is noted on the Chain of Custody Record), and place the Kit in a sturdy cardboard box (the same box that the kit was shipped or transported in, if possible). Use packing tape to seal the box along all seams.

12.2.3. Deliver the package directly to Beacon's laboratory or to an authorized shipping company (FedEx, UPS, DHL, etc.) for delivery to BEACON or an authorized laboratory.

13. Appendix A: SOP Annual Review

The following document(s) has been reviewed as part of the annual review process:

Document	Rev. #	Reviewed by	Reviewed Date	Change needed?

14. Appendix B: Read and Understood

I have read, and understand this revision of SOP 11, and agree to comply with the requirements within this document.

Employee	Signature	Date
Harry O'Neill	Digitally signed by Harry St. A. O'Neill DN: cn=Harry St. A. O'Neill, o=Beacon Environmental Services, Inc., ou, email=Harry.ONeill@Beacon-usa.com, c=US Date: 2020.06.10 11:20:31 -04'00'	
Ryan Schneider	Ryan W. Schneider Digitally signed by Ryan W. Schneider Date: 2020.06.02 09:38:24 -04'00'	
Ken Ifeacho	Kenny Ifeacho Digitally signed by Kenny Ifeacho DN: cn=Kenny Ifeacho, o=Beacon Environmental Services, ou=Laboratory, email=kenny.ifeacho@beacon-usa.com, c=US Date: 2020.06.02 13:47:36 -04'00'	
Chris Worrell	Christopher Worrell 2020.06.11 10:54:01 -04'00'	
Pete Kelly	Digitally signed by Peter B. Kelly DN: cn=Peter B. Kelly, o, ou, email=petebkelly@gmail.com, c=US Date: 2020.06.02 15:46:02 -04'00'	
Allison Felter	Digitally signed by Allison Felter DN: cn=Allison Felter, o=Beacon Environmental Services, ou, email=allison.felter@beacon-usa.com, c=US Date: 2020.06.02 14:04:28 -04'00'	
Steve Thornley	IDENTRUST 2020.05.28 13:59:43-04'00	

ATTACHMENT 2
RELEVANT QUALITY ASSURANCE PROJECT PLAN WORKSHEETS

This page intentionally blank

WORKSHEET #12 — MEASUREMENT PERFORMANCE CRITERIA

Matrix: Air
Analytical Group or Method: VOC/TO-17
Concentration Level: Low

DATA QUALITY INDICATOR (DQI)	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field Duplicates	RPD ≤ 30% when VOCs are detected in both samples ≥ sample-specific LOQ
Analytical Precision (laboratory)	Laboratory Control Sample Duplicates	RPD ≤ 30%
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	Analyte-specific (Below)
Overall accuracy/bias (contamination)	Trip Blanks	No target analyte concentrations ≥ LOQ
Comparability	Field Duplicates	RPD ≤ 30% when VOCs are detected in both samples ≥ sample-specific LOQ
Representativeness	Field Duplicates	RPD ≤ 30% when VOCs are detected in both samples ≥ sample-specific LOQ
	Trip Blanks	No target analyte concentrations ≥ LOQ
Sensitivity	LOD/LOQ/DL Study	LOQ>2X LOD>2X DL (see worksheet 15)
Completeness	All samples listed in project collected and analyzed.	All samples listed in project collected and analyzed.

ANALYTICAL ACCURACY/BIAS			
LCS: Analyte (VOC)	**CL_LL**	**CL_UL**	**RPD**
Vinyl Chloride	64	127	30
1,1-Dichloroethene	61	133	30
trans-1,2-Dichloroethene	67	124	30
cis-1,2-Dichloroethene	70	121	30
Trichloroethene	71	123	30
Tetrachloroethene	66	124	30
SURROGATES			
1,2-DCA-d4	70	130	
Toluene-d8	70	130	

Notes:
CL_LL = Control limit, lower limit
CL_UL = Control limit, upper limit
DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
RPD = relative percent difference
VOCs = volatile organice compounds

WORKSHEET #15 — PROJECT SCREENING LEVELS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Matrix: Air
Analytical Group or Method: VOC/TO-17
Concentration Level: Low

CHEMICAL	CAS NUMBER	PROJECT SCREENING LEVEL (µg /m³)	PROJECT SCREENING LEVEL REFERENCE	PROJECT QL GOAL (µg /m³)	LABORATORY-SPECIFIC[1]		
					LOQ (µg /m³)	LOD (µg /m³)	DL (µg /m³)
Tetrachloroethene	127-18-4	41	ADEC	4.1	0.42	0.21	0.11
Trichloroethene	79-01-6	2.0	ADEC	0.2	0.36	0.18	0.09
cis-1,2-Dichloroethene	156-59-2	NA	NA	NA	0.33	0.17	0.08
trans-1,2-Dichloroethene	156-60-5	790	ADEC	79	0.33	0.17	0.08
1,1-Dichloroethene	75-35-4	79	ADEC	7.9	0.51	0.26	0.13
Vinyl Chloride	75-01-4	1.7	ADEC	0.17	0.41	0.21	0.10

Notes:
[1] Laboratory-specific concentrations are based on a 30-day sampling period.

ADEC = Alaska Department of Environmental Conservation. 2017. *Vapor Intrusion Guidance for Contaminated Sites.* State of Alaska Department of Environmental Conservation, Division of Spill Prevention and Response Contaminated Sites Program. October.
DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
NA = not applicable
QL = quantitation limit
µg /m³ = micrograms per cubic meter

WORKSHEET #19 — ANALYTICAL SOP REQUIREMENTS TABLE

MATRIX	ANALYTICAL GROUP	ANALYTICAL AND PREPARATION METHOD / SOP REFERENCE	CONTAINERS	SAMPLE VOLUME	PRESERVATION REQUIREMENTS	MAXIMUM HOLDING TIME (PREPARATION / ANALYSIS)
Air	VOCs	USEPA TO17/SOP 7	Sorbent tube	NA	NA	30 days

Notes:
NA = not applicable
SOP = Standard Operating Procedure
VOCs = volatile organic compounds

WORKSHEET #21 — Field SOPs

SOP # OR REFERENCE	TITLE, REVISION, AND DATE (IF AVAILABLE)	ORIGINATING ORGANIZATION	SOP OPTION OR EQUIPMENT TYPE (IF SOP PROVIDES DIFFERENT OPTIONS)	MODIFIED FOR PROJECT?	COMMENTS
11	SOPs for the Collection and Return Shipment of Axial Type Passive Diffusion Samplers, Rev 5, June 2, 2020	Beacon Environmental	Applies to all equipment used for passive sampling of VOCs in air	No	

Notes:
SOP = Standard Operating Procedure
VOC = volatile organic compound

WORKSHEET #23 — ANALYTICAL SOP REFERENCES TABLE

LABORATORY SOP NUMBER	TITLE AND REVISION DATE	DEFINITIVE OR SCREENING DATA	MATRIX AND ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	MODIFIED FOR PROJECT WORK?
7	GC/MS Sample Analysis for Packed Tubes by EPA Methods TO-17 and TO-15, Rev 13, 5/27/2020	Definitive	Air / VOCs	TD-GC/MS	Beacon Environmental	No

Notes:
GC/MS = gas chromatography-mass spectrometry
VOCs = volatile organic compounds
SOP = Standard Operating Procedure

WORKSHEET #24 — ANALYTICAL INSTRUMENT CALIBRATION TABLE

Beacon Environmental Services, Inc. is accredited to ISO/IEC 17025:2017 and DoD Quality Systems Manual version 5.3 for Environmental Laboratories

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE
GCMS	Tune Check (BFB Tuning Verification)	Prior to ICAL, and prior to each 24-hour period of sample analysis	Ion abundance criteria as described in Table 2 or 3 of SOP 7, (EPA METHOD TO17)	1) Repeat BFB analysis 2) Retune instrument	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)
GCMS	See SOP 7, (EPA METHOD TO17) Initial Calibration (ICAL) – minimum of five levels for all analytes including surrogates	Minimum of Quarterly and Initially or if continuing calibration no longer meets criteria	Each analyte must meet one of the three options below: Option 1: RSD for each analyte ≤ 30% (Table B-21 DOD QSM 5.3 2019); Option 2: linear least squares regression for each analyte: r2 ≥ 0.99; Option 3: non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99.	Remake standard, reanalyze, then recalibrate. Minimum 5 levels for linear and 6 levels for quadratic with one calibration point at the same concentration as the daily CCV. The lowest calibration standard concentration at or below the LOQ. No samples shall be analyzed until ICAL has passed. Perform system maintenance if necessary	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)
GCMS	Retention Time window position establishment	Once per ICAL and at the beginning of the analytical sequence	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used. Calculated for each analyte and surrogate.	NA	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)
GCMS	Evaluation of Relative Retention Times (RRT)	With each sample.	RRT of each reported analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL After maintenance is performed which may affect retention times, RRTs may be updated based on the daily CCV. RRTs shall be compared with the most recently updated RRTs.	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)
GCMS	Initial Calibration Verification (ICV or LCSD)	Once after each ICAL, analysis of second source standard prior to sample analysis.	Percent difference of +/-30% (Table B-21 DOD QSM 5.3 2019)	1) Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration. 2) Problem must be corrected. Samples may not be analyzed until there is a valid ICV.	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE
GCMS	Continuing Calibration Verification (CCV or LCS)	Daily before sample analysis; after every 12 hours of analysis time; and at the end of the analytical batch run.	Concentration the same as the mid-point calibration standard (or lower). All reported analytes within +/-30% of true value. Note: If CCV is biased high and analyte is ND (not detected) results are acceptable. It will be noted in case narrative. All reported analytes and surrogates withing +/-50% for end of analytical batch Closing CCV	1) Reanalyze CCV [DoD: Analyze two additional CCVs] 2) Identify and correct problem; re-analyze or if necessary, qualify the data (if reanalysis not possible). 3) Repeat initial calibration if CCV corrective action is unsuccessful.	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)
GCMS	Method Blank (MB)	One per preparatory batch	No analytes detected > 1/2 LOQ or 1/10 the amount measured in any associated sample, or 1/10 the regulatory limit, whichever is greater. Common contaminants must not be detected > LOQ.	Correct problem. If required, re-prep and reanalyzed MB and all samples processed with the contaminated blank.	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)
GCMS	Internal Standards (IS)	All samples, duplicates, blanks and standards	**ICAL Standards** The area response for each internal standard must be within 40% of the mean area response of the calibration standards for each internal standard. The retention time shift for each internal standard at each calibration level must be within 20 seconds of the mean retention time of the calibration standards for each internal standard. **Field Samples, Blanks & QC** RT of each IS must be within +/-0.33 minutes of the most recent initial calibration.	1) Identify and correct the problem 2) Reanalyze the sample unless obvious matrix interference exists. 3) Problem persists, qualify data (if reanalysis not possible).	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17) (Fluorobenzene, Chlorobenzene-d5, 1,4-Dichlorobenzene-d4)
GCMS	Surrogate Standards	All samples, duplicates, blanks and standards	70-130% recovery unless specified in DOD QSM 5.3, see Table C-43 Method TO-15 Gas Matrix in DOD QSM Version 5.3 2019	1) Identify and correct the problem 2) Reanalyze the sample unless obvious matrix interference exists 3) If problem persists, qualify data	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)
GCMS	Limit of Quantitation (LOQ)	Quarterly verification required	1) At or above the low standard of the current initial calibration. 2) % recovery for each analyte within laboratory generated control limits.	1) Reanalyze 2) Identify and correct problem; reanalyze. 3) Repeat verification at higher level to set higher LOQ if corrective action is unsuccessful.	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION (CA)	PERSON RESPONSIBLE FOR CA	SOP REFERENCE
GCMS	Detection Limit (DL) with Limit of Detection Verification	Quarterly verification required	Limit of Detection Verification - Response with a minimum signal to noise ratio of 3:1	1) Repeat detection limit determination and LOD verification at higher concentration or perform and pass two consecutive LOD verifications at a higher concentration and set the LOD at the higher concentration.	Dept. Supervisor, however other trained analysts in the team may be responsible.	SOP 7, (EPA METHOD TO17)

Analyte (VOC)	Calibration Range (ng)	Calibration points	RSD Acceptance	Linear Range Acceptance	Quadratic Acceptance
Vinyl Chloride	2.5-1000	11	<30%	≥0.99	≥0.99
1,1-Dichloroethene	2.5-1000	11	<30%	≥0.99	≥0.99
trans-1,2-Dichloroethene	2.5-1000	11	<30%	≥0.99	≥0.99
cis-1,2-Dichloroethene	2.5-1000	11	<30%	≥0.99	≥0.99
Trichloroethene	2.5-1000	11	<30%	≥0.99	≥0.99
Tetrachloroethene	2.5-1000	11	<30%	≥0.99	≥0.99

WORKSHEET #25 — ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION TABLE

Beacon Environmental is accredited to ISO/IEC 17025:2017 and DoD Quality Systems Manual for Environmental Laboratories, Version 5.3

INSTRUMENT / EQUIPMENT	MAINTENANCE ACTIVITY	TESTING ACTIVITY	INSPECTION ACTIVITY	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	RESPONSIBLE PERSON	SOP REFERENCE
TD-GC/MS	Transfer Line	Preventative	Check for leaks and O-ring wear, check cold trap (front Tenax trap),	When responses start to drop, and tune fails.	Tune and CCV pass criteria	Tighten ferrules, inspect for leaks, and check the alignment	Analyst	Beacon Environmental's Quality System Manual, Rev. 9, 9/11/19 and SOP 20, rev. 7, 5/28/20
TD-GC/MS	Detector	Preventative	Clean detector, change pump oil	When responses start to drop, and tune fails.	Tune passes, air, and water not present in the scan.	Dissemble detector and check parts; check filaments, reanalyze tune.	Analyst	Beacon Environmental's Quality System Manual, Rev. 9, 9/11/19 and SOP 20, rev. 7, 5/28/20

WORKSHEET #26 & 27 — SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Beacon Environmental is accredited to ISO/IEC 17025:2017 and DoD Quality Systems Manual for Environmental Laboratories, Version 5.3

ACTIVITY	ORGANIZATION AND TITLE OR POSITION OF PERSON RESPONSIBLE FOR THE ACTIVITY	SOP REFERENCE
Sample labeling		
Chain-of-custody form completion		
Packaging		
Shipping coordination		
Sample receipt, inspection, & log-in	Beacon Environmental Chemist I	Sample Receipt, Storage, Tracking, and Disposition, SOP 14, Rev 16 June 27, 2020
Sample custody and storage	Beacon Environmental Chemist I	Sample Receipt, Storage, Tracking, and Disposition, SOP 14, Rev 16 June 27, 2020
Sample disposal	Beacon Environmental Chemist I	Sample Receipt, Storage, Tracking, and Disposition, SOP 14, Rev 16 June 27, 2020

WORKSHEET #28 — LABORATORY QC SAMPLES TABLE

Matrix: Air
Analytical Group or Method: VOC/TO-17
Concentration Level: Low

QC SAMPLE	FREQUENCY / NUMBER	METHOD / SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
Tune Check	Before ICAL and before each 12 hours of sample analysis.	Specific ion abundance criteria of BFB from method.	Retune instrument and verify.	Analyst / Laboratory Quality Assurance Officer		Specific ion abundance criteria of BFB from method.
Calibration (ICAL)	Quarterly	RSD $\leq$ 30% Linear $r^2 \geq 0.99$ Quadratic $r^2 \geq 0.99$	Correct problem, repeat ICAL	Analyst / Laboratory Quality Assurance Officer		Minimum 5 levels for linear and 6 levels fro quadratic with one calibration point same as daily CCV; Lowest standard at or below LOQ; No samples shall be analyzed until ICAL has passed
Evaluation of Relative Retention times (RRT)	With each sample	RRT $\pm$ 0.06 RRT units	Correct problem and rerun ICAL	Analyst / Laboratory Quality Assurance Officer		RRTs shall be compared with the most recently updated RRts
Initial Calibration Verification (ICV)	One per preparatory batch of up to 20 samples.	QC acceptance criteria +/- 30% of true value for all QA/QC analytes and target analytes	Correct problem, reprep and reanalyze LCSD and all samples in associated batch for failed analytes. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	All target analytes w/in +/- 30%	All target analytes in samples found to be within +/- 30%
Method Blank	1 per prep. batch of up to 20 samples	No analytes detected > ½ reporting limit (RL), 1/10 the amount measured in any sample, or 1/10 the regulatory limit, whichever is greater.	Reprep and reanalyze the method blank and all samples processed with the contaminated blank. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	No common laboratory chemicals on method blank	The concentration of any target analyte (chemical of concern) in the blank exceeds 1/2 the LOQ or is greater than 1/10th the amount measured in any associated sample, or 1/10th the regulatory limit, whichever is greater;

QC SAMPLE	FREQUENCY / NUMBER	METHOD / SOP QC ACCEPTANCE LIMITS	CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR CORRECTIVE ACTION	DATA QUALITY INDICATOR (DQI)	MEASUREMENT PERFORMANCE CRITERIA
LCS containing all analytes (CCV)	1 per prep batch of up to 20 samples	QC acceptance criteria +/- 30 of true value for all QA/QC analytes and target analytes, unless listed in DoD/DOE QSM 5.3 Appendix C 2019	Correct problem, reprep and reanalyze LCS and all samples in associated batch for failed analytes. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	All target compounds w/in +/- 30%, unless listed in DoD/DOE QSM 5.3 Appendix C 2019	All target analytes in samples found to be within +/- 30%, unless listed in DoD/DOE QSM 5.3 Appendix C 2019
LCSD (second source) (ICV)	One per preparatory batch of up to 20 samples.	QC acceptance criteria +/- 30% of true value for all QA/QC analytes and target analytes	Correct problem, reprep and reanalyze LCSD and all samples in associated batch for failed analytes. If problem persists, call PM.	Analyst / Laboratory Quality Assurance Officer	All target analytes w/in +/- 30%	All target analytes in samples found to be within +/- 30%
Internal standards (IS)	Each sample, standard, and QC sample	Retention time +/- 10 seconds from retention time of the calibration mid-point standard and extracted ion current profile area within 60-140 percent of area from IS calibration midpoint standard.	Inspect mass spectrometer and GC for malfunctions and make corrections as appropriate. Reanalysis of samples that were analyzed while system was malfunctioning is mandatory, if possible, qualify data.	Analyst / Laboratory Quality Assurance Officer		Retention time +/- 10 seconds from retention time of the calibration mid-point standard and extracted ion current profile area within 60-140 percent of area from IS calibration midpoint standard.
Surrogates	Each sample, standard, and QC sample	70-130%, unless listed in DoD/DOE QSM 5.3 Appendix C 2019	Identify and correct problem. If necessary, re-prepare and re-analyze method blank and associated samples. If matrix effect is verified, reanalysis is not needed, and discuss in narrative.	Analyst / Laboratory Quality Assurance Officer		70-130%, unless listed in DoD/DOE QSM 5.3 Appendix C 2019
Closing Calibration Check	One per preparatory batch of up to 20 samples.	50-150%	All reported analytes and surrogates within +/- 50% for end of analytical batch CCV.	Analyst / Laboratory Quality Assurance Officer	All target analytes within +/- 50%	All target analytes within +/- 50%

ANALYTICAL ACCURACY/BIAS			
LCS: Analyte (VOC)	**CL_LL**	**CL_UL**	**RPD**
Vinyl Chloride	64	127	30
1,1-Dichloroethene	61	133	30
trans-1,2-Dichloroethene	67	124	30
cis-1,2-Dichloroethene	70	121	30
Trichloroethene	71	123	30
Tetrachloroethene	66	124	30
SURROGATES			
1,2-DCA-d4	70	130	
Toluene-d8	70	130	

Notes:
CL_LL = Control limit, lower limit
CL_UL = Control limit, upper limit
RPD = relative percent difference
VOC = volatile organic compounds

WORKSHEET #30 — ANALYTICAL SERVICES TABLE

MATRIX	ANALYTICAL GROUP	ANALYTICAL METHOD	DATA PACKAGE TURNAROUND TIME	LABORATORY / ORGANIZATION (NAME AND ADDRESS, CONTACT PERSON AND TELEPHONE NUMBER)	BACKUP LABORATORY / ORGANIZATION (NAME AND ADDRESS, CONTACT PERSON AND TELEPHONE NUMBER)
Air	VOCs	EPA TO17	15 business days	Beacon Environmental Harry O'Neill 2203A Commerce Road, Suite 1, Forest Hill, MD 21050 (410) 838-8780	NA
Air	TPH	EPA TO17	15 business days	Beacon Environmental Harry O'Neill 2203A Commerce Road, Suite 1, Forest Hill, MD 21050 (410) 838-8780	NA

ATTACHMENT 3
LABORATORY ACCREDITATIONS

This page intentionally blank

THE STATE of ALASKA
GOVERNOR MICHAEL J. DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program
Laboratory Approval Program

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.465.5390
Fax: 907.269.7649
cs.lab.cert@alaska.gov

March 21, 2019

Steve Thornley
Beacon Environmental Services, Inc.
2203A Commerce Rd, Suite 1
Forest Hill, MD 21050

RE: Contaminated Sites Laboratory Approval **19-002**

Thank you for submitting an application to the Alaska Department of Environmental Conservation's Contaminated Sites Laboratory Approval Program (CS-LAP), on March 20, 2019. Based on your lab's Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) approval through Perry Johnson Laboratory Accreditation, Inc. (PJLA), Beacon Environmental Services, Inc., located at the above address, is granted ***Approved*** status to perform the analyses listed in the attached *Scope of Approval*, for Alaska contaminated sites projects, including underground storage tanks and leaking underground storage tank sites (UST/LUST), under the July 1, 2017 amendments to 18 AAC 78. This approval is effective March 21, 2019, and expires on ***October 31, 2020***.

Be aware that **any** changes in your NELAP or DoD-ELAP approval status must be reported to the CS program within 3 business days. Failure to do so will result in revocation of **all** CS-LAP approvals for a period of one year. Notification should be in writing sent to cs.lab.cert@alaska.gov. We recommend also contacting the CS-LAP by telephone to verify that the message was received.

Please remember to include the laboratory's ID number, listed above, on all correspondence concerning the laboratory. To apply for renewal of your approval, please complete the application found on the CS-LAP webpage and submit to cs.submittals@alaska.gov. The required documentation must be submitted for renewal no later than 30 days before your date of expiration.

If you have any questions, please contact the CS-LAP at (907) 465-5390, or by email at cs.lab.cert@alaska.gov. Labs are also highly encouraged to join the CS-LAP listserv by going to http://list.state.ak.us/mailman/listinfo/cs.lab.approval.

Respectfully,

Brian Englund

Attachment: Scope of Approval

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
1-43-2	Air	Benzene	8260C	PJLA
71-43-2	Air	Benzene	TO-15	PJLA
71-43-2	Air	Benzene	TO-17	PJLA
108-86-1	Air	Bromobenzene	8260C	PJLA
108-86-1	Air	Bromobenzene	TO-15	PJLA
108-86-1	Air	Bromobenzene	TO-17	PJLA
74-97-5	Air	Bromochloromethane	8260C	PJLA
74-97-5	Air	Bromochloromethane	TO-17	PJLA
75-27-4	Air	Bromodichloromethane	TO-15	PJLA
75-25-2	Air	Bromoform	8260C	PJLA
75-25-2	Air	Bromoform	TO-15	PJLA
75-25-2	Air	Bromoform	TO-17	PJLA
104-51-8	Air	Butylbenzene, n-	8260C	PJLA
104-51-8	Air	Butylbenzene, n-	TO-15	PJLA
104-51-8	Air	Butylbenzene, n-	TO-17	PJLA
135-98-8	Air	Butylbenzene, sec-	8260C	PJLA
135-98-8	Air	Butylbenzene, sec-	TO-15	PJLA
135-98-8	Air	Butylbenzene, sec-	TO-17	PJLA
98-06-6	Air	Butylbenzene, tert-	8260C	PJLA
98-06-6	Air	Butylbenzene, tert-	TO-15	PJLA
98-06-6	Air	Butylbenzene, tert-	TO-17	PJLA
75-15-0	Air	Carbon Disulfide	8260C	PJLA
75-15-0	Air	Carbon Disulfide	TO-15	PJLA
75-15-0	Air	Carbon Disulfide	TO-17	PJLA
56-23-5	Air	Carbon Tetrachloride	8260C	PJLA
56-23-5	Air	Carbon Tetrachloride	TO-15	PJLA
56-23-5	Air	Carbon Tetrachloride	TO-17	PJLA
3114-55-4	Air	Chlorobenzene	8260C	PJLA
108-90-7	Air	Chlorobenzene	TO-15	PJLA
108-90-7	Air	Chlorobenzene	TO-17	PJLA
67-66-3	Air	Chloroform	8260C	PJLA
67-66-3	Air	Chloroform	TO-15	PJLA
67-66-3	Air	Chloroform	TO-17	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
98-82-8	Air	Cumene	8260C	PJLA
98-82-8	Air	Cumene	TO-15	PJLA
98-82-8	Air	Cumene	TO-17	PJLA
124-48-1	Air	Dibromochloromethane	8260C	PJLA
124-48-1	Air	Dibromochloromethane	TO-15	PJLA
124-48-1	Air	Dibromochloromethane	TO-17	PJLA
106-93-4	Air	Dibromoethane, 1,2- (Ethylene Dibromide)	8260C	PJLA
106-93-4	Air	Dibromoethane, 1,2- (Ethylene Dibromide)	TO-15	PJLA
106-93-4	Air	Dibromoethane, 1,2- (Ethylene Dibromide)	TO-17	PJLA
74-95-3	Air	Dibromomethane (Methylene Bromide)	8260C	PJLA
74-95-3	Air	Dibromomethane (Methylene Bromide)	TO-15	PJLA
74-95-3	Air	Dibromomethane (Methylene Bromide)	TO-17	PJLA
95-50-1	Air	Dichlorobenzene, 1,2-	8260C	PJLA
95-50-1	Air	Dichlorobenzene, 1,2-	TO-15	PJLA
95-50-1	Air	Dichlorobenzene, 1,2-	TO-17	PJLA
541-73-1	Air	Dichlorobenzene, 1,3-	8260C	PJLA
541-73-1	Air	Dichlorobenzene, 1,3-	TO-15	PJLA
541-73-1	Air	Dichlorobenzene, 1,3-	TO-17	PJLA
106-46-7	Air	Dichlorobenzene, 1,4-	8260C	PJLA
106-46-7	Air	Dichlorobenzene, 1,4-	TO-15	PJLA
106-46-7	Air	Dichlorobenzene, 1,4-	TO-17	PJLA
75-71-8	Air	Dichlorodifluoromethane (Freon-12)	8260C	PJLA
75-71-8	Air	Dichlorodifluoromethane (Freon-12)	TO-15	PJLA
75-71-8	Air	Dichlorodifluoromethane (Freon-12)	TO-17	PJLA
75-34-3	Air	Dichloroethane, 1,1-	8260C	PJLA
107-06-2	Air	Dichloroethane, 1,2-	8260C	PJLA
107-06-2	Air	Dichloroethane, 1,2-	TO-15	PJLA
107-06-2	Air	Dichloroethane, 1,2-	TO-17	PJLA
75-35-4	Air	Dichloroethylene, 1,1-	8260C	PJLA
75-35-4	Air	Dichloroethylene, 1,1-	TO-15	PJLA
75-35-4	Air	Dichloroethylene, 1,1-	TO-17	PJLA
156-59-2	Air	Dichloroethylene, 1,2-cis-	8260C	PJLA
156-59-2	Air	Dichloroethylene, 1,2-cis-	TO-15	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
156-59-2	Air	Dichloroethylene, 1,2-cis-	TO-17	PJLA
156-60-5	Air	Dichloroethylene, 1,2-trans-	8260C	PJLA
156-60-5	Air	Dichloroethylene, 1,2-trans-	TO-15	PJLA
156-60-5	Air	Dichloroethylene, 1,2-trans-	TO-17	PJLA
78-87-5	Air	Dichloropropane, 1,2-	8260C	PJLA
78-87-5	Air	Dichloropropane, 1,2-	TO-15	PJLA
78-87-5	Air	Dichloropropane, 1,2-	TO-17	PJLA
542-75-6	Air	Dichloropropene, 1,3-	8260C	PJLA
542-75-6	Air	Dichloropropene, 1,3-	TO-15	PJLA
542-75-6	Air	Dichloropropene, 1,3-	TO-17	PJLA
123-91-1	Air	Dioxane, 1,4-	8260C	PJLA
123-91-1	Air	Dioxane, 1,4-	TO-15	PJLA
123-91-1	Air	Dioxane, 1,4-	TO-17	PJLA
100-41-4	Air	Ethylbenzene	8260C	PJLA
100-41-4	Air	Ethylbenzene	TO-15	PJLA
100-41-4	Air	Ethylbenzene	TO-17	PJLA
87-68-3	Air	Hexachlorobutadiene	8260C	PJLA
87-68-3	Air	Hexachlorobutadiene	TO-15	PJLA
87-68-3	Air	Hexachlorobutadiene	TO-17	PJLA
67-72-1	Air	Hexachloroethane	8260C	PJLA
67-72-1	Air	Hexachloroethane	TO-15	PJLA
67-72-1	Air	Hexachloroethane	TO-17	PJLA
108-10-1	Air	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260C	PJLA
108-10-1	Air	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	TO-15	PJLA
108-10-1	Air	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	TO-17	PJLA
1634-04-4	Air	Methyl tert-Butyl Ether (MTBE)	8260C	PJLA
1634-04-4	Air	Methyl tert-Butyl Ether (MTBE)	TO-15	PJLA
1634-04-4	Air	Methyl tert-Butyl Ether (MTBE)	TO-17	PJLA
75-09-2	Air	Methylene Chloride	8260C	PJLA
75-09-2	Air	Methylene Chloride	TO-15	PJLA
75-09-2	Air	Methylene Chloride	TO-17	PJLA
91-57-6	Air	Methylnaphthalene, 2-	8260C	PJLA
91-57-6	Air	Methylnaphthalene, 2-	TO-15	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
91-57-6	Air	Methylnaphthalene, 2-	TO-17	PJLA
91-20-3	Air	Naphthalene	8260C	PJLA
91-20-3	Air	Naphthalene	TO-15	PJLA
91-20-3	Air	Naphthalene	TO-17	PJLA
103-65-1	Air	Propyl benzene	8260C	PJLA
103-65-1	Air	Propyl benzene	TO-15	PJLA
103-65-1	Air	Propyl benzene	TO-17	PJLA
100-45-5	Air	Styrene	8260C	PJLA
100-42-5	Air	Styrene	TO-15	PJLA
100-42-5	Air	Styrene	TO-17	PJLA
630-20-6	Air	Tetrachloroethane, 1,1,1,2-	8260C	PJLA
630-20-6	Air	Tetrachloroethane, 1,1,1,2-	TO-15	PJLA
630-20-6	Air	Tetrachloroethane, 1,1,1,2-	TO-17	PJLA
79-34-5	Air	Tetrachloroethane, 1,1,2,2-	8260C	PJLA
79-34-5	Air	Tetrachloroethane, 1,1,2,2-	TO-15	PJLA
79-34-5	Air	Tetrachloroethane, 1,1,2,2-	TO-17	PJLA
127-18-4	Air	Tetrachloroethene	8260C	PJLA
127-18-4	Air	Tetrachloroethene	TO-15	PJLA
127-18-4	Air	Tetrachloroethene	TO-17	PJLA
108-88-3	Air	Toluene	8260C	PJLA
108-88-3	Air	Toluene	TO-15	PJLA
108-88-3	Air	Toluene	TO-17	PJLA
76-13-1	Air	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260C	PJLA
76-13-1	Air	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	TO-15	PJLA
76-13-1	Air	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	TO-17	PJLA
87-61-6	Air	Trichlorobenzene, 1,2,3-	8260C	PJLA
87-61-6	Air	Trichlorobenzene, 1,2,3-	TO-15	PJLA
87-61-6	Air	Trichlorobenzene, 1,2,3-	TO-17	PJLA
120-82-1	Air	Trichlorobenzene, 1,2,4-	8260C	PJLA
120-82-1	Air	Trichlorobenzene, 1,2,4-	TO-15	PJLA
120-82-1	Air	Trichlorobenzene, 1,2,4-	TO-17	PJLA
71-55-6	Air	Trichloroethane, 1,1,1-	8260C	PJLA
71-55-6	Air	Trichloroethane, 1,1,1-	TO-15	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
71-55-6	Air	Trichloroethane, 1,1,1-	TO-17	PJLA
79-00-5	Air	Trichloroethane, 1,1,2-	8260C	PJLA
79-00-5	Air	Trichloroethane, 1,1,2-	TO-15	PJLA
79-00-5	Air	Trichloroethane, 1,1,2-	TO-17	PJLA
79-01-6	Air	Trichloroethylene	8260C	PJLA
79-01-6	Air	Trichloroethylene	TO-15	PJLA
79-01-6	Air	Trichloroethylene	TO-17	PJLA
75-69-4	Air	Trichlorofluoromethane	8260C	PJLA
75-69-4	Air	Trichlorofluoromethane	TO-15	PJLA
75-69-4	Air	Trichlorofluoromethane	TO-17	PJLA
75-01-4	Air	Trichlorofluoromethane (Freon 11)	8260C	PJLA
96-18-4	Air	Trichloropropane, 1,2,3-	8260C	PJLA
96-18-4	Air	Trichloropropane, 1,2,3-	TO-15	PJLA
96-18-4	Air	Trichloropropane, 1,2,3-	TO-17	PJLA
95-63-6	Air	Trimethylbenzene, 1,2,4-	8260C	PJLA
95-63-6	Air	Trimethylbenzene, 1,2,4-	TO-15	PJLA
95-63-6	Air	Trimethylbenzene, 1,2,4-	TO-17	PJLA
108-67-8	Air	Trimethylbenzene, 1,3,5-	8260C	PJLA
108-67-8	Air	Trimethylbenzene, 1,3,5-	TO-15	PJLA
108-67-8	Air	Trimethylbenzene, 1,3,5-	TO-17	PJLA
75-01-4	Air	Vinyl chloride	8260C	PJLA
75-01-4	Air	Vinyl Chloride	TO-15	PJLA
75-01-4	Air	Vinyl Chloride	TO-17	PJLA
N/A	Air	Xylene, m+p-	8260C	PJLA
N/A	Air	Xylene, m+p-	TO-15	PJLA
N/A	Air	Xylene, m+p-	TO-17	PJLA
95-47-6	Air	Xylene, o-	8260C	PJLA
95-47-6	Air	Xylene, o-	TO-15	PJLA
95-47-6	Air	Xylene, o-	TO-17	PJLA

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Laboratory of:

Beacon Environmental Services, Inc.

2203A Commerce Road, Forest Hill, Maryland 21050

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2017 "General Requirements for the competence of Testing and Calibration Laboratories" and the DoD Quality Systems Manual for Environmental Laboratories Version 5.3 May 2019 and is accredited is accordance with the:

United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP)

This accreditation demonstrates technical competence for the defined scope:

Environmental Testing

(As detailed in the supplement)

Accreditation claims for such testing and/or calibration services shall only be made from addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen
President/Operations Manager

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
September 7, 2012	July 23, 2018	October 31, 2020
Revision Date:	*Accreditation No.:*	*Certificate No.:*
August 3, 2019	72690	L18-339-R1

Perry Johnson Laboratory Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

Beacon Environmental Services, Inc.

2203A Commerce Road, Forest Hill, Maryland 21050
Contact Name: Harry O'Neill Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Air	EPA 325B	GC/MS	Benzene
Air	EPA 325B	GC/MS	Toluene
Air	EPA 325B	GC/MS	Ethylbenzene
Air	EPA 325B	GC/MS	o-Xylene
Air	EPA 325B	GC/MS	p&m-Xylenes
Air	EPA 8260C	GC/MS	1,1,1,2-Tetrachloroethane
Air	EPA 8260C	GC/MS	1,1,1-Trichloroethane
Air	EPA 8260C	GC/MS	1,1,2,2-Tetrachloroethane
Air	EPA 8260C	GC/MS	1,1,2-Trichloroethane
Air	EPA 8260C	GC/MS	1,1,2-trichlorotrifluoroethane (Freon 113)
Air	EPA 8260C	GC/MS	1,1-Dichloroethane
Air	EPA 8260C	GC/MS	1,1-Dichloroethene
Air	EPA 8260C	GC/MS	1,1-Dichloropropene
Air	EPA 8260C	GC/MS	1,2,3-Trichlorobenzene
Air	EPA 8260C	GC/MS	1,2,3-Trichloropropane
Air	EPA 8260C	GC/MS	1,2,4-Trichlorobenzene
Air	EPA 8260C	GC/MS	1,2,4-Trimethylbenzene
Air	EPA 8260C	GC/MS	1,2-Dibromoethane (EDB)
Air	EPA 8260C	GC/MS	1,2-Dichlorobenzene
Air	EPA 8260C	GC/MS	1,2-Dichloroethane
Air	EPA 8260C	GC/MS	1,2-Dichloropropane
Air	EPA 8260C	GC/MS	1,3,5-Trimethylbenzene
Air	EPA 8260C	GC/MS	1,3-Dichlorobenzene
Air	EPA 8260C	GC/MS	1,3-Dichloropropane
Air	EPA 8260C	GC/MS	1,4-Dichlorobenzene
Air	EPA 8260C	GC/MS	1,4-Dioxane
Air	EPA 8260C	GC/MS	2,2-Dichloropropane
Air	EPA 8260C	GC/MS	2-Chlorotoluene
Air	EPA 8260C	GC/MS	2-Methylnaphthalene
Air	EPA 8260C	GC/MS	4-Chlorotoluene
Air	EPA 8260C	GC/MS	4-Methyl-2-pentanone (MIBK)
Air	EPA 8260C	GC/MS	Benzene
Air	EPA 8260C	GC/MS	Bromobenzene
Air	EPA 8260C	GC/MS	Bromochloromethane
Air	EPA 8260C	GC/MS	Bromodichloromethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, Maryland 21050
Contact Name: Harry O'Neill Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Air	EPA 8260C	GC/MS	Bromoform
Air	EPA 8260C	GC/MS	Carbon Disulfide
Air	EPA 8260C	GC/MS	Carbon Tetrachloride
Air	EPA 8260C	GC/MS	Chlorobenzene
Air	EPA 8260C	GC/MS	Chloroform
Air	EPA 8260C	GC/MS	cis-1,2-Dichloroethene
Air	EPA 8260C	GC/MS	cis-1,3-Dichloropropene
Air	EPA 8260C	GC/MS	Dibromochloromethane
Air	EPA 8260C	GC/MS	Dibromomethane
Air	EPA 8260C	GC/MS	Dichlorodifluoromethane (Freon 12)
Air	EPA 8260C	GC/MS	Ethylbenzene
Air	EPA 8260C	GC/MS	Hexachlorobutadiene
Air	EPA 8260C	GC/MS	Hexachloroethane
Air	EPA 8260C	GC/MS	Isopropylbenzene
Air	EPA 8260C	GC/MS	Methylene Chloride
Air	EPA 8260C	GC/MS	Methyl-t-butyl ether
Air	EPA 8260C	GC/MS	Naphthalene
Air	EPA 8260C	GC/MS	n-Butylbenzene
Air	EPA 8260C	GC/MS	n-Propylbenzene
Air	EPA 8260C	GC/MS	o-Xylene
Air	EPA 8260C	GC/MS	p&m-Xylenes
Air	EPA 8260C	GC/MS	p-Isopropyltoluene
Air	EPA 8260C	GC/MS	sec-Butylbenzene
Air	EPA 8260C	GC/MS	Styrene
Air	EPA 8260C	GC/MS	tert-Butylbenzene
Air	EPA 8260C	GC/MS	Tetrachloroethene
Air	EPA 8260C	GC/MS	Toluene
Air	EPA 8260C	GC/MS	trans-1,2-Dichloroethene
Air	EPA 8260C	GC/MS	trans-1,3-Dichloropropene
Air	EPA 8260C	GC/MS	Trichloroethene
Air	EPA 8260C	GC/MS	Trichlorofluoromethane (Freon 11)
Air	EPA 8260C	GC/MS	Vinyl Chloride
Air	EPA TO-15	GC/MS	1,1,1,2-Tetrachloroethane
Air	EPA TO-15	GC/MS	1,1,1-Trichloroethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, Maryland 21050
Contact Name: Harry O'Neill Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Air	EPA TO-15	GC/MS	1,1,2,2-Tetrachloroethane
Air	EPA TO-15	GC/MS	1,1,2-trichlorotrifluoroethane (Freon 113)
Air	EPA TO-15	GC/MS	1,1,2-Trichloroethane
Air	EPA TO-15	GC/MS	1,1-Dichloroethane
Air	EPA TO-15	GC/MS	1,1-Dichloroethene
Air	EPA TO-15	GC/MS	1,1-Dichloropropene
Air	EPA TO-15	GC/MS	1,2,3-Trichlorobenzene
Air	EPA TO-15	GC/MS	1,2,3-Trichloropropane
Air	EPA TO-15	GC/MS	1,2,4-Trichlorobenzene
Air	EPA TO-15	GC/MS	1,2,4-Trimethylbenzene
Air	EPA TO-15	GC/MS	1,2-Dibromoethane (EDB)
Air	EPA TO-15	GC/MS	1,2-Dichlorobenzene
Air	EPA TO-15	GC/MS	1,2-Dichloroethane
Air	EPA TO-15	GC/MS	1,2-Dichloropropane
Air	EPA TO-15	GC/MS	1,3,5-Trimethylbenzene
Air	EPA TO-15	GC/MS	1,3-Dichlorobenzene
Air	EPA TO-15	GC/MS	1,3-Dichloropropane
Air	EPA TO-15	GC/MS	1,4-Dichlorobenzene
Air	EPA TO-15	GC/MS	2,2-Dichloropropane
Air	EPA TO-15	GC/MS	2-Chlorotoluene
Air	EPA TO-15	GC/MS	2-Methylnaphthalene
Air	EPA TO-15	GC/MS	4-Chlorotoluene
Air	EPA TO-15	GC/MS	4-Methyl-2-pentanone (MIBK)
Air	EPA TO-15	GC/MS	Benzene
Air	EPA TO-15	GC/MS	Bromobenzene
Air	EPA TO-15	GC/MS	Bromochloromethane
Air	EPA TO-15	GC/MS	Bromodichloromethane
Air	EPA TO-15	GC/MS	Bromoform
Air	EPA TO-15	GC/MS	Carbon Disulfide
Air	EPA TO-15	GC/MS	Carbon Tetrachloride
Air	EPA TO-15	GC/MS	Chlorobenzene
Air	EPA TO-15	GC/MS	Chloroform
Air	EPA TO-15	GC/MS	cis-1,2-Dichloroethene
Air	EPA TO-15	GC/MS	cis-1,3-Dichloropropene
Air	EPA TO-15	GC/MS	Dibromochloromethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, Maryland 21050
Contact Name: Harry O'Neill Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Air	EPA TO-15	GC/MS	Dibromomethane
Air	EPA TO-15	GC/MS	Dichlorodifluoromethane (Freon 12)
Air	EPA TO-15	GC/MS	Ethylbenzene
Air	EPA TO-15	GC/MS	Hexachlorobutadiene
Air	EPA TO-15	GC/MS	Hexachloroethane
Air	EPA TO-15	GC/MS	Isopropylbenzene
Air	EPA TO-15	GC/MS	Methylene Chloride
Air	EPA TO-15	GC/MS	Methyl-t-butyl ether
Air	EPA TO-15	GC/MS	Naphthalene
Air	EPA TO-15	GC/MS	n-Butylbenzene
Air	EPA TO-15	GC/MS	n-Propylbenzene
Air	EPA TO-15	GC/MS	o-Xylene
Air	EPA TO-15	GC/MS	p&m-Xylenes
Air	EPA TO-15	GC/MS	p-Isopropyltoluene
Air	EPA TO-15	GC/MS	sec-Butylbenzene
Air	EPA TO-15	GC/MS	Styrene
Air	EPA TO-15	GC/MS	tert-Butylbenzene
Air	EPA TO-15	GC/MS	Tetrachloroethene
Air	EPA TO-15	GC/MS	Toluene
Air	EPA TO-15	GC/MS	trans-1,2-Dichloroethene
Air	EPA TO-15	GC/MS	trans-1,3-Dichloropropene
Air	EPA TO-15	GC/MS	Trichloroethene
Air	EPA TO-15	GC/MS	Trichlorofluoromethane (Freon 11)
Air	EPA TO-15	GC/MS	Vinyl Chloride
Air	EPA TO-15	GC/MS	1,4-Dioxane
Air	EPA TO-17	GC/MS	1,4-Dioxane
Air	EPA TO-17	GC/MS	1,1,1,2-Tetrachloroethane
Air	EPA TO-17	GC/MS	1,1,1-Trichloroethane
Air	EPA TO-17	GC/MS	1,1,2,2-Tetrachloroethane
Air	EPA TO-17	GC/MS	1,1,2-Trichloroethane
Air	EPA TO-17	GC/MS	1,1,2-trichlorotrifluoroethane (Freon 113)
Air	EPA TO-17	GC/MS	1,1-Dichloroethane
Air	EPA TO-17	GC/MS	1,1-Dichloroethene
Air	EPA TO-17	GC/MS	1,1-Dichloropropene

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, Maryland 21050
Contact Name: Harry O'Neill Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Air	EPA TO-17	GC/MS	1,2,3-Trichlorobenzene
Air	EPA TO-17	GC/MS	1,2,3-Trichloropropane
Air	EPA TO-17	GC/MS	1,2,4-Trichlorobenzene
Air	EPA TO-17	GC/MS	1,2,4-Trimethylbenzene
Air	EPA TO-17	GC/MS	1,2-Dibromoethane (EDB)
Air	EPA TO-17	GC/MS	1,2-Dichlorobenzene
Air	EPA TO-17	GC/MS	1,2-Dichloroethane
Air	EPA TO-17	GC/MS	1,2-Dichloropropane
Air	EPA TO-17	GC/MS	1,3,5-Trimethylbenzene
Air	EPA TO-17	GC/MS	1,3-Dichlorobenzene
Air	EPA TO-17	GC/MS	1,3-Dichloropropane
Air	EPA TO-17	GC/MS	1,4-Dichlorobenzene
Air	EPA TO-17	GC/MS	2,2-Dichloropropane
Air	EPA TO-17	GC/MS	2-Chlorotoluene
Air	EPA TO-17	GC/MS	2-Methylnaphthalene
Air	EPA TO-17	GC/MS	4-Chlorotoluene
Air	EPA TO-17	GC/MS	4-Methyl-2-pentanone (MIBK)
Air	EPA TO-17	GC/MS	Benzene
Air	EPA TO-17	GC/MS	Bromobenzene
Air	EPA TO-17	GC/MS	Bromochloromethane
Air	EPA TO-17	GC/MS	Bromodichloromethane
Air	EPA TO-17	GC/MS	Bromoform
Air	EPA TO-17	GC/MS	Carbon Disulfide
Air	EPA TO-17	GC/MS	Carbon Tetrachloride
Air	EPA TO-17	GC/MS	Chlorobenzene
Air	EPA TO-17	GC/MS	Chloroform
Air	EPA TO-17	GC/MS	cis-1,2-Dichloroethene
Air	EPA TO-17	GC/MS	cis-1,3-Dichloropropene
Air	EPA TO-17	GC/MS	Dibromochloromethane
Air	EPA TO-17	GC/MS	Dibromomethane
Air	EPA TO-17	GC/MS	Dichlorodifluoromethane (Freon 12)
Air	EPA TO-17	GC/MS	Ethylbenzene
Air	EPA TO-17	GC/MS	Hexachlorobutadiene
Air	EPA TO-17	GC/MS	Hexachloroethane

Certificate of Accreditation: Supplement

ISO/IEC 17025:2017 and DoD-ELAP

Beacon Environmental Services, Inc.
2203A Commerce Road, Forest Hill, Maryland 21050
Contact Name: Harry O'Neill Phone: 410-838-8780

Accreditation is granted to the facility to perform the following testing:

Matrix	Standard/Method	Technology	Analyte
Air	EPA TO-17	GC/MS	Isopropylbenzene
Air	EPA TO-17	GC/MS	Methylene Chloride
Air	EPA TO-17	GC/MS	Methyl-t-butyl ether
Air	EPA TO-17	GC/MS	Naphthalene
Air	EPA TO-17	GC/MS	n-Butylbenzene
Air	EPA TO-17	GC/MS	n-Propylbenzene
Air	EPA TO-17	GC/MS	o-Xylene
Air	EPA TO-17	GC/MS	p&m-Xylenes
Air	EPA TO-17	GC/MS	p-Isopropyltoluene
Air	EPA TO-17	GC/MS	sec-Butylbenzene
Air	EPA TO-17	GC/MS	Styrene
Air	EPA TO-17	GC/MS	tert-Butylbenzene
Air	EPA TO-17	GC/MS	Tetrachloroethene
Air	EPA TO-17	GC/MS	Toluene
Air	EPA TO-17	GC/MS	trans-1,2-Dichloroethene
Air	EPA TO-17	GC/MS	trans-1,3-Dichloropropene
Air	EPA TO-17	GC/MS	Trichloroethene
Air	EPA TO-17	GC/MS	Trichlorofluoromethane (Freon 11)
Air	EPA TO-17	GC/MS	Vinyl Chloride

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc. has assessed the Organization of:

Beacon Environmental Services, Inc.

2203A Commerce Road, Forest Hill, Maryland 21050

and hereby declares that Organization has met the requirements of ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories" and the Field Sampling and Measurement Organization Sector Volume 1 "General Requirements for Field Sampling and Measurement Organizations" (FSMO-V1-2014) and is accredited in accordance with the:

TNI National Environmental Field Activities Program (NEFAP)

This accreditation demonstrates the technical competence for the defined scope:

Environmental Field Sampling (Air and Emissions)

(As detailed in the supplement)

Accreditation claims for such activities shall only be made from the addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation Body's duty to observe and comply with the said rules.

For PJLA:

Tracy Szerszen
President/Operations Manager

Initial Accreditation Date:	*Issue Date:*	*Expiration Date:*
September 7, 2012	July 23, 2018	October 31, 2020
Revision Date:	*Accreditation No.:*	*Certificate No.:*
August 3, 2019	72690	L18-338-R1

Perry Johnson Laboratory Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: www.pjlabs.com

Certificate of Accreditation: Supplement

TNI National Environmental Field Activities Program (NEFAP)

Beacon Environmental Services, Inc.

2203A Commerce Road, Forest Hill, Maryland 21050
Contact Name: Harry O'Neill Phone: 410-838-8780

Accreditation is granted to the facility to perform the following field sampling:

FIELD OF SAMPLING/TEST	ITEMS, MATERIALS OR PRODUCTS SAMPLED/TESTED	SPECIFIC TESTS OR PROPERTIES MEASURED	SPECIFICATION, STANDARD METHOD OR TECHNIQUE USED
Passive Soil Gas Sampling	Air	Volatile Organic Compounds	Beacon SOP 10 – Collection and Return Shipment of Passive Soil Gas Samplers SOP 1 PSG Sampler Manufacturing SOP 4 PSG Sampler Shipment
Passive Indoor/Ambient Air Sampling	Air	Volatile Organic Compounds	Beacon SOP 11 - Passive Diffusion Samplers with Sorbent Tubes SOP 6 Sorbent Tube Shipment SOP 16 Sorbent Tube Preparation
Fugitive and Area Sources Sampler	Air	Volatile Organic Compounds	Method 325A- Deployment and VOC Sample Collection
Soil Gas and Indoor/Ambient Air Sampling with Pumps	Air	Organics	Thermal Desorption GC/MSD, EPA Method TO-17

This page intentionally blank

Draft
Appendix B
Post-Closure Groundwater Monitoring Quality Assurance Project Plan

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS III

1.0 INTRODUCTION 1
2.0 ANALYTICAL METHODS AND PERMIT COMPLIANCE 3

2.1 Groundwater Protection Standards 3
2.1 Analytical Methods for Groundwater Monitoring and Vapor Sampling 4

3.0 DATA QUALITY INDICATORS 21

3.1 Precision 21
3.2 Accuracy 22
3.3 Representativeness 22
3.4 Completeness 22
3.5 Comparability 23
3.6 Sensitivity 23
3.7 Measurement Performance Criteria 23

4.0 LABORATORY REPORTING REQUIREMENTS 37

4.1 Analytical Data Package Requirements 37
4.2 Laboratory Data Deliverables 38
4.3 Laboratory Result Reporting Requirements 38
4.4 Laboratory Data Review and Evaluation 38
4.5 Laboratory Preventive Maintenance and Corrective Action 39

5.0 DATA VALIDATION 41

5.1 Data Verification Procedures 41
5.2 Data Validation Procedures 41
5.3 Data Validation Guidelines 42
5.4 Data Usability Assessment 43

6.0 REPORTING AND DATABASE MANAGEMENT 45

6.1 Data Quality Summary Report 45
6.2 Data Management 45

7.0 PERFORMANCE AND SYSTEM AUDITS AND CORRECTIVE ACTION 47
8.0 REFERENCES 49

TABLE OF CONTENTS (CONTINUED)

TABLES

Table 1	Groundwater Protection Standards	3
Table 2	Quarterly Groundwater Monitoring Methods	5
Table 3	Vapor Sampling Methods	11
Table 4	Triennial Groundwater Monitoring Methods for Appendix IX Compounds	13
Table 5	Measurement Performance Criteria for Method AK102/AK103 (DRO/RRO)	24
Table 6	Measurement Performance Criteria for Method SW6020 (Total Metals Excluding Mercury)	25
Table 7	Measurement Performance Criteria for Method SW7470 (Total Mercury)	26
Table 8	Measurement Performance Criteria for Method SW8081 (Organochlorine Pesticides)	27
Table 9	Measurement Performance Criteria for Method SW8082 (PCBs)	28
Table 10	Measurement Performance Criteria for Method SW8151 (Chlorinated Herbicides)	29
Table 11	Measurement Performance Criteria for Method SW8260 (VOCs)	30
Table 12	Measurement Performance Criteria for Method SW8270 (SVOCs), SW8270 SIM (Organophosphorus Pesticides), and SW8270 SIM (PAH)	31
Table 13	Measurement Performance Criteria for Method SW8290 (Polychlorinated Dioxins and Furans)	32
Table 14	Measurement Performance Criteria for Method SW9014 (Cyanide)	33
Table 15	Measurement Performance Criteria for Method TO-12 (Modified) in Vapor Samples (NMOC)	34
Table 16	Measurement Performance Criteria for EPA Method 25 in Vapor Samples (NMOC)	35
Table 17	Measurement Performance Criteria for Method TO-15 (VOCs) in Vapor Samples	36
Table 18	Validation Qualifiers	42

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
>	greater than
<	less than
≤	less than or equal to
%R	percent recovery
±	plus or minus
µg/L	micrograms per liter
ADEC	Alaska Department of Environmental Conservation
ATL	Air Technology Laboratories
CA	corrective action
CAS RN	Chemical Abstracts Service Registry Number
CCV	continuing calibration verification
CFR	Code of Federal Regulations
CoC	chain-of-custody
DL	detection limit
DoD	Department of Defense
DQI	data quality indicator
DQO	data quality objective
DRO	diesel-range organics
EATL	Eurofins Air Toxics Laboratory
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EMAX	EMAX Laboratories, Inc.
EPA	U.S. Environmental Protection Agency
GC	gas chromatography
GC/MS	gas chromatography-mass spectrometry
GW	groundwater
HWMU	Hazardous Waste Management Unit
ICAL	initial calibration
ICV	initial calibration verifications
ID	identification
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MPC	measurement performance criteria
MS	matrix spike
MSD	matrix spike duplicate

ACRONYMS AND ABBREVIATIONS (CONTINUED)

NA	not applicable
ND	non-detect
NMOC	non-methane organic compounds
PAH	polycyclic aromatic hydrocarbons
PARCCS	precision, accuracy, representativeness, comparability, completeness, and sensitivity
PCB	polychlorinated biphenyl
PDF	portable document format
ppbv	parts per billion by volume
ppmv	parts per million by volume
ppmv-C	parts per million by volume, as carbon
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RF	response factor
RPD	relative percent difference
RRO	residual-range organics
RSD	relative standard deviation
SDG	sample delivery group
SIM	selected ion monitoring
SOP	standard operating procedure
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbons
VOC	volatile organic compound

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the quality assurance (QA) and quality control (QC) objectives, organization, and functional activities associated with the sampling and analyses of environmental samples obtained during the Base Kodiak Post-Closure Groundwater Monitoring Program at three regulated Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Units (HWMUs): Site 3 – Coast Guard Laundry, Site 6A – MOGAS, and Site 7A – Barrel Storage Area No. 1. The purpose of this QAPP is to establish the analytical and documentation protocols to be used when analyzing and reviewing data collected from the project sites in compliance with the RCRA Permit (U.S. Environmental Protection Agency [EPA] 2021). This QAPP was written in accordance with EPA guidance documents (EPA 2000, 2001, and 2014).

As part of this investigation, groundwater and air samples will be collected and analyzed. The sampling methods and procedures included in this QAPP are intended to produce data of sufficient technical quality to assist in evaluating compliance with the RCRA Permit.

This page intentionally blank

2.0 ANALYTICAL METHODS AND PERMIT COMPLIANCE

Post-closure monitoring includes groundwater and vapor sampling at three HWMUs, Site 3 – Coast Guard Laundry, Site 6A – MOGAS, and Site 7A – Barrel Storage Area No. 1. Groundwater samples are collected at Site 3 – Coast Guard Laundry and Site 7A – Barrel Storage Area No. 1 on a quarterly basis (Appendix A, Section 8). In addition, vapor samples will be collected at Site 3 and Site 7A when the remediation systems are in active operation, typically during the third and fourth quarter, to evaluate system performance. As part of post-closure detection monitoring at Site 6A, groundwater samples are collected on an annual basis (Appendix A, Section 8).

Triennially, during the October (fourth quarter) sampling event, selected wells at Site 3 and Site 7A are sampled for all hazardous constituents listed in Appendix IX of Code of Federal Regulations Title 40 Part 264 (40 CFR Part 264). The next triennial sampling event is planned for October 2021.

The following sections present the groundwater protection standards and analytical methods used for groundwater monitoring and vapor sampling.

2.1 Groundwater Protection Standards

Analytical methods and subcontract laboratories are selected to provide accurate data at the appropriate sensitivity to meet the project data quality objectives (DQOs) and ensure permit compliance. Analytical methods and groundwater protection standards for each site are presented in Table 1. Laboratory limits of detection (LOD) and limits of quantitation (LOQ) must be below the Groundwater Protection Standards for permit-required analytes.

Table 1 Groundwater Protection Standards

HAZARDOUS CONSTITUENT	ANALYTICAL METHOD	GROUNDWATER PROTECTION STANDARD [µg/L]
Site 3 – Coast Guard Laundry		
Chloroform	SW8260C	100
cis-1,2-Dichloroethene	SW8260C	70
Tetrachloroethene	SW8260C	5
trans-1,2-Dichloroethene	SW8260C	100
Trichloroethene	SW8260C	5
Vinyl Chloride	SW8260C	2
Site 6A – MOGAS		
2-Butanone (Methyl ethyl ketone, MEK)	SW8260C	170
Benzene	SW8260C	5
Ethylbenzene	SW8260C	700
Toluene	SW8260C	1,000
Total Xylenes	SW8260C	10,000
2,4-Dimethylphenol	SW8270D	400
2-Methylnaphthalene	SW8270D SIM	180
Naphthalene	SW8270D SIM	1,460

Table 1 Groundwater Protection Standards

HAZARDOUS CONSTITUENT	ANALYTICAL METHOD	GROUNDWATER PROTECTION STANDARD [µg/L]
Site 7A – Barrel Storage Area No. 1		
TPH (RRO)	AK103	1100
Dieldrin	SW8081B	50
beta-BHC	SW8081B	50
Tetrachloroethene	SW8260C	5
Trichloroethene	SW8260C	5
cis-1,2-Dichloroethene	SW8260C	70
trans-1,2-Dichloroethene	SW8260C	100
Vinyl Chloride	SW8260C	2
Carbon Tetrachloride	SW8260C	5

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

2.1 Analytical Methods for Groundwater Monitoring and Vapor Sampling

For groundwater monitoring and vapor sampling at Site 3, Site 6A, and Site 7A, samples will be analyzed for standard analyte lists using the analytical methods in Tables 2 and 3. Triennially, selected wells at Site 3 and Site 7A are sampled for all hazardous constituents listed in Appendix IX of 40 CFR Part 264 (see Table 4). The schedule for groundwater monitoring and vapor sampling is included in Section 7.0 of the RCRA Quarterly Sampling and Analysis Plan (Appendix A).

Groundwater is currently being monitored at each site for the analytes listed in Table 1. In addition to these analytes, samples are analyzed for the standard full lists of analytes using these methods. Analytes detected at concentrations above the LOQ will be evaluated as described in Section VI.D.5. of the RCRA Permit (EPA 2021). Table 2 includes a standard list of target analytes for each analytical method, with the analytes monitored at each site indicated with an X. Target analyte lists may vary slightly based on the subcontracted laboratory.

The analytical methods presented in the following tables are currently used for groundwater monitoring of the listed analytes. Method versions may vary based on subcontract laboratory accreditations (e.g., SW8260C versus SW8260D). The use of an alternate analytical method that is equivalent or superior to the recommended methods may be requested for prior approval in accordance with Section I.M.4. of the RCRA Permit (EPA 2021).

Table 2 Quarterly Groundwater Monitoring Methods

ANALYTE	CAS RN	METHOD	SITE 3[1]	SITE 6A[1]	SITE 7A[1]	GW PROTECTION STANDARD [µg/L]	LAB LOQ[2] [µg/L]
Diesel-range organics	C10-C25	AK102				NA	500
Residual-range organics	C25-C36	AK103			X	1100	1000
4,4'-DDD	72-54-8	SW8081B				NA	0.1
4,4'-DDE	72-55-9	SW8081B				NA	0.1
4,4'-DDT	50-29-3	SW8081B				NA	0.1
Aldrin	309-00-2	SW8081B				NA	0.1
alpha-BHC	319-84-6	SW8081B				NA	0.1
alpha-Chlordane	5103-71-9	SW8081B				NA	0.1
beta-BHC	319-85-7	SW8081B			X	50	0.1
delta-BHC	319-86-8	SW8081B				NA	0.1
Dieldrin	60-57-1	SW8081B			X	50	0.1
Endosulfan I	959-98-8	SW8081B				NA	0.1
Endosulfan II	33213-65-9	SW8081B				NA	0.1
Endosulfan sulfate	1031-07-8	SW8081B				NA	0.1
Endrin	72-20-8	SW8081B				NA	0.1
Endrin aldehyde	7421-93-4	SW8081B				NA	0.1
Endrin ketone	53494-70-5	SW8081B				NA	0.1
gamma-BHC (Lindane)	58-89-9	SW8081B				NA	0.1
gamma-Chlordane	5566-34-7	SW8081B				NA	0.1
Heptachlor	76-44-8	SW8081B				NA	0.1
Heptachlor epoxide	1024-57-3	SW8081B				NA	0.1
Methoxychlor	72-43-5	SW8081B				NA	1
Toxaphene	8001-35-2	SW8081B				NA	2
1,1,1,2-Tetrachloroethane	630-20-6	SW8260C				NA	1
1,1,1-Trichloroethane	71-55-6	SW8260C				NA	1
1,1,2,2-Tetrachloroethane	79-34-5	SW8260C				NA	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	SW8260C				NA	1
1,1,2-Trichloroethane	79-00-5	SW8260C				NA	1
1,1-Dichloroethane	75-34-3	SW8260C				NA	1
1,1-Dichloroethene	75-35-4	SW8260C				NA	1
1,1-Dichloropropene	563-58-6	SW8260C				NA	1
1,2,3-Trichlorobenzene	87-61-6	SW8260C				NA	1
1,2,3-Trichloropropane	96-18-4	SW8260C				NA	2
1,2,4-Trichlorobenzene	120-82-1	SW8260C				NA	1
1,2,4-Trimethylbenzene	95-63-6	SW8260C				NA	1
1,2-Dibromo-3-chloropropane	96-12-8	SW8260C				NA	2

Table 2 Quarterly Groundwater Monitoring Methods

ANALYTE	CAS RN	METHOD	SITE 3[1]	SITE 6A[1]	SITE 7A[1]	GW PROTECTION STANDARD [µg/L]	LAB LOQ[2] [µg/L]
1,2-Dibromoethane	106-93-4	SW8260C				NA	1
1,2-Dichlorobenzene	95-50-1	SW8260C				NA	1
1,2-Dichloroethane	107-06-2	SW8260C				NA	1
1,2-Dichloropropane	78-87-5	SW8260C				NA	1
1,3,5-Trimethylbenzene	108-67-8	SW8260C				NA	1
1,3-Dichlorobenzene	541-73-1	SW8260C				NA	1
1,3-Dichloropropane	142-28-9	SW8260C				NA	1
1,4-Dichlorobenzene	106-46-7	SW8260C				NA	1
2,2-Dichloropropane	594-20-7	SW8260C				NA	1
2-Butanone (MEK)	78-93-3	SW8260C		X		170	20
2-Chlorotoluene	95-49-8	SW8260C				NA	1
2-Hexanone (MBK)	591-78-6	SW8260C				NA	20
4-Chlorotoluene	106-43-4	SW8260C				NA	1
4-methyl-2-pentanone (MIBK)	108-10-1	SW8260C				NA	20
Acetone	67-64-1	SW8260C				NA	20
Benzene	71-43-2	SW8260C		X		5	1
Bromobenzene	108-86-1	SW8260C				NA	1
Bromochloromethane	74-97-5	SW8260C				NA	1
Bromodichloromethane	75-27-4	SW8260C				NA	1
Bromoform	75-25-2	SW8260C				NA	1
Bromomethane	74-83-9	SW8260C				NA	1
Carbon Disulfide	75-15-0	SW8260C				NA	1
Carbon Tetrachloride	56-23-5	SW8260C				NA	1
Chlorobenzene	108-90-7	SW8260C				NA	1
Chloroethane	75-00-3	SW8260C				NA	2
Chloroform	67-66-3	SW8260C	X			100	1
Chloromethane	74-87-3	SW8260C				NA	1
cis-1,2-Dichloroethene	156-59-2	SW8260C	X		X	70	1
cis-1,3-Dichloropropene	10061-01-5	SW8260C				NA	1
Dibromochloromethane	124-48-1	SW8260C				NA	1
Dibromomethane	74-95-3	SW8260C				NA	1
Dichlorodifluoromethane	75-71-8	SW8260C				NA	1
Ethylbenzene	100-41-4	SW8260C		X		700	1
Hexachlorobutadiene	87-68-3	SW8260C				NA	2
Isopropylbenzene (Cumene)	98-82-8	SW8260C				NA	1
m,p-Xylene	108-38-3 / 106-42-3	SW8260C		X		10000	2

Table 2 Quarterly Groundwater Monitoring Methods

ANALYTE	CAS RN	METHOD	SITE 3[1]	SITE 6A[1]	SITE 7A[1]	GW PROTECTION STANDARD [µg/L]	LAB LOQ[2] [µg/L]
Methyl tert butyl ether	1634-04-4	SW8260C				NA	1
Methylene chloride	75-09-2	SW8260C				NA	2
Naphthalene	91-20-3	SW8260C				NA	2
n-Butylbenzene	104-51-8	SW8260C				NA	1
n-Propylbenzene	103-65-1	SW8260C				NA	1
o-Xylene	95-47-6	SW8260C		X		10,000	1
p-Isopropyltoluene	99-87-6	SW8260C				NA	1
sec-Butylbenzene	135-98-8	SW8260C				NA	1
Styrene	100-42-5	SW8260C				NA	1
tert-Butylbenzene	98-06-6	SW8260C				NA	1
Tetrachloroethene (PCE)	127-18-4	SW8260C	X		X	5	1
Toluene	108-88-3	SW8260C		X		1,000	1
trans-1,2-Dichloroethene	156-60-5	SW8260C	X		X	100	1
trans-1,3-Dichloropropene	10061-02-6	SW8260C				NA	1
Trichloroethene	79-01-6	SW8260C	X		X	5	1
Trichlorofluoromethane	75-69-4	SW8260C				NA	1
Vinyl Acetate	108-05-4	SW8260C				NA	2
Vinyl Chloride	75-01-4	SW8260C	X			2	1
Xylenes (Total)	1330-20-7	SW8260C		X		10,000	3
1,2,4-Trichlorobenzene	120-82-1	SW8270D				NA	20
1,2-Dichlorobenzene	95-50-1	SW8270D				NA	10
1,2-Diphenylhydrazine[3]	122-66-7 / 103-33-3	SW8270D				NA	10
1,3-Dichlorobenzene	541-73-1	SW8270D				NA	10
1,4-Dichlorobenzene	106-46-7	SW8270D				NA	10
2,4,5-Trichlorophenol	95-95-4	SW8270D				NA	10
2,4,6-Trichlorophenol	88-06-2	SW8270D				NA	10
2,4-Dichlorophenol	120-83-2	SW8270D				NA	10
2,4-Dimethylphenol	105-67-9	SW8270D				NA	10
2,4-Dinitrophenol	51-28-5	SW8270D				NA	20
2,4-Dinitrotoluene	121-14-2	SW8270D				NA	10
2,6-Dinitrotoluene	606-20-2	SW8270D				NA	10
2-Chloronaphthalene	91-58-7	SW8270D				NA	10
2-Chlorophenol	95-57-8	SW8270D				NA	10
2-Methylnaphthalene	91-57-6	SW8270D				NA	10
2-Methylphenol (o-Cresol)	95-48-7	SW8270D				NA	10
3,3'-Dichlorobenzidine	91-94-1	SW8270D				NA	10

Table 2 Quarterly Groundwater Monitoring Methods

ANALYTE	CAS RN	METHOD	SITE 3[1]	SITE 6A[1]	SITE 7A[1]	GW PROTECTION STANDARD [µg/L]	LAB LOQ[2] [µg/L]
3-Nitroaniline	99-09-2	SW8270D				NA	10
3-,4-Methylphenol (m/p-Cresol)[4]	108-39-4 / 106-44-5	SW8270D		X		400	10
4,6-Dinitro-2-methylphenol	534-52-1	SW8270D				NA	20
4-Bromophenyl-phenyl ether	101-55-3	SW8270D				NA	10
4-Chloro-3-methylphenol	59-50-7	SW8270D				NA	10
4-Chloroaniline	106-47-8	SW8270D				NA	20
4-Chlorophenyl-phenyl ether	7005-72-3	SW8270D				NA	10
4-Nitroaniline	100-01-6	SW8270D				NA	10
4-Nitrophenol	100-02-7	SW8270D				NA	20
Acenaphthene	83-32-9	SW8270D				NA	10
Acenaphthylene	208-96-8	SW8270D				NA	10
Anthracene	120-12-7	SW8270D				NA	10
Benz(a)anthracene	56-55-3	SW8270D				NA	10
Benzaldehyde	100-52-7	SW8270D				NA	10
Benzo(a)pyrene	50-32-8	SW8270D				NA	10
Benzo(b)fluoranthene	205-99-2	SW8270D				NA	10
Benzo(g,h,i)perylene	191-24-2	SW8270D				NA	10
Benzo(k)fluoranthene	207-08-9	SW8270D				NA	10
Benzoic Acid	65-85-0	SW8270D				NA	100
Benzyl Alcohol	100-51-6	SW8270D				NA	10
bis(2-Chloroethoxy)methane	111-91-1	SW8270D				NA	10
bis(2-Chloroethyl)ether	111-44-4	SW8270D				NA	10
bis(2-Chloroisopropyl)ether	108-60-1	SW8270D				NA	10
Bis(2-ethylhexyl)phthalate	117-81-7	SW8270D				NA	20
Butylbenzylphthalate	85-68-7	SW8270D				NA	10
Carbazole	86-74-8	SW8270D				NA	10
Chrysene	218-01-9	SW8270D				NA	10
Dibenz(a,h)anthracene	53-70-3	SW8270D				NA	10
Dibenzofuran	132-64-9	SW8270D				NA	10
Diethylphthalate	84-66-2	SW8270D				NA	10
Dimethylphthalate	131-11-3	SW8270D				NA	10
di-N-Butyl Phthalate	84-74-2	SW8270D				NA	10
di-N-Octyl Phthalate	117-84-0	SW8270D				NA	10
Fluoranthene	206-44-0	SW8270D				NA	10
Fluorene	86-73-7	SW8270D				NA	10
Hexachlorobenzene	118-74-1	SW8270D				NA	10

Table 2 Quarterly Groundwater Monitoring Methods

ANALYTE	CAS RN	METHOD	SITE 3[1]	SITE 6A[1]	SITE 7A[1]	GW PROTECTION STANDARD [µg/L]	LAB LOQ[2] [µg/L]
Hexachlorobutadiene	87-68-3	SW8270D				NA	10
Hexachloroethane	67-72-1	SW8270D				NA	10
Indeno(1,2,3-cd)pyrene	193-39-5	SW8270D				NA	10
Isophorone	78-59-1	SW8270D				NA	10
Naphthalene	91-20-3	SW8270D				NA	10
Nitrobenzene	98-95-3	SW8270D				NA	10
N-Nitrosodimethylamine	62-75-9	SW8270D				NA	10
N-Nitroso-di-n-propylamine	621-64-7	SW8270D				NA	10
n-Nitrosodiphenylamine	86-30-6	SW8270D				NA	10
Pentachlorophenol	87-86-5	SW8270D				NA	20
Phenanthrene	85-01-8	SW8270D				NA	10
Phenol	108-95-2	SW8270D				NA	10
Pyrene	129-00-0	SW8270D				NA	10
1-Methylnaphthalene	90-12-0	SW8270D SIM				NA	0.5
2-Methylnaphthalene	91-57-6	SW8270D SIM		X		180	0.5
Acenaphthene	83-32-9	SW8270D SIM				NA	0.5
Acenaphthylene	208-96-8	SW8270D SIM				NA	0.5
Anthracene	120-12-7	SW8270D SIM				NA	0.5
Benzo(a)anthracene	56-55-3	SW8270D SIM				NA	0.5
Benzo(a)pyrene	50-32-8	SW8270D SIM				NA	0.5
Benzo(b)fluoranthene	205-99-2	SW8270D SIM				NA	0.5
Benzo(g,h,i)perylene	191-24-2	SW8270D SIM				NA	0.5
Benzo(k)fluoranthene	207-08-9	SW8270D SIM				NA	0.5
Chrysene	218-01-9	SW8270D SIM				NA	0.5
Dibenzo(a,h)anthracene	53-70-3	SW8270D SIM				NA	0.5
Fluoranthene	206-44-0	SW8270D SIM				NA	0.5
Fluorene	86-73-7	SW8270D SIM				NA	0.5
Indeno(1,2,3-cd)pyrene	193-39-5	SW8270D SIM				NA	0.5
Naphthalene	91-20-3	SW8270D SIM		X		1,460	0.5
Phenanthrene	85-01-8	SW8270D SIM				NA	0.5
Pyrene	129-00-0	SW8270D SIM				NA	0.5

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

1 "X" indicates that the analyte is monitored at that site. Groundwater protection standards are listed for each analyte.

2 Laboratory LOQs from EMAX Laboratories, Inc. (EMAX).

3 As azobenzene.

4 3-Methylphenol and 4-methylphenol coelute cannot be separated.

This page intentionally blank

Table 3 Vapor Sampling Methods

ANALYTE[1]	CAS RN	METHOD	LAB LOQ[2]	UNITS
Total NMOC (as hexane)	NA	EPA TO-12 (Mod)	0.05	ppmv
Total NMOC (as carbon)	NA	EPA Method 25	10	ppmv-C
1,1,1,2- Tetrachloroethane	630-20-6	EPA TO-15	0.5	ppbv
1,1,1-Trichloroethane	71-55-6	EPA TO-15	0.5	ppbv
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	76-13-1	EPA TO-15	0.5	ppbv
1,1,2,2-Tetrachloroethane	79-34-5	EPA TO-15	0.5	ppbv
1,1,2-Trichloroethane	79-00-5	EPA TO-15	0.5	ppbv
1,1-Dichloroethane	75-34-3	EPA TO-15	0.5	ppbv
1,1-Dichloroethene	75-35-4	EPA TO-15	0.5	ppbv
1,2,4-Trichlorobenzene	120-82-1	EPA TO-15	0.5	ppbv
1,2,4-Trimethylbenzene	95-63-6	EPA TO-15	0.5	ppbv
1,2-Dibromoethane	106-93-4	EPA TO-15	0.5	ppbv
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	76-14-2	EPA TO-15	0.5	ppbv
1,2-Dichlorobenzene	95-50-1	EPA TO-15	0.5	ppbv
1,2-Dichloroethane	107-06-2	EPA TO-15	0.5	ppbv
1,2-Dichloropropane	78-87-5	EPA TO-15	0.5	ppbv
1,3,5-Trimethylbenzene	108-67-8	EPA TO-15	0.5	ppbv
1,3-Dichlorobenzene	541-73-1	EPA TO-15	0.5	ppbv
1,4-Dichlorobenzene	106-46-7	EPA TO-15	0.5	ppbv
2-Butanone (MEK)	78-93-3	EPA TO-15	0.5	ppbv
2-Hexanone	591-78-6	EPA TO-15	0.5	ppbv
4-Ethyl-toluene	622-96-8	EPA TO-15	0.5	ppbv
4-Methyl-2-pentanone	108-10-1	EPA TO-15	0.5	ppbv
Acetone	67-64-1	EPA TO-15	1	ppbv
Benzene	71-43-2	EPA TO-15	0.5	ppbv
Benzyl Chloride (alpha-chlorotoluene)	100-44-7	EPA TO-15	1.3	ppbv
Bromodichloromethane	75-27-4	EPA TO-15	0.5	ppbv
Bromoform	75-25-2	EPA TO-15	0.5	ppbv
Bromomethane	74-83-9	EPA TO-15	0.5	ppbv
Carbon Disulfide	75-15-0	EPA TO-15	1	ppbv
Carbon Tetrachloride	56-23-5	EPA TO-15	0.5	ppbv
Chlorobenzene	108-90-7	EPA TO-15	0.5	ppbv
Chloroethane	75-00-3	EPA TO-15	1	ppbv
Chloroform	67-66-3	EPA TO-15	0.5	ppbv
Chloromethane	74-87-3	EPA TO-15	1	ppbv
cis-1,2-Dichloroethene	156-59-2	EPA TO-15	0.5	ppbv
cis-1,3-Dichloropropene	10061-01-5	EPA TO-15	0.5	ppbv

Table 3 Vapor Sampling Methods

ANALYTE[1]	CAS RN	METHOD	LAB LOQ[2]	UNITS
Dibromochloromethane	124-48-1	EPA TO-15	0.5	ppbv
Dichlorodifluoromethane (Freon 12)	75-71-8	EPA TO-15	0.5	ppbv
Ethylbenzene	100-41-4	EPA TO-15	0.5	ppbv
Hexachlorobutadiene	87-68-3	EPA TO-15	0.5	ppbv
m,p-Xylene	108-38-3/106-42-3	EPA TO-15	0.5	ppbv
Methylene Chloride	75-09-2	EPA TO-15	0.5	ppbv
o-Xylene	95-47-6	EPA TO-15	0.5	ppbv
Styrene	100-42-5	EPA TO-15	0.5	ppbv
Tetrachloroethene	127-18-4	EPA TO-15	0.5	ppbv
Toluene	108-88-3	EPA TO-15	0.5	ppbv
trans-1,2-Dichloroethene	156-60-5	EPA TO-15	0.5	ppbv
trans-1,3-Dichloropropene	10061-02-6	EPA TO-15	1	ppbv
Trichloroethene	79-01-6	EPA TO-15	0.5	ppbv
Trichlorofluoromethane (Freon 11)	75-69-4	EPA TO-15	0.5	ppbv
Vinyl Acetate	108-05-4	EPA TO-15	0.5	ppbv
Vinyl Chloride	75-01-4	EPA TO-15	0.5	ppbv

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] 1,2,3-Trichlorobenzene, 1,2,3-trichloropropane, and bromochloromethane will not be reported.
[2] Laboratory LOQs from Air Technology Laboratories (ATL), except TO-12 from Eurofins Air Toxics Laboratory (EATL).

Table 4 Triennial Groundwater Monitoring Methods for Appendix IX Compounds

ANALYTE	CAS RN	METHOD	GW PROTECTION STANDARD [µg/L]	LAB LOQ[1] [µg/L]
1,2,3,4,6,7,8-HpCDD	35822-46-9	EPA 1613/SW8290A	NA	25
1,2,3,4,6,7,8-HpCDF	67562-39-4	EPA 1613/SW8290A	NA	25
1,2,3,4,7,8,9-HpCDF	55673-89-7	EPA 1613/SW8290A	NA	25
1,2,3,4,7,8-HxCDD	39227-28-6	EPA 1613/SW8290A	NA	25
1,2,3,4,7,8-HxCDF	70648-26-9	EPA 1613/SW8290A	NA	25
1,2,3,6,7,8-HxCDD	57653-85-7	EPA 1613/SW8290A	NA	25
1,2,3,6,7,8-HxCDF	57117-44-9	EPA 1613/SW8290A	NA	25
1,2,3,7,8,9-HxCDD	19408-74-3	EPA 1613/SW8290A	NA	25
1,2,3,7,8,9-HxCDF	72918-21-9	EPA 1613/SW8290A	NA	25
1,2,3,7,8-PeCDD	40321-76-4	EPA 1613/SW8290A	NA	25
1,2,3,7,8-PeCDF	57117-41-6	EPA 1613/SW8290A	NA	25
2,3,4,6,7,8-HxCDF	60851-34-5	EPA 1613/SW8290A	NA	25
2,3,4,7,8-PeCDF	57117-31-4	EPA 1613/SW8290A	NA	25
2,3,7,8-TCDD	1746-01-6	EPA 1613/SW8290A	NA	10
2,3,7,8-TCDF	51207-31-9	EPA 1613/SW8290A	NA	10
HXCDDs (total)	34465-46-8	EPA 1613/SW8290A	NA	25
HXCDFs (total)	55684-94-1	EPA 1613/SW8290A	NA	25
OCDD	3268-87-9	EPA 1613/SW8290A	NA	50
OCDF	39001-02-0	EPA 1613/SW8290A	NA	50
PeCDDs (total)	36088-22-9	EPA 1613/SW8290A	NA	25
PECDFs (total)	30402-15-4	EPA 1613/SW8290A	NA	25
TCDDs (total)	41903-57-5	EPA 1613/SW8290A	NA	25
TCDFs (total)	55722-27-5	EPA 1613/SW8290A	NA	25
Cyanide	57-12-5	SW9014	NA	10
Sulfide	18496-25-8	EPA 376.2	NA	100
Antimony	7440-36-0	SW6020A	NA	1
Arsenic (total)	7440-38-2	SW6020A	NA	1
Barium (total)	7440-39-3	SW6020A	NA	1
Beryllium (total)	7440-41-7	SW6020A	NA	0.5
Cadmium (total)	7440-43-9	SW6020A	NA	1
Chromium (total)	7440-47-3	SW6020A	NA	1
Cobalt (total)	7440-48-4	SW6020A	NA	0.75
Copper (total)	7440-50-8	SW6020A	NA	2
Lead (total)	7439-92-1	SW6020A	NA	1
Nickel (total)	7440-02-0	SW6020A	NA	1
Selenium (total)	7782-49-2	SW6020A	NA	1

Table 4 Triennial Groundwater Monitoring Methods for Appendix IX Compounds

ANALYTE	CAS RN	METHOD	GW PROTECTION STANDARD [µg/L]	LAB LOQ[1] [µg/L]
Silver (total)	7440-22-4	SW6020A	NA	1
Thallium (total)	7440-28-0	SW6020A	NA	0.5
Tin (total)	7440-31-5	SW6020A	NA	1
Vanadium (total)	7440-62-2	SW6020A	NA	1
Zinc (total)	7440-66-6	SW6020A	NA	20
Mercury (total)	7439-97-6	SW7470A	NA	0.5
4,4'-DDD	72-54-8	SW8081B	NA	0.1
4,4'-DDE	72-55-9	SW8081B	NA	0.1
4,4'-DDT	50-29-3	SW8081B	NA	0.1
Aldrin	309-00-2	SW8081B	NA	0.1
alpha-BHC	319-84-6	SW8081B	NA	0.1
beta-BHC	319-85-7	SW8081B	50	0.1
Chlordane[2]	57-74-9	SW8081B	NA	2
delta-BHC	319-86-8	SW8081B	NA	0.1
Dieldrin	60-57-1	SW8081B	50	0.1
Endosulfan I	959-98-8	SW8081B	NA	0.1
Endosulfan II	33213-65-9	SW8081B	NA	0.1
Endosulfan Sulfate	1031-07-8	SW8081B	NA	0.1
Endrin	72-20-8	SW8081B	NA	0.1
Endrin Aldehyde	7421-93-4	SW8081B	NA	0.1
gamma-BHC (Lindane)	58-89-9	SW8081B	NA	0.1
Heptachlor	76-44-8	SW8081B	NA	0.1
Heptachlor Epoxide	1024-57-3	SW8081B	NA	0.1
Methoxychlor	72-43-5	SW8081B	NA	1
Toxaphene	8001-35-2	SW8081B	NA	2
Aroclor 1016	12674-11-2	SW8082A	NA	1
Aroclor 1221	11104-28-2	SW8082A	NA	1
Aroclor 1232	11141-16-5	SW8082A	NA	1
Aroclor 1242	53469-21-9	SW8082A	NA	1
Aroclor 1248	12672-29-6	SW8082A	NA	1
Aroclor 1254	11097-69-1	SW8082A	NA	1
Aroclor 1260	11096-82-5	SW8082A	NA	1
2,4,5-T	93-76-5	SW8151A	NA	1
2,4,5-TP (Silvex)	93-72-1	SW8151A	NA	1
2,4-D	94-75-7	SW8151A	NA	1
Dinoseb	88-85-7	SW8151A	NA	1

Table 4 Triennial Groundwater Monitoring Methods for Appendix IX Compounds

ANALYTE	CAS RN	METHOD	GW PROTECTION STANDARD [µg/L]	LAB LOQ[1] [µg/L]
1,1,1,2-Tetrachloroethane	630-20-6	SW8260C	NA	1
1,1,1-Trichloroethane	71-55-6	SW8260C	NA	1
1,1,2,2-Tetrachloroethane	79-34-5	SW8260C	NA	1
1,1,2-Trichloroethane	79-00-5	SW8260C	NA	1
1,1-Dichloroethane	75-34-3	SW8260C	NA	1
1,1-Dichloroethene	75-35-4	SW8260C	NA	1
1,2,3-Trichloropropane	96-18-4	SW8260C	NA	2
1,2,4-Trichlorobenzene	120-82-1	SW8260C	NA	1
1,2-Dibromo-3-chloropropane	96-12-8	SW8260C	NA	2
1,2-Dibromoethane	106-93-4	SW8260C	NA	1
1,2-Dichlorobenzene	95-50-1	SW8260C	NA	1
1,2-Dichloroethane	107-06-2	SW8260C	NA	1
1,2-Dichloropropane	78-87-5	SW8260C	NA	1
1,3-Dichlorobenzene	541-73-1	SW8260C	NA	1
1,4-Dichlorobenzene	106-46-7	SW8260C	NA	1
2-Butanone (MEK)	78-93-3	SW8260C	170	20
2-Hexanone (MBK)	591-78-6	SW8260C	NA	20
4-methyl-2-pentanone (MIBK)	108-10-1	SW8260C	NA	20
Acetone	67-64-1	SW8260C	NA	20
Acetonitrile	75-05-8	SW8260C	NA	20
Acrolein	107-02-8	SW8260C	NA	20
Acrylonitrile	107-13-1	SW8260C	NA	20
Allyl Chloride	107-05-1	SW8260C	NA	5
Benzene	71-43-2	SW8260C	5	1
Bromodichloromethane	75-27-4	SW8260C	NA	2
Bromoform	75-25-2	SW8260C	NA	1
Bromomethane	74-83-9	SW8260C	NA	1
Carbon Disulfide	75-15-0	SW8260C	NA	1
Carbon Tetrachloride	56-23-5	SW8260C	5	1
Chlorobenzene	108-90-7	SW8260C	NA	1
Chloroethane	75-00-3	SW8260C	NA	2
Chloroform	67-66-3	SW8260C	100	1
Chloromethane	74-87-3	SW8260C	NA	1
Chloroprene	126-99-8	SW8260C	NA	2
cis-1,3-Dichloropropene	10061-01-5	SW8260C	NA	1
Dibromochloromethane	124-48-1	SW8260C	NA	1

Table 4 Triennial Groundwater Monitoring Methods for Appendix IX Compounds

ANALYTE	CAS RN	METHOD	GW PROTECTION STANDARD [µg/L]	LAB LOQ[1] [µg/L]
Dibromomethane	74-95-3	SW8260C	NA	1
Dichlorodifluoromethane	75-71-8	SW8260C	NA	1
Ethyl methacrylate	97-63-2	SW8260C	NA	2
Ethylbenzene	100-41-4	SW8260C	NA	1
Hexachlorobutadiene	87-68-3	SW8260C	NA	2
Iodomethane	74-88-4	SW8260C	NA	2
Isobutyl alcohol	78-83-1	SW8260C	NA	40
Methyl methacrylate	80-62-6	SW8260C	NA	2
Methylacrylonitrile	298-00-0	SW8260C	NA	20
Methylene Chloride	75-09-2	SW8260C	NA	1
Propionitrile	107-12-0	SW8260C	NA	20
Styrene	100-42-5	SW8260C	NA	1
Tetrachloroethene	127-18-4	SW8260C	5	1
Toluene	108-88-3	SW8260C	1,000	1
trans-1,2-Dichloroethene	156-60-5	SW8260C	100	1
trans-1,3-Dichloropropene	10061-02-6	SW8260C	NA	1
trans-1,4-Dichloro-2-butene	110-57-6	SW8260C	NA	2
Trichloroethene	79-01-6	SW8260C	5	1
Trichlorofluoromethane	75-69-4	SW8260C	NA	1
Vinyl Acetate	108-05-4	SW8260C	NA	2
Vinyl Chloride	75-01-4	SW8260C	2	1
Xylene (total)	1330-20-7	SW8260C	10,000	3
1,2,4,5-Tetrachlorobenzene	95-94-3	SW8270D	NA	10
1,3,5-Trinitrobenzene	99-35-4	SW8270D	NA	40
1,3-Dinitrobenzene	99-65-0	SW8270D	NA	10
1,4-Dioxane	123-91-1	SW8270D	NA	20
1,4-Naphthoquinone	130-15-4	SW8270D	NA	10
1,4-Phenylenediamine	106-50-3	SW8270D	NA	40
1-Naphthylamine	134-32-7	SW8270D	NA	10
2,3,4,6-Tetrachlorophenol	58-90-2	SW8270D	NA	10
2,4,5-Trichlorophenol	95-95-4	SW8270D	NA	10
2,4,6-Trichlorophenol	88-06-2	SW8270D	NA	10
2,4-Dichlorophenol	120-83-2	SW8270D	NA	10
2,4-Dimethylphenol	105-67-9	SW8270D	400	10
2,4-Dinitrophenol	51-28-5	SW8270D	NA	20
2,4-Dinitrotoluene	121-14-2	SW8270D	NA	10

Table 4 Triennial Groundwater Monitoring Methods for Appendix IX Compounds

ANALYTE	CAS RN	METHOD	GW PROTECTION STANDARD [µg/L]	LAB LOQ[1] [µg/L]
2,6-Dichlorophenol	87-65-0	SW8270D	NA	10
2,6-Dinitrotoluene	606-20-2	SW8270D	NA	10
2-Acetylaminofluorene	53-96-3	SW8270D	NA	10
2-Chloronaphthalene	91-58-7	SW8270D	NA	10
2-Chlorophenol	95-57-8	SW8270D	NA	10
2-Methyphenol (o-Cresol)	95-48-7	SW8270D	NA	10
2-Naphthylamine	91-59-8	SW8270D	NA	20
2-Nitroaniline	88-74-4	SW8270D	NA	10
2-Nitrophenol	88-75-5	SW8270D	NA	10
2-Picoline	109-06-8	SW8270D	NA	10
3,3'-Dichlorobenzidine	91-94-1	SW8270D	NA	10
3,3'-Dimethylbenzidine	119-93-7	SW8270D	NA	20
3-Methylcholanthrene	56-49-5	SW8270D	NA	10
3-,4-Methylphenol[3] (m/p-Cresol)	108-39-4/ 106-44-5	SW8270D	NA	10
3-Nitroaniline	99-09-2	SW8270D	NA	10
4,6-Dintro-2-methyphenol	534-52-1	SW8270D	NA	20
4-Aminobiphenyl	92-67-1	SW8270D	NA	10
4-Bromophenyl phenyl ether	101-55-3	SW8270D	NA	10
4-chloro-3-methylphenol	59-50-7	SW8270D	NA	10
4-chloroaniline	7005-72-3	SW8270D	NA	10
4-Chlorophenyl phenyl ether	106-47-8	SW8270D	NA	20
4-Nitroaniline	100-01-6	SW8270D	NA	10
4-Nitrophenol	100-02-7	SW8270D	NA	20
4-Nitroquinoline-1-oxide	56-57-5	SW8270D	NA	20
5-Nitro-o-toluidine	99-55-8	SW8270D	NA	10
7,12-Dimethylbenz(a)anthracene	57-97-6	SW8270D	NA	10
Acetophenone	98-86-2	SW8270D	NA	20
alpha, alpha-Dimethylphenethylamine	122-09-8	SW8270D	NA	60
Aniline	62-53-3	SW8270D	NA	20
Aramite #1	140-57-8	SW8270D	NA	10
Benzyl Alcohol	100-51-6	SW8270D	NA	10
bis(2-chloroethoxy)methane	111-91-1	SW8270D	NA	10
bis(2-chloroethyl)ether	111-44-4	SW8270D	NA	10
bis(2-Chloroisopropyl)ether	108-60-1	SW8270D	NA	10
Bis(2-ethylhexyl)phthalate	117-81-7	SW8270D	NA	20

Table 4 Triennial Groundwater Monitoring Methods for Appendix IX Compounds

ANALYTE	CAS RN	METHOD	GW PROTECTION STANDARD [µg/L]	LAB LOQ[1] [µg/L]
Butyl benzyl phthalate	85-68-7	SW8270D	NA	10
Chlorobenzilate	510-15-6	SW8270D	NA	10
Diallate	2303-16-4	SW8270D	NA	10
Dibenzofuran	132-64-9	SW8270D	NA	10
Diethyl phthalate	84-66-2	SW8270D	NA	10
Dimethyl phthalate	131-11-3	SW8270D	NA	10
Di-n-butyl phthalate	84-74-2	SW8270D	NA	10
Di-n-octyl phthalate	117-84-0	SW8270D	NA	10
Diphenylamine[4]	122-39-4	SW8270D	NA	10
Ethyl methanesulfonate	62-50-0	SW8270D	NA	10
Famphur	52-85-7	SW8270D	NA	50
Hexachlorobenzene	118-74-1	SW8270D	NA	10
Hexachlorocyclopentadiene	77-47-4	SW8270D	NA	10
Hexachloroethane	67-72-1	SW8270D	NA	10
Hexachlorophene	70-30-4	SW8270D	NA	100
Hexachloropropene	1888-71-7	SW8270D	NA	10
Isodrin	465-73-6	SW8270D	NA	10
Isophorone	78-59-1	SW8270D	NA	10
Isosafrole	120-58-1	SW8270D	NA	20
Kepone	143-50-0	SW8270D	NA	50
Methapyrilene	91-80-5	SW8270D	NA	60
Methyl methanesulfonate	66-27-3	SW8270D	NA	10
Nitrobenzene	98-95-3	SW8270D	NA	10
N-Nitrosodiethylamine	55-18-5	SW8270D	NA	10
n-Nitrosodimethylamine	62-75-9	SW8270D	NA	10
N-Nitrosodi-n-butylamine	924-16-3	SW8270D	NA	10
n-Nitroso-di-n-propylamine	621-64-7	SW8270D	NA	10
n-Nitrosodiphenylamine[4]	86-30-6	SW8270D	NA	10
n-Nitrosomethylethylamine	10595-95-6	SW8270D	NA	10
n-Nitrosomorpholine	59-89-2	SW8270D	NA	10
N-Nitrosopiperidine	100-75-4	SW8270D	NA	10
N-Nitrosopyrrolidine	930-55-2	SW8270D	NA	10
O,O,O-Triethyl phosphorothioate	126-68-1	SW8270D	NA	10
o-Toluidine	95-53-4	SW8270D	NA	20
p-(Dimethylamino)azobenzene	60-11-7	SW8270D	NA	10
Pentachlorobenzene	608-93-5	SW8270D	NA	10

Table 4 Triennial Groundwater Monitoring Methods for Appendix IX Compounds

ANALYTE	CAS RN	METHOD	GW PROTECTION STANDARD [µg/L]	LAB LOQ[1] [µg/L]
Pentachloroethane	76-01-7	SW8270D	NA	10
Pentachloronitrobenzene	82-68-8	SW8270D	NA	10
Pentachlorophenol	87-86-5	SW8270D	NA	20
Phenacetin	62-44-2	SW8270D	NA	10
Phenol	108-95-2	SW8270D	NA	10
Pronamide	23950-58-5	SW8270D	NA	10
Pyridine	110-86-1	SW8270D	NA	40
Safrole	94-59-7	SW8270D	NA	10
Thionazin	297-97-2	SW8270D	NA	20
Dimethoate	60-51-5	SW8270D (PEST)	NA	20
Disulfoton	298-04-4	SW8270D (PEST)	NA	20
Methyl parathion	126-98-7	SW8270D (PEST)	NA	10
Parathion	56-38-2	SW8270D (PEST)	NA	10
Phorate	298-02-2	SW8270D (PEST)	NA	10
Tetraethyl dithiopyrophosphate	3689-24-5	SW8270D (PEST)	NA	10
2-Methylnaphthalene	91-57-6	SW8270D SIM	180	0.5
Acenaphthene	83-32-9	SW8270D SIM	NA	0.5
Acenaphthylene	208-96-8	SW8270D SIM	NA	0.5
Anthracene	120-12-7	SW8270D SIM	NA	0.5
Benzo(a)anthracene	56-55-3	SW8270D SIM	NA	0.5
Benzo(a)pyrene	50-32-8	SW8270D SIM	NA	0.5
Benzo(b)fluoranthene	205-99-2	SW8270D SIM	NA	0.5
Benzo(g,h,I) perylene	191-24-2	SW8270D SIM	NA	0.5
Benzo(k)fluoranthene	207-08-9	SW8270D SIM	NA	0.5
Chrysene	218-01-9	SW8270D SIM	NA	0.5
Dibenz(a,h,)anthracene	53-70-3	SW8270D SIM	NA	0.5
Fluoranthene	206-44-0	SW8270D SIM	NA	0.5
Fluorene	86-73-7	SW8270D SIM	NA	0.5
Indeno(1,2,3-c,d)pyrene	193-39-5	SW8270D SIM	NA	0.5
Naphthalene	91-20-3	SW8270D SIM	1,460	0.5
Phenanthrene	85-01-8	SW8270D SIM	NA	0.5
Pyrene	129-00-0	SW8270D SIM	NA	0.5

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] Laboratory LOQs from EMAX, except method EPA 1613/SW8290 from ALS Houston.

[2] As technical chlordane.

[3] 3-Methylphenol and 4-methylphenol coelute and cannot be separated.

[4] n-Nitrosodiphenylamine as diphenylamine. Diphenylamine and n-nitrosodiphenylamine cannot be separated.

This page intentionally blank

3.0 DATA QUALITY INDICATORS

The overall QC objectives for sampling and laboratory activities are to develop and implement procedures for obtaining and evaluating data in an accurate, precise, and complete manner so that measurement data and laboratory procedures provide information that is comparable to and representative of field conditions. The quality of the data collected for this project will be verified through appropriate measurement performance criteria (MPC) established for both sampling procedures and analytical methods. The criteria also relate to data quality indicators (DQIs) consisting of precision, accuracy, representativeness, completeness, comparability, and sensitivity (commonly referred to as PARCCS) parameters. The quality of the sampling procedures and laboratory results will be evaluated for compliance with project DQOs through a review of overall PARCCS, in accordance with the QC procedures described in the following sections.

Tables 5 through 17 summarize the MPC for each matrix and analytical group. The tables identify the DQIs, MPC, and QC sampling and/or activity that will be used to assess performance for both the sampling and analytical measurement systems. In general, the MPC follow those defined in the U.S. Department of Defense (DoD) *Quality Systems Manual (QSM) for Environmental Laboratories Version 5.3* (or more recent) (DoD 2019a) and the analytical methods (Alaska Department of Environmental Conservation [ADEC] 2017; EPA 2015).

3.1 Precision

Precision measures the scatter in the data resulting from random error. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision can be measured using laboratory control sample (LCS) and laboratory control sample duplicates (LCSD). Laboratory precision in the sample matrix can be evaluated using laboratory replicates and matrix spike (MS)/matrix spike duplicate (MSD) samples. Field precision can be evaluated with primary samples and field duplicate samples.

Precision will be evaluated by comparing the following:

- LCS and LCSD (if prepared and analyzed) to determine the precision of the laboratory procedures and verify matrix interference
- MS/MSD samples to determine the effect of the sample matrix on the precision of the results generated using the selected analytical method
- Primary and field duplicate sample results

The required level of precision for field duplicate samples is relative percent difference (RPD) of 30% for aqueous samples and 25% for vapor samples (if collected and analyzed). RPD is calculated using the following formula:

$$RPD = \frac{2[|D_1 - D_2|]}{D_1 + D_2} x100$$

Where: D_1 = first sample value

D_2 = second sample value

3.2 Accuracy

Accuracy measures the closeness of the measured value to the true value. Analytical accuracy is assessed by "spiking" samples with known standards (e.g., LCS and/or LCSD, surrogates, and/or MS/MSD) and establishing the percent recovery.

Accuracy will be evaluated by reviewing the following:

- Calibrations – initial and continuing, acceptance, and frequency
- Method blanks – detections in the method blank may indicate potential high bias in associated samples
- Surrogates – recovery and frequency
- LCS and LCSD recoveries
- MS/MSD recoveries
- Relative response factors (RFs) and relative standard deviation (RSD) – appropriate calibration procedures improve accuracy of measurement results
- Gas chromatography (GC) second-column confirmation, if required by the method
- Tuning criteria GC/mass-spectrometry (GC/MS) – acceptability and frequency (to ensure accuracy of mass and ion abundance measurements)
- Internal standards (GC and GC/MS) – acceptability and frequency

Percent recovery (%R) for surrogates, LCS/LCSD, and MS/MSD is calculated using the following formula:

$$\%R = \frac{(S - U)}{C_{sa}} \times 100$$

Where: S = measured concentration in spiked aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added

3.3 Representativeness

Representativeness measures how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the matrix sampled. The sampling plan design, sampling techniques, and sample handling protocols (e.g., storage, preservation, and transportation) have been developed to assure representative samples. Representativeness will be evaluated by reviewing the following:

- Sampling design, including sample quantities and locations
- Sampling procedures and equipment
- Sample chain-of-custody (CoC) forms and field logbooks
- Holding times and preservation

3.4 Completeness

Completeness is a measure of the amount of valid data obtained compared with the amount that was expected to be obtained under correct, normal conditions. Valid data are considered usable in the context of project DQOs and/or end data uses. Completeness will be calculated using the following formula:

$$\%Completeness = \left(\frac{V}{n}\right) \times 100$$

Where: V = number of measurements determined to be valid
n = total number of measurements

The target completeness goal for this project is 90 percent.

3.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. To ensure data set comparability, the following steps will be taken:

- Using standard methods for sampling and analysis
- Reporting data in standard units
- Operating instruments within their calibrated range according to established procedures that are based on approved methodology
- Using only standards supplied by the field test kit manufacturer for field screening analysis
- Using standard and comprehensive reporting formats

3.6 Sensitivity

Sensitivity is the ability of a method or instrument to detect the target analytes at the level of interest. The capability of analytical laboratory methods and instrumentation to provide data with the sensitivity to meet the DQOs is evaluated during the planning phase. Laboratory limits (including detection limits [DL], LOD, and LOQ), are evaluated against permit-specified Groundwater Protection Standards to ensure that the selected analytical methods and/or laboratory can provide data that meet the project DQOs.

If a result is greater than the DL and less than the LOQ, the result will be reported as a detected concentration and flagged as estimated, "J." If no detected concentration is determined down to the DL, the result will be reported to the LOD concentration (with the added variables of sample dilution, final volume, and sample mass included), reported as a non-detect (ND) result. A detected result greater than or equal to the LOQ will be reported without a qualifying flag unless otherwise required by QC exceedance.

Sample dilution due to target and/or non-target compound concentrations or matrix interference could prevent achievement of project sensitivity goals. Samples must be analyzed initially while undiluted, when reasonable. If dilution is necessary, both the original and the diluted results must be reported. Samples that are not analyzed undiluted must be supported by matrix interference documentation, such as sample viscosity, color, odor, or results from other analyses of the same sample, to show that undiluted analysis is not possible. Appropriate cleanup procedures must be followed to minimize matrix effects on reporting limits.

3.7 Measurement Performance Criteria

Tables 5 through 17 summarize the MPC for all analytical methods and matrices.

Table 5 Measurement Performance Criteria for Method AK102/AK103 (DRO/RRO)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per extraction batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[1]
Accuracy/Precision	LCS/LCSD Recoveries/RPD MS/MSD Recoveries/RPD	Analyze 1 set per extraction batch	DRO: 75 to 125%R[2] RRO: 60-120%R[2] RPD ≤ 20%[2]
Accuracy	Surrogate Recoveries	Every sample	60-120%R (lab samples)[2] 50-150%R (field samples)[2]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 20% difference[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be extracted and analyzed within holding times: 14 days to extraction, 40 days to analysis
Representativeness/Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] DoD QSM 5.3 (DoD 2019a).

[2] *Underground Storage Tank Procedures Manual* (ADEC 2017).

Table 6 Measurement Performance Criteria for Method SW6020 (Total Metals Excluding Mercury)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per preparatory batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[1]
Accuracy/Precision	LCS Recoveries (LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per preparatory batch	%R limits, DoD QSM 5.3, Table C-6[1] RPD ≤ 20%[1]
Accuracy/Bias	Post-digestion spike	Analyze 1 per extraction batch	Recovery within 80-120%[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 10% difference[1]
Accuracy/Bias	Interfering element check standards	Every analytical batch, per laboratory SOPs	ICS-A: Absolute value of concentration for all non-spiked project analytes <1/2 LOQ (unless they are a verified trace impurity from one of the spiked analytes); ICS-AB: Within ±20% of expected value[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be prepared and analyzed within holding time: 180 days
Representativeness/Usability	Temperature Blank	1 measurement per cooler	None
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] DoD QSM 5.3 (DoD 2019a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 7 Measurement Performance Criteria for Method SW7470 (Total Mercury)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per preparatory batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample.[1]
Accuracy/Precision	LCS Recoveries (LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per preparatory batch	82-119%R, DoD QSM 5.3, Table C-6[1] RPD ≤ 20%[1]
Accuracy/Bias	Post-digestion spike	Analyze 1 per extraction batch	Recovery within 80-120%[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 10% difference[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be prepared and analyzed within holding time: 28 days
Representativeness/Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] DoD QSM 5.3 (DoD 2019a).

Table 8 Measurement Performance Criteria for Method SW8081 (Organochlorine Pesticides)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per extraction batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample.[1]
Accuracy/Precision	LCS Recoveries (and LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per extraction batch	%R, DoD QSM 5.3, Table C-16[1] RPD ≤ 30%[1]
Accuracy	Surrogate Recoveries	Every sample	%R, DoD QSM 5.3, Table C-16[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 20% difference[1]
Accuracy/Bias	Breakdown check	Every analytical batch, per laboratory SOPs	Degradation ≤ 15% each for dichlorodiphenyltrichloroethane and Endrin[1]
Accuracy/Bias	Second-column confirmation	All results > DL	RPD between primary and secondary column ≤ 40%[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be extracted and analyzed within holding times: 7 days to extraction, 40 days to analysis
Representativeness/Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] DoD QSM 5.3 (DoD 2019a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 9 Measurement Performance Criteria for Method SW8082 (PCBs)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per extraction batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample.[1]
Accuracy/Precision	LCS Recoveries (and LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per extraction batch	%R, DoD QSM 5.3, Table C-18[1] RPD ≤ 30%[1]
Accuracy	Surrogate Recoveries	Every sample	%R, DoD QSM 5.3, Table C-18[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 20% difference[1]
Accuracy/Bias	Second-column confirmation	All results > DL	RPD between primary and secondary column ≤ 40%[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be extracted and analyzed within holding times: 40 days to extraction and analysis
Representativeness/Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] DoD QSM 5.3 (DoD 2019a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 10 Measurement Performance Criteria for Method SW8151 (Chlorinated Herbicides)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per extraction batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample.[1]
Accuracy/Precision	LCS Recoveries (and LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per extraction batch	%R, DoD QSM 5.3, Table C-22[1] RPD ≤ 30%[1]
Accuracy	Surrogate Recoveries	Every sample	%R, DoD QSM 5.3, Table C-22[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 20% difference[1]
Accuracy/Bias	Second-column confirmation	All results > DL	RPD between primary and secondary column ≤ 40%[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be extracted and analyzed within holding times: 7 days to extraction, 40 days to analysis
Representativeness/Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] DoD QSM 5.3 (DoD 2019a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 11 Measurement Performance Criteria for Method SW8260 (VOCs)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per extraction batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[1]
Accuracy/Precision	LCS Recoveries (and LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per extraction batch	%R limits, DoD QSM 5.3, Table C-24[1] RPD ≤ 20%[1]
Accuracy	Surrogate Recoveries	Every sample	%R limits, DoD QSM 5.3, Table C-24[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 20% difference (≤ 50% for end of analytical batch CCV)[1]
Sensitivity	Internal Standards	Every analytical batch, per laboratory SOPs	RT ±10 seconds from RT of the IS of the calibration midpoint and extracted ion current profile area within -50% to +100% of area from IS calibration midpoint standard[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be analyzed within holding time: 14 days to analysis
Representativeness/Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C Water samples must have < 6-mm diameter headspace in vials
Representativeness/ Usability/Contamination	Trip Blank	1 per cooler containing volatile samples	≤ DL
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] DoD QSM 5.3 (DoD 2019a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 12 Measurement Performance Criteria for Method SW8270 (SVOCs), SW8270 SIM (Organophosphorus Pesticides), and SW8270 SIM (PAH)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per extraction batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[1]
Accuracy/Precision	LCS Recoveries (and LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per extraction batch	%R limits, QSM 5.3, Table C-26 (SVOC/Pesticides)[1] %R limits, QSM 5.3, Table C-28 (PAH)[1] RPD ≤ 20%[1]
Accuracy	Surrogate Recoveries	Every sample	%R limits, DoD QSM 5.3, Table C-26 (SVOC/Pesticides) %R limits, DoD QSM 5.3, Table C-28 (PAH)[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 20% difference (≤ 50% for end of analytical batch CCV)[1]
Sensitivity	Internal Standards	Every analytical batch, per laboratory SOPs	RT ±10 seconds from RT of the IS of the calibration midpoint and extracted ion current profile area within -50% to +100% of area from IS calibration midpoint standard[1]
Representativeness/ Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be extracted and analyzed within holding times: 7 days to extraction, 40 days to analysis
Representativeness/ Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] DoD QSM 5.3 (DoD 2019a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 13 Measurement Performance Criteria for Method SW8290 (Polychlorinated Dioxins and Furans)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per extraction batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample.[1] (OCDD considered a comment laboratory contaminant.)
Accuracy/Precision	LCS Recoveries (and LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per extraction batch	%R limits, DoD QSM 5.3, Table C-30[1] RPD ≤ 20%[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	Ion abundance ratios in accordance with method. RF (unlabeled standards) ± 20%D of average RF from initial calibration (ICAL); and RF (labelled standards) within ± 30%D of average RF from ICAL.[1]
Sensitivity	Internal Standards	Every analytical batch, per laboratory SOPs	40-135%R[1]
Representativeness/ Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be extracted and analyzed within holding times: 30 days to extraction, 45 days to analysis
Representativeness/ Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] DoD QSM 5.3 (DoD 2019a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 14 Measurement Performance Criteria for Method SW9014 (Cyanide)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 30% for waters
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per preparatory batch	No analytes detected > 1/2 LOQ or > 1/10 the amount found in any sample.[1]
Accuracy/Precision	LCS Recoveries (LCSD, if performed); MS/MSD Recoveries; RPD	Analyze 1 set per preparatory batch	83-116%R, DoD QSM 5.3, Table C-39[1] RPD ≤ 20%[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 10% difference[1]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be prepared and analyzed within holding time: 14 days
Representativeness/Usability	Temperature Blank	1 measurement per cooler	Temperature 0 to 6°C
Representativeness/Usability/ Contamination	Equipment Blank Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	LOD for ND results below Groundwater Protection Standards. For analytes without Groundwater Protection Standards, evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] DoD QSM 5.3 (DoD 2019a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 15 Measurement Performance Criteria for Method TO-12 (Modified) in Vapor Samples (NMOC)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate (if collected and analyzed)	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 25% for vapor samples
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per preparatory batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[1]
Accuracy/Precision	LCS/LCSD Recoveries	Analyze 1 set per preparatory batch	75-125%R[2]
Accuracy/Precision	Sample analysis	Every sample	Single analysis. Duplicate sample with RPD ≤ 25% for detections more than 5 times the reporting limit.[2]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be prepared and analyzed within holding time: 30 days
Representativeness/Usability/ Contamination	Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	Evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] DoD QSM 5.3 (DoD 2019a).
[2] Laboratory criteria from Eurofins Air Toxics (EATL).

Table 16 Measurement Performance Criteria for EPA Method 25 in Vapor Samples (NMOC)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate (if collected and analyzed)	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 25% for vapor samples
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per preparatory batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[1]
Accuracy/Precision	Triplicate analysis	Every sample	RPD < 5%
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be prepared and analyzed within holding time: 30 days
Representativeness/Usability/ Contamination	Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	Evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] DoD QSM 5.3 (DoD 2019a).

[2] Laboratory criteria from Air Technology Laboratories (ATL).

Table 17 Measurement Performance Criteria for Method TO-15 (VOCs) in Vapor Samples

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITIES	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field Duplicate (if collected and analyzed)	1 per 10 or fewer primary sample, per analyte, per matrix	RPD ≤ 25% for vapor samples
Accuracy/Bias/Contamination	Method Blank	Analyze 1 per preparatory batch	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[1]
Accuracy/Precision	LCS/LCSD Recoveries, RPD	Analyze 1 set per preparatory batch	%R, DoD QSM 5.3, Table C-43[1] RPD < 30%[1]
Accuracy/Bias	ICV and CCV	Every analytical batch, per laboratory SOPs	≤ 30% difference[1]
Sensitivity	Internal Standard	Every analytical batch, per laboratory SOPs	Field samples, blanks, and QC: Retention time of each internal standard within 20 seconds of most recent ICAL
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Every sample and analysis	Samples must be prepared and analyzed within holding time: 30 days
Representativeness/Usability	Canister vacuum/pressure	1 measurement per sample	28-30”Hg prior to sampling
Representativeness/Usability/ Contamination	Field Blank	1 per Site, per event, collected using re-usable equipment	≤ DL
Sensitivity	Evaluate laboratory LODs and LOQs against project criteria	Every analyte	Evaluate sample LOQs compared to laboratory LOQ goals.
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	Each Site, each sampling event	90%

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] DoD QSM 5.3 (DoD 2019a).

4.0 LABORATORY REPORTING REQUIREMENTS

The laboratory used to perform work for this project is required to follow the appropriate program and method requirements to ensure that the data quality is acceptable and can be used to support project decisions.

Laboratory certification requirements include the following:

- Current State of Alaska certificate of approval
- DoD Environmental Laboratory Accreditation Program (ELAP) approval for the fields of testing and matrices proposed on the project

Analytical methods must be DoD ELAP accredited, where possible. DoD accreditation not required (TO-12) and/or not available (EPA Method 25) for air analysis for non-methane organic compounds (NMOC).

The following sections describe laboratory requirements for data packages, result reporting, and data evaluation.

4.1 Analytical Data Package Requirements

A group of samples submitted to the laboratory at the same time and included on the same CoC, or a set of CoCs within a shipment, will be considered a sample delivery group (SDG). The results for an SDG will be reported as one analytical data package. Laboratories must provide Stage 4 data packages that meet the minimum requirements included in Appendix A of the DoD QSM 5.3 (DoD 2019a).

Laboratory analytical reports must meet the following minimum requirements:

- Case narrative
- Project name
- Field sample identification (ID) number on CoC
- Abbreviated subcontracted laboratory name
- Subcontracted laboratory report number
- Lab ID number for sample
- Date sample collected
- Date sample received at subcontracted laboratory
- Date sample extracted, prepared, and analyzed
- Extraction or preparation procedures, if appropriate
- Analysis procedure including method numbers
- Analyte of parameter
- Initial and continuing calibration
- Analytical results and units
- Dilution factor
- Chromatograms and spectra for all methods
- Matrix
- Sample description (i.e., non-homogeneous, cloudy, viscous, etc.)

- All versions of the CoC record and sample cooler receipt forms, with all forms properly signed and dated

4.2 Laboratory Data Deliverables

At minimum, laboratory data deliverables for each SDG will include the following:

- Searchable and bookmarked electronic Stage 4 data package in portable document format (PDF) for each SDG consistent with DoD QSM Version 5.3 or more recent (DoD 2019a).
- Microsoft Excel electronic deliverable or other electronic format for each SDG for data qualification, as well as for import to the database established for the management of Base Kodiak monitoring data (Section 6.2).

4.3 Laboratory Result Reporting Requirements

The following result reporting requirements will be met for laboratory data:

- DLs and sample results should be reported to one decimal place more than the corresponding LOQ, unless the appropriate number of significant figures for the measurement dictates otherwise.
- Samples should be analyzed undiluted, if possible. ND results will be reported to the LOD.

All reported data will reflect any dilutions and/or concentrations. The dilution factor, if applicable, will be noted on the analytical report. Such changes should also be reflected in the reporting limits with footnotes detailing the reason for the dilution. If dilution is required, data from both runs will be recorded and reported; however, one result will be selected and reported as the primary result. If samples must be rerun for any reason, the data will be included in the report. Chemical data results between the DL and the LOQ will be flagged "J."

4.4 Laboratory Data Review and Evaluation

Initial data reduction, evaluation, and reporting at the laboratory will be carried out as described in the appropriate analytical protocols and the laboratory QA manual. All analytical data that the laboratory generates will be verified before submittal to the project team. This internal data review process will include all aspects of data generation, reduction, and QC assessment.

The laboratory will apply data qualifiers as part of its internal validation activities. The allowable data qualifiers for definitive data are Q, J, B, U, and N, defined in the DoD QSM. Flagging criteria apply when acceptance criteria are not met and when CAs are not successful or not performed.

The project chemist or data reviewer will subsequently evaluate the flags that the laboratory applied as part of its data validation and usability assessment activities. The flags may be accepted, modified, or rejected. For all data qualifiers that are changed, clear justification must be provided.

4.5 Laboratory Preventive Maintenance and Corrective Action

Laboratory preventative maintenance will be implemented in accordance with the laboratory QA manual and associated laboratory standard operating procedure (SOP). At a minimum, all major instrumentation will have associated records and logbooks, including schedules and maintenance criteria.

Preventative maintenance in the laboratory will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments, and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. Details of the maintenance procedures are addressed in the respective laboratory's SOPs and methods manuals.

Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to change as indicated by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the method-specific QC criteria.

During the course of the project, data quality issues affecting the analytical results may arise. The Project Manager, project chemist, qualified environmental professional, and contract laboratory analysts may be involved in the corrective action (CA), which may be immediate or long-term. An immediate CA may involve recalculating, reanalyzing, or repeating sample collection and should be conducted as soon as possible. Long-term CAs may be identified through performance evaluation samples, standards, control charts, or other devices. If acceptance criteria were not achieved and a CA was not successful, or a CA was not performed, the appropriate data qualifiers should be applied.

This page intentionally blank

5.0 DATA VALIDATION

The data validation process consists of data verification, data quality review, and data usability assessment. Data verification confirms that the specified requirements have been performed. Data quality review and assessment involve a systematic process of evaluating whether the data comply with the predefined requirements of the project (including method, procedural, and contract requirements) and comparing the data with the QC criteria specified in this QAPP. The data usability assessment is an evaluation based on the results of data verification and validation in the context of the overall project objectives.

5.1 Data Verification Procedures

Data verification inputs include planning documents, field records, and laboratory records. Data verification is a check that all specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records are available to proceed to data quality review.

Records, documents, and/or procedures that may be reviewed as part of the data verification process include, but are not limited to, the following:

- Field documentation including field logbook(s), global positioning system (GPS) coordinates, and photographs
- Field SOPs (verify that sampling SOPs were followed)
- Analytical SOPs (verify that analytical SOPs were followed)
- Sample receipt documentation including CoC forms, cooler receipt forms, and laboratory log-in information
- Field measurements, including water quality parameters
- Laboratory data packages (verify information provided for Stage 4 data package)
- Laboratory electronic data deliverables (EDDs) (verify that EDDs are consistent with PDF report and contract requirements)
- Analytical results (verify that all data for all samples were provided and that the specified analytical methods were used by the laboratory)
- Field QC sample results (verify all QAPP-required QC samples were collected and analyzed)

5.2 Data Validation Procedures

All project data will be reviewed on an analytical batch basis by assessing QC samples and associated field sample results. Data validation will be performed using the QC criteria defined in this QAPP; at a minimum the DoD QSM Version 5.3 or more recent (DoD 2019a); specific method guidance, such as the ADEC *Underground Storage Tanks Procedures Manual* (ADEC 2017); *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW 846* (EPA 2015); and the laboratory SOPs, in that order.

Laboratory data will be validated by an independent third-party subcontractor. Data validation includes the review of the analytical data including QC sample results, field and laboratory QA reports, and all data submittals. A Stage 4 data validation in accordance with the General Data Validation Guidelines

(DoD 2019b) is required. Reporting requirements, including completion of the ADEC Laboratory Data Review Checklist (ADEC 2015, 2020), are described in Section 6.0.

Information reviewed during the data validation may include, but is not limited to, the following:

- CoC and supporting records (such as ground courier documents), laboratory receipt checklist, and field QC records (if separate from CoC)
- Sample results forms
- Holding time compliance
- QC sample frequencies
- Blanks
- LCS recoveries (and precision, if LCSD performed)
- Surrogate spike recoveries
- MS/MSD recoveries and precision
- Field duplicate precision
- Method QC (preparation batch QC) and forms
- Instrument quantitation forms (raw data) and standards traceability logs
- Raw data (quantitation forms, instrument chromatograms and spectra)
- Case narrative review, laboratory flagging review, and other method specific criteria.

In addition, EDDs will be evaluated for consistency with project and contract requirements. EDDs will be consistent with the Stage 4 PDF report.

5.3 Data Validation Guidelines

The data validation will identify results requiring qualification and potential effects on data usability based on the MPC in Tables 5 through 17. Table 18 defines the qualifiers to be applied to the analytical data set, as appropriate. Direction of bias will be indicated when possible.

Table 18 Validation Qualifiers

QUALIFIER[1]	DESCRIPTION
U	The analyte was not detected and is reported as less than the LOD.
J	The reported result is an estimated value with an unknown bias.
J (±)	The result is an estimated value biased high (+) or biased low (-).
UJ	The analyte was not detected and is reported as less than the LOD, and the associated numerical value is approximate.
X	Sample results were affected by serious deficiencies in the ability to analyze the sample and meet QC criteria. Exclusion of the result is recommended.

Notes:
For definitions, see the Acronyms and Abbreviations section.

[1] Data validation will indicate when performance criteria are not met. The final rejection of data must be decided by the project team in the context of project objectives and not based solely on the assessment performed by the data validator.

Results may not be qualified in the following circumstances:

- Surrogate or MS recoveries were outside QC limits, and the sample was diluted by a factor of 5 or greater.
- MS recoveries were outside QC limits, and the spiked concentration was less than that of the parent sample.
- An analyte was detected in the method blank, but there was no detection in the sample.
- MS/MSD or LCS/LCSD recoveries exceeded upper control limits, and there was no detection in the sample(s).

Data may be rejected on the following grounds:

- Initial calibration (per compound) criteria not met
- Continuing calibration (per compound) not verified
- All ND results with the continuing calibration recovery less than control limits
- All ND results with the LCS recovery less than control limits
- LCS recovery less than 10% and the associated sample result is ND
- Result is ND and missed holding time greater than two times the method-specified holding time
- Result is ND and surrogate recovery is less than 10% (dilution factor of 5 or less)

5.4 Data Usability Assessment

The data usability assessment is an evaluation based on the results of data verification and quality review in the context of the overall project decisions or objectives. The assessment determines whether the project execution and resulting data meet the project DQOs. The sampling and analytical activities must be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data.

Data gaps may be present if (1) a sample is not collected, (2) a sample is not analyzed for the requested parameters, or (3) the data are determined to be unusable. The need for further investigation will be determined on a case-by-case basis. This determination will depend on whether data can be extrapolated from adjacent sample locations and whether the data are needed based on the results from adjacent sample locations.

This page intentionally blank

6.0 REPORTING AND DATABASE MANAGEMENT

This section describes reporting and data management requirements for the project.

6.1 Data Quality Summary Report

A data quality report will be prepared summarizing the findings of the data verification and data validation and discussing their effect on overall data usability. In addition to the overall data quality report, the data validator will complete the ADEC Laboratory Data Review Checklist (ADEC 2015, 2020) for each laboratory data package. In addition, a summary of the findings of the chemical data quality report will be included in the text of the report.

The data quality report will present detailed results of the data quality review and usability assessment, including, but not limited to, a discussion of all QC parameters evaluated; the acceptance criteria used to evaluate each parameter; the extent of the QC exceedance; identification of samples affected by the QC exceedance; and discussion of any qualifiers applied to the samples results, including potential direction of bias and relationship to screening levels and/or cleanup levels (if possible). Significant trends and biases in the data will be evaluated and identified. A detailed description will be provided for any CAs and/or systematic problems that were identified during the data review process.

Analytical data will be tabulated in the completed report. All analytical results, including duplicate results, will be reported with any appropriate qualifiers in accompanying data tables.

6.2 Data Management

The objective of this plan is to assure that data collected during the project are processed and archived in a manner that assures data quality, security, and retrievability, thereby assuring information integrity. A data management system will be used to store and track these data.

The laboratory will provide an EDD so that the sample results can be incorporated into the database established for the Kodiak monitoring data. The information compiled for the chemical analysis results will include:

- Sampling date
- Location identification, sample identification
- Field QA/QC sample identification and duplicate sample cross reference identification
- Field QA/QC sample results
- Sample matrix
- Constituents, results, units, QA qualifiers, detection limits

Information from sampling and analysis will be entered into the database within 1 month following the site visit or receipt of the data from the laboratory. Results received from the laboratory and data validation review results will be entered into the database. After the entries are complete, 10 percent of all data will be hand verified against raw data (i.e., field forms and laboratory certificates) by a person other than the database manager. If an error is found, another 10 percent will be checked. If an error is found again, 100 percent of the entries will be hand verified.

This page intentionally blank

7.0 PERFORMANCE AND SYSTEM AUDITS AND CORRECTIVE ACTION

The QA Coordinator will monitor the performance of the field and laboratory QA program. This will be achieved through regular contact with the field and analytical QA staff.

If routine QC audits result in detection of unacceptable conditions or data, the Task Order Manager in conjunction with the QA Officer will be responsible for implementing procedures to correct these conditions. The QA Officer provides a measure of assurance that CA will be an ongoing process that will have a limited impact on project schedule. Specific CAs are outlined in each respective EPA method used and can include but are not limited to the following:

- Identifying the source of the violation;
- Re-analyzing samples if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and/or
- Accepting data and flagging to indicate the level of uncertainty.

This page intentionally blank

8.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2015. Laboratory Data Review Checklist for Air Samples. February.

ADEC. 2017. *Underground Storage Tanks Procedures Manual.* March.

ADEC. 2020. Laboratory Data Review Checklist. May.

U.S. Department of Defense (DoD). 2019a. *Quality Systems Manual (QSM) Version 5.3.* May.

DoD. *2019b. General Data Validation Guidelines, Revision 1.* September.

U.S. Environmental Protection Agency (EPA). 2000. *EPA Quality Manual for Environmental Programs* (CIO 2105-P-01-0). EPA/. May.

EPA. 2001. *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5).* EPA/240/B-01/003.

EPA. 2014. *Guidance for Quality Assurance Project Plans (EPA QA/G-5).* EPA/240/R-02/009. February.

EPA. 2015. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA publication SW-846, Third Edition, Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), and V (2015).*

EPA. 2021. RCRA Permit. Base Kodiak No. AK9690330742. As amended March 2021.

This page intentionally blank

Draft
Attachment 4B

Closure Plan for the Hazardous Waste Storage Building N-48

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 INTRODUCTION **1**
2.0 FACILITY DESCRIPTION **3**
3.0 DESCRIPTION OF CLOSURE ACTIVITIES **7**

3.1 Closure Performance Standard [40 CFR 264.111 and 264.178] 7
3.2 Closure Notification [40 CFR 264.112] 7
3.3 Partial Closure [40 CFR 264.112(d)] 7
3.4 Amendment of Closure Plan [40 CFR 264.112(c)] 7
3.5 Maximum Waste Inventory [40 CFR 264.112(b)(3)] 8
3.6 Inventory Removal and Disposal [40 CFR 112(b)(3) and 264.114] 8
3.7 Waste Residue Removal and Decontamination [40 CFR 264.112(b)(4)] 9
3.7.1 Visual Inspection of the HWSB 9
3.7.2 Monitoring and Verification of Decontamination 9
3.7.3 Specific Procedures for Waste Residue Removal and Decontamination [40 CFR 264.114] 11
3.7.4 Soil Sampling 12
3.7.5 Sample Handling 13
3.8 Schedule for Closure [40 CFR 264.112(b)(6)] 13
3.9 Extension of Closure Time [40 CFR 264.113(a) and 264.113(b)] 13
3.10 Certification of Closure [40 CFR 270.11(d) and 264.115] 14

4.0 SURVEY PLAT [40 CFR 270.11(D) AND 264.115] **17**
5.0 POST-CLOSURE PLAN [40 CFR 270.14(B)(13)] **19**
6.0 NOTICE IN DEED [40 CFR 270.14(B)(14)] **21**
7.0 CLOSURE COST ESTIMATE [40 CFR 270.14(B)(15)] **23**
8.0 FINANCIAL ASSURANCE MECHANISM FOR CLOSURE [40 CFR 270.14(B)(15) AND 264.140(C)] **25**
9.0 POST-CLOSURE COST ESTIMATE [40 CFR 270.14(B)(16) AND 264.140(C)] **27**
10.0 FINANCIAL ASSURANCE MECHANISM FOR POST-CLOSURE CARE [40 CFR 270.14(B)(16) AND 264.140(C)] **29**
11.0 LIABILITY REQUIREMENTS [40 CFR 270.14(B)(17) AND 264.140(C)] **31**
12.0 STATE MECHANISMS **33**

12.1 Use of State-Required Financial Mechanisms [40 CFR 270.14(b)(18) and 264.140(c)] 33
12.2 State Assumption of Responsibility [40 CFR 270.14(b)(18) and 264.140(c)] 33

TABLES

Table 1 Closure Schedule for HWSB 14

FIGURES

Figure 1 Base Kodiak Hazardous Waste Storage Building Complex
Figure 2 Example Concrete Sampling Locations

This page intentionally blank

ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HWSB	Hazardous Waste Storage Building
RCRA	Resource Conservation and Recovery Act
TSDF	Treatment, Storage, and Disposal Facilities
USCG	U.S. Coast Guard

This page intentionally blank

1.0 INTRODUCTION

This Closure Plan specifies performance standards and describes procedures for closure of the Hazardous Waste Storage Building (HWSB) located at the U. S. Coast Guard (USCG) Base Kodiak. The purpose of this closure plan is to describe the procedures involved in the removal of waste, cleaning and decontaminating the HWSB, and ensuring that any soil contaminated above action levels is removed at closure.

The USCG intends to close the site by removing all waste and waste residues; therefore, a post-closure plan is not provided. However, if closure as a storage unit is not possible, the closure plan will be amended accordingly, and a post-closure plan will be prepared.

This page intentionally blank

2.0 FACILITY DESCRIPTION

The HWSB is located in the northwestern portion of the Base Kodiak on the Nyman Peninsula on Seafarer Drive. The HWSB (Building N-48) is a one-story building constructed in 1988 for the temporary storage of hazardous waste or materials prior to transportation off-site for treatment and disposal. It consists of an entry area, office area (Room 102), a locker room (Room 103), a restroom, a shower room, a waste storage room (Room 106), a waste handling and storage room (Room 107), a supply storage room (Room 108), the storage room (Room 109), and the outside waste loading/loading area.

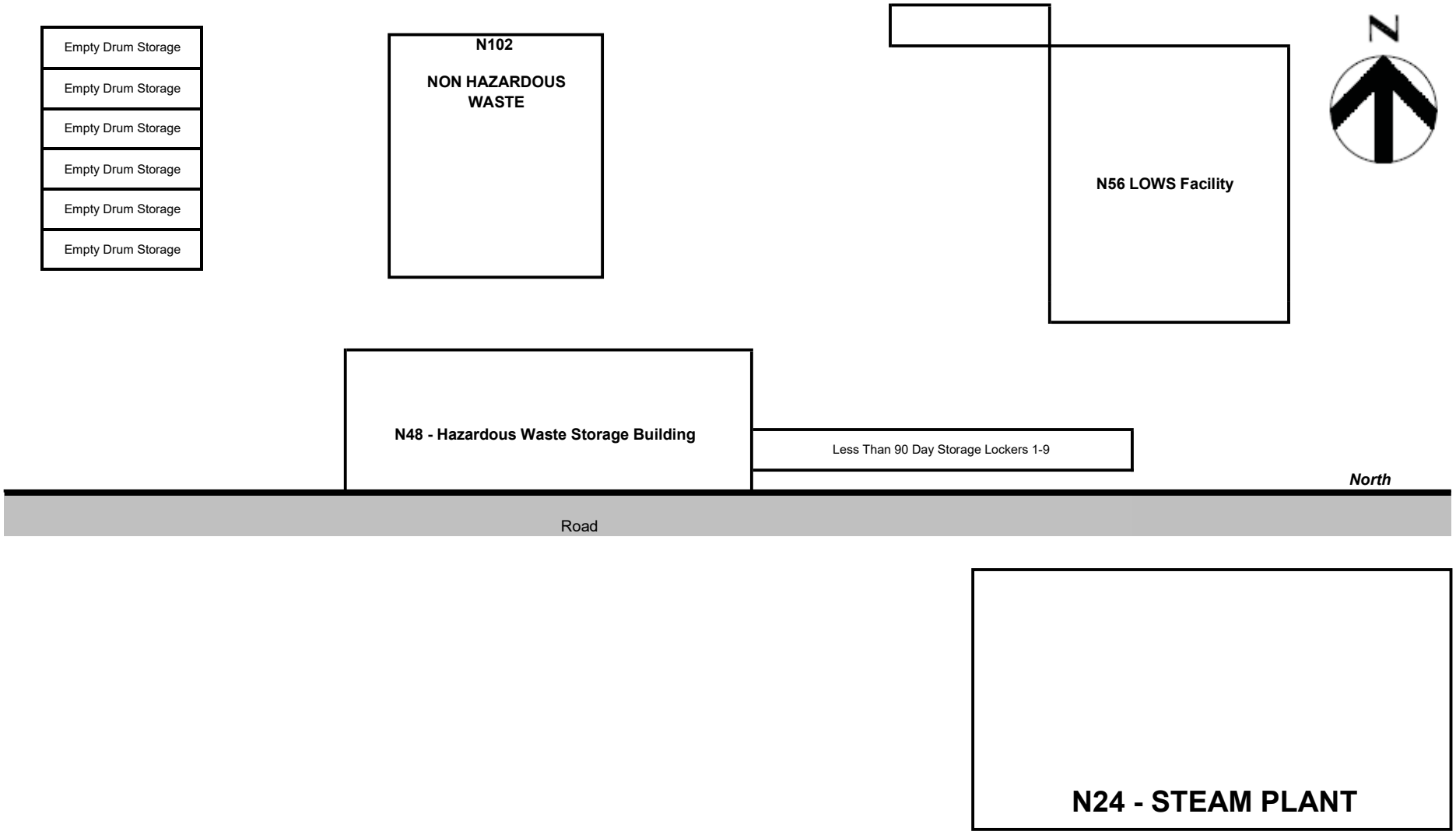
Building N-48 has 2800 square feet of interior floor space. The container storage area has 1,792 square feet of floor space. The base of the container storage area is a 6-inch-thick concrete foundation coated with a chemically-resistant epoxy seal. Room 107 has approximately 250 square feet of floor space and is also coated with a chemically-resistant epoxy seal. Figure 1 shows the layout of the Building N-48 interior.

The waste unloading/loading area is located outside the south door of the container storage area. All waste handling operations occur on the 8-foot by 10-foot loading pad. During interim status operation, waste loading to semi-trailers occurred in the unpaved area. No spills occurred in the outside unpaved area during interim status operation.

The HWSB provides temporary storage of hazardous wastes which are generated from aircraft maintenance and support; support for Base-based vessels and visiting vessels; facility maintenance; maintenance of aids to navigation, including ancillary facilities; and oil spill response activities. Some waste generated from investigations associated with corrective action activities associated with discontinued historical operations have been stored at the HWSB. A detailed description of the wastes managed at the HWSB may be found in Attachment 2 of the Resources Conservation and Recovery Act (RCRA) permit. Hazardous waste is stored in the HWSB until such time it is transported offsite to a RCRA facility for treatment, storage, or disposal. Wastes stored at the HWSB include D001-D010, D018, D022, D035, D039, D043, F001-F005, F027, F039, and a variety of U-listed wastes (U-165 and U-188) mostly comprising off-specification or out-of-date solvents.

This page intentionally blank

Figure 1 **Base Kodiak Hazardous Waste Storage Building Complex**



This page intentionally blank

3.0 DESCRIPTION OF CLOSURE ACTIVITIES

The following sections provide detailed information on the closure activities to be performed at the HWSB.

3.1 Closure Performance Standard [40 CFR 264.111 and 264.178]

Upon completion of closure of the HWSB, there will be no stored waste (regulated or nonregulated) or hazardous waste residues remaining in the container storage area (Room 109) or the waste handling room (Room 107) in HWSB or in the waste unloading/loading area. Closure will commence with the receipt of the last wastes at the HWSB. All stored waste will be subsequently removed from the HWSB and shipped offsite for treatment, storage, or disposal.

The floor surface of Rooms 107, each bay of Room 109, and the loading pad will also be inspected for evidence of spillage. If there is no historical or visual evidence of leaks, spills, or contamination, the room or lift will be considered to have met the closure performance standards given in Title 40 of the Code of Federal Regulations (CFR), Part 264.111 (40 CFR 264.111). If documentation of past leaks or spills exists, or visual evidence of contamination exists, concrete chip samples will be collected and analyzed as described in Section 3.7. If no contaminants are detected based on the analytical procedures described in Section 3.7, then the area will be considered to have met closure performance standards. If contaminants are detected above health-based action levels in effect at the time of closure, the bay will be decontaminated as described in Section 3.7. Health-based risk levels will consist of surface soil ingestion risk levels for volatile and semi-volatile organic compounds, PCBs and arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver in place at the time of closure. A soil health-based risk level will be used because there are no risk levels of concrete, and because this provides a conservative comparison for potential soil contamination, as if the contaminants had reached the soil beneath the building. Additional concrete chip samples will be collected after decontamination to measure the effectiveness of cleaning activities. If no contaminants are detected above action levels after additional concrete removal, the closure performance standards will have been met and the unit considered clean closed.

Once the HWSB has been certified closed by an independent, registered professional engineer, it will no longer be designated as a hazardous waste management unit and will be released to the Facilities Engineering Division for future use.

3.2 Closure Notification [40 CFR 264.112]

The USCG will notify the U.S. Environmental Protection Agency (EPA) 45 days prior to the expected date that closure operations are expected to begin as required in 40 CFR 264.112(d).

3.3 Partial Closure [40 CFR 264.112(d)]

Since other active hazardous waste management units are present at the Base, closure of this unit may constitute a partial closure as defined in 40 CFR 260.10, if other units are active at the time of closure of the HWSB.

3.4 Amendment of Closure Plan [40 CFR 264.112(c)]

USCG will amend the closure plan for any of the following occurrences:

- If any changes, events, or evidence is found requiring closure of the unit as a landfill,
- Any modifications or operational changes made to the existing HWSB which may affect the closure plan,
- Change in the expected year of closure, or
- Unexpected events that might occur during the conduct of partial or final closure activities (e.g. sampling reveals unexpected contamination).

The closure plan will be amended accordingly and submitted to the EPA Region 10 Administrator at least 60 days prior to the proposed change in facility design and operation or no later than 60 days after the occurrence of an unexpected event which has affected the closure plan. The closure plan will be amended and submitted to the EPA Region 10 Administrator 30 days after the occurrence of an unexpected event during partial or final closure activities.

3.5 Maximum Waste Inventory [40 CFR 264.112(b)(3)]

The maximum waste inventory at the HWSB during its active life is 14,080 gallons. The storage configuration representing this maximum inventory is described in Attachment 5 of the RCRA permit. Waste received at the HWSB is packaged in U.S. Department of Transportation (DOT)-approved containers. The size and number of containers stored at the HWSB varies at any given time. No soil contamination is known to be present at the HWSB. Therefore, for the purpose of this closure plan a conservative estimate of 10 cubic yards of potentially contaminated soil has been made as part of the maximum inventory.

3.6 Inventory Removal and Disposal [40 CFR 112(b)(3) and 264.114]

Closure will commence with the final receipt of waste at the HWSB. All wastes in storage will then be removed from the HWSB using the operating procedures outlined in Section 4.0 of the RCRA Part B permit application. RCRA waste will be shipped off site for treatment or disposal using the procedures outlined in Attachments 2, 5, and 6 of the RCRA permit. No treatment or stabilization of wastes will be performed prior to transport of wastes, unless regulations change to require such activities. RCRA waste will be transported off site by an EPA-approved hazardous waste transporter to a RCRA treatment, storage, or disposal facility in accordance with the shipping, manifesting, and documentation requirements of the RCRA permit. A uniform hazardous waste shipping manifest will accompany the waste shipments from the Base to a RCRA treatment, storage, or disposal facility. All shipments will be accompanied by appropriate land disposal restriction notices and certifications.

The HWSB will receive notification from the receiving facility that it has received the waste, and will also receive any applicable treatment or disposal certifications, notifications, or certificates. Anticipated disposal methods match those indicated in the Waste Analysis Plan, Attachment 2 of the RCRA permit. Manifests, notifications, certifications are documentation of the removal and disposition of the waste. Non-RCRA waste will be packaged, labeled, and transported offsite in accordance with applicable state and federal regulations in effect at the time of closure. Removal of all wastes from the HWSB will be documented in the HWSB operating record.

3.7 Waste Residue Removal and Decontamination [40 CFR 264.112(b)(4)]

Once the final waste inventory has been removed from the HWSB, the waste handling and storage room (Room 107) and the container storage area (Room 109) will be swept clean of dirt and debris. Solid material generated from this sweeping will be collected in DOT- approved containers.

3.7.1 Visual Inspection of the HWSB

A visual assessment of whether spills have occurred within the HWSB will be performed after all waste has been removed. The visual inspection will include an evaluation of the concrete floor throughout the HWSB. If evidence of spillage is observed within a bay or on other floor surfaces, appropriate actions to decontaminate or remove the portions of the contaminated structure will be undertaken (Section 3.7.3). Evidence of spillage includes, but is not limited to, discoloration, material degradation such as pitting and corrosion, and odors. If evidence of spillage is found, the contaminated area will be marked (using nonhazardous indelible markers, paints, diagrams, maps, or similar materials) for investigation and potential decontamination.

3.7.2 Monitoring and Verification of Decontamination

If a bay or other floor surface is found to have evidence of spillage or contamination, concrete chip sampling will be performed. Sampling locations are selected on the following basis (Figure 2):

- If visual evidence of contamination exists, samples will be collected from the area of suspected contamination (see Bay X, Figure 2). If a floor surface contains multiple areas of visual contamination, the surface will be divided into four equal rectangular sampling grid units. Each grid unit will be sampled. If multiple "hot spots" are present within one grid area, concrete chips from each "hot spot" will be collected and composited as the sample for that grid unit (see Bay Y, Figure 2).
- If no visual evidence exists but historical documentation of spills exists, then each grid unit will be divided into quarters. A sample from each quarter will be collected, and the four quarter samples composited into the sample representing that grid unit (see Bay Z, Figure 2).

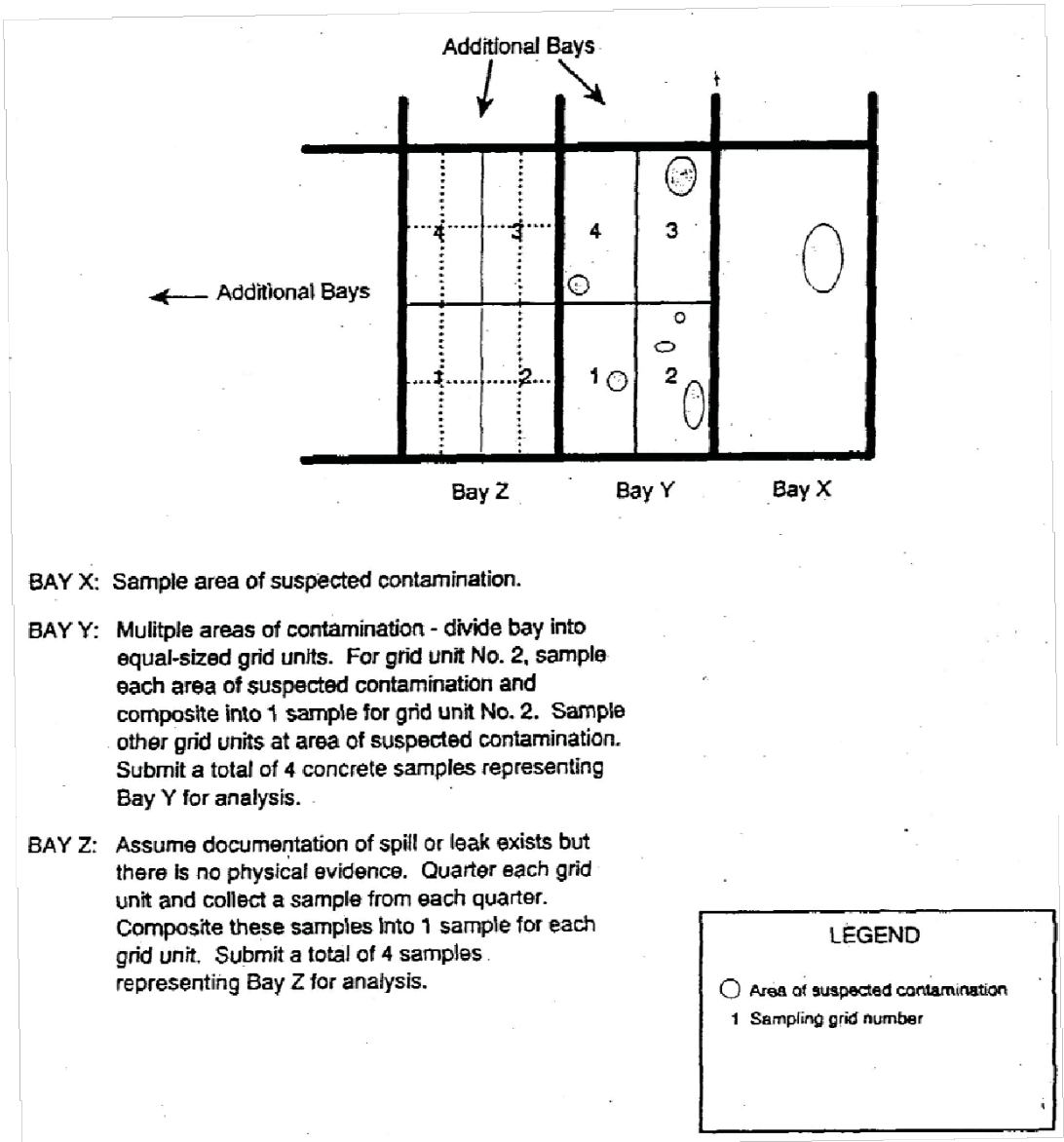
The concrete will be chiseled using tempered steel tools. The bits of concrete will be pulverized until a mesh size of 80-200 is obtained. The resulting fine bits and powder will be collected in a sample jar(s) and submitted for analysis using standard soil sample handling procedures for SW-846 analytical methods.

The concrete chip samples will be analyzed for the following compounds:

- Semi-volatile organic compounds (SW-846 Method 8270)
- Total arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver (SW 846 method 6010 for all metals except mercury [SW 846 Method 7471]
- PCBs (SW 846 method 8082 for PCBs only).

Samples will be analyzed according to the methods found in SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (EPA 1986) or an EPA-approved equivalent method. The selection of these parameters is based upon the inventory of chemicals and waste materials which have been stored at the HWSB. Volatile organic compounds are not targeted for analysis because the physical nature of sampling concrete will result in the volatilization of the volatile organic compounds. The use of tempered steel tools will minimize metal contamination from sampling materials.

Figure 2 Example Concrete Sampling Locations



Quality control samples will also be collected during all sampling activities. A duplicate sample (i.e. a sample collected within the same area) will be collected at a frequency of 1 per every 10 field samples for each matrix sampled for each day in the field for each target analyte. To monitor the effectiveness of equipment decontamination procedures for non- disposable sampling equipment, an equipment rinse sample will be collected at a rate of 1 for 20 samples. All quality control samples will be handled similarly to environmental samples and analyzed for the same constituents.

If contaminants are not detected above reported analytical quantitation limits or the levels reported in background samples, the bay in which the sample was taken will be considered clean and no further action will be necessary. If any contaminant is detected above the level in "clean" concrete background samples, then a comparison of the detected contaminants will be made to a soil health-based risk level. A soil health-based risk level will be used because there are no risk levels of concrete, and because this provides a conservative comparison for potential soil contamination, as if the contaminants had reached the soil beneath the building. If any contaminants are above a risk level, then the entire gridded area in which the sample was taken will be considered contaminated. At that time, decontamination procedures described in Section 3.7.3 will be undertaken. Once completed, additional concrete chip samples will be collected as described above to assess the effectiveness of decontamination operations. Cleanup efforts will continue as long as is necessary to obtain concrete chip samples which do not return results above a soil health- based risk level. If effective decontamination of the building cannot be performed, the unit may be removed and the concrete shipped off site to an appropriate disposal facility based on the results of the concrete sampling. Otherwise the unit will be sealed and closed as a landfill. In this scenario, a post-closure plan will be submitted. As closure sampling is completed, an amendment will be submitted for the closure plan to carry out one of the above scenarios, if necessary.

3.7.3 Specific Procedures for Waste Residue Removal and Decontamination [40 CFR 264.114]

To ensure the proper waste residue removal and decontamination of the HWSB, the following steps will be conducted during closure:

1. During all closure activities, a comprehensive safety plan will be adhered to by trained personnel to ensure safe closure proceedings. The safety plan will be approved by the USCG and include guidance on personal protective equipment and site monitoring.
2. The HSWB will be cleaned of debris; the debris will be appropriately containerized in 55-gallon open top drums (or other DOT-approved bulk containers) compatible with the types of material to be placed in them, and transported to an approved offsite hazardous waste treatment or disposal facility.
3. Each bay that was shown to be contaminated according to concrete chip sample results will be decontaminated by washing or the best method available at the time of closure. A decontamination fluid may be used with wash water to facilitate the cleaning effort. Wash water will collect on the curbed floors and in the sumps in Room 107 and Room 109. Wash water will be removed from these areas using a sump pump to pump the wash water into DOT-approved containers. Containers will be labeled according to the location of the wash water collected (Room 107, Room 109, sumps). Any residual liquid will be removed with absorbent material which will be placed in a separate container.
4. Accumulated water will be managed as a hazardous waste (containing the same contaminants that were detected during concrete chip sampling).

5. Any decontamination equipment used which may come into contact with hazardous waste, will be decontaminated after use. Decontamination will include washing with a cleanser appropriate to the type(s) of contamination present. Washwaters will be collected and managed as a hazardous waste.
6. Any HWSB operating equipment, such as the forklift, which may have come into contact with hazardous waste, will be decontaminated in one of the bays after final use. Decontamination will include washing with a cleanser appropriate to the type(s) of contamination present. Washwaters will be collected and managed as a hazardous waste.
7. The hydraulic scissors lift will be removed from the pit and foundation and relocated to Room 107 in the HWSB where it will be steam cleaned or washed. When the scissors lift has been cleaned three 10-centimeter smear samples will be obtained and analyzed for semi- volatile contaminants (SW 846 method 8270) and PCBs (SW 846 method 8082) to verify that no contamination exists. If the scissors lift is free from contamination, it will be relocated for future use. If contamination is present and decontamination is unsuccessful, the scissors lift will be disposed of appropriately, based on the sampling results.
8. The scissors lift foundation and pit will be steam cleaned or washed. The ground surface around the scissors lift will be covered with plastic sheeting and temporary containment barriers constructed prior to cleaning in order to protect the surrounding ground surface and allow wash water to collect. All collected wash water will be removed from the containment structure, and managed as a hazardous waste.

3.7.4 Soil Sampling

Contaminant release to the soil column is considered unlikely. The concrete flooring is currently in good condition (no cracks or gaps), and the foundation contains a lining designed to prevent ground water infiltration (and thus outward contaminant migration through the foundation). If releases were to occur, the most likely scenario would be a spill in the vicinity of the scissors lift. To assess this potential release route, five surface soil samples will be obtained around the scissors lift. Stained soil will be sampled, if present, to obtain a worst case for potential contamination. Otherwise, the samples will be evenly spaced around the lift and within 5 feet of it. Teflon or stainless-steel scoops will be used to obtain these samples. One duplicate soil sample will be obtained from one of the sample locations. A field blank, equipment rinse, and trip blank will also be collected. The samples, field blank and equipment rinse will be analyzed for:

- Volatile compounds (SW 846 Method 8260)
- Semi-volatile organic compounds (SW 846 Method 8270)
- Total arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver (SW 846 method 6010 for all metals except mercury [SW 846 Method 7471]
- PCBs (SW 846 method 8082)

If no contaminants are detected above analytical quantitation limits, it is doubtful that migration of any contaminants occurred to the soil column and no further soil investigations will be conducted as part of closure activities. If soil contamination is detected, the concentrations will be compared to surface soil health-based risk levels. If concentrations of any contaminants are above health-based risk levels, an amendment to this closure plan will be submitted detailing proposed subsurface investigation activities,

and an excavation plan. If soils are contaminated but are not above health-based risk levels, then no further investigations will be conducted, and no soil removal will be conducted.

If it is determined during closure that the possibility of soil contamination underlying the HWSB exists, then a site investigation will be conducted in order to identify the source, nature and extent of contamination. The determination of potential soil contamination under the building will be based on operating records of spills, indications of cracks or gaps, flooring repair records, etc., to assess the potential for liquids to have penetrated cracks or gaps in the concrete and migrating under the building. The review of records will determine the need for further field investigations.

If necessary, samples will be collected from underneath the concrete foundation in the area of the potential contamination. These samples will be obtained by coring through the concrete and obtaining samples from the top 6-12 inches of soil beneath the concrete. These samples will be analyzed for the same contaminants as the soil around the loading pad, and with the same frequency of quality assurance samples. Soil sample results will be compared with health-based risk levels to determine if any other action is necessary. If contaminants are above health-based risk levels, then an amendment to the closure plan will be developed to prepare an action plan for potential soil removal. Remedial action will be selected and implemented as necessary and with the review and approval of ADEC and EPA Region 10.

3.7.5 Sample Handling

All samples will be labeled with waterproof labels containing pre-printed or handwritten in permanent black ink information concerning the name of the project area and the analysis type. Labels will be secured to each container. The sampling date and time will be recorded in the sample logbook and on the label for the corresponding sample. All samples will be numbered in a systematic manner.

Sampling containers, preservatives, and holding times for use during closure sampling activities will be developed at the time of closure. All sampling containers will be certified as pre-cleaned and will remain sealed until ready for use. Chain-of-custody procedures will begin immediately after sample collection. All samples will be shipped in accordance with the following: DOT regulations (49 CFR 171 through 178); EPA sample handling, packaging, and shipping methods (40 CFR 262.30 through 262.34); and Base Kodiak shipping requirements.

3.8 Schedule for Closure [40 CFR 264.112(b)(6)]

The HWSB is an integral part of the operation of the Base. It is anticipated that the HWSB will continue to operate as long as the Base is in existence. The HWSB has been operating as a hazardous waste management unit since 1989. Based on this operational start date, it is estimated that the HWSB will continue to operate through the year 2039. If it becomes necessary to operate the HWSB beyond the year 2039, this Plan will be amended. Prior to closing, the EPA Region 10 Administrator will be notified in writing at least 45 days in advance of the date that closure operations are planned to begin. The schedule for closure of the HWSB is provided in Table 1.

3.9 Extension of Closure Time [40 CFR 264.113(a) and 264.113(b)]

Closure activities are anticipated to be completed within the prescribed 180-day period. No extension is requested at this time. If closure activities cannot be completed within the 180- day period, an extension will be requested from the Region 10 Administrator. The request for an extension will be made 30 days prior to expiration of the 180-day period.

Table 1 Closure Schedule for HWSB

ACTIVITY	DAY COMPLETED
Final receipt of wastes at HWSB	Day 0
Complete shipment of all wastes from HWSB to offsite TSDF	Day 15
Complete initial cleaning of storage areas, waste unloading and loading area and conduct visual inspection	Day 30
Complete sampling of concrete and soil around loading area and under building (if necessary)	Day 30
Evaluate sample data	Day 60
Complete repeat decontamination and confirmatory sampling, if required	Day 90
Evaluate data from confirmatory sampling and analysis and repeat cleaning or remove floor of building	Day 120
Complete decontamination of waste handling equipment	Day 130
Transport waste generated by cleaning or decontamination efforts to an appropriate treatment, storage, or disposal facility	Day 150
Complete all closure activities	Day 180
Submit closure certification to EPA Region 10	60 days after completion of closure

Notes:
EPA = U.S. Environmental Protection Agency
HWSB = Hazardous Waste Storage Building
TSDF = Treatment, Storage, and Disposal Facilities

3.10 Certification of Closure [40 CFR 270.11(d) and 264.115]

Within 60 days after completion of closure of the HWSB, USCG will submit to EPA a certification of closure. The certification will be signed by both the USCG and a qualified registered professional engineer. This certification will state that the HWSB has been closed in accordance with the approved closure plan. Documentation supporting the closure certification will be retained and furnished to EPA upon request. The USCG will certify closure with the following statement (or similar statement):

> *The undersigned, owner/operator of the HWSB hereby certify that I have reviewed the approved closure plan for the HWSB and, to the best of my information and belief, all closure activities were performed in accordance with the specifications identified in the approved closure plan. (Signature and date.)*

The USCG will engage a qualified professional engineer to certify that the HWSB has been closed in accordance with the approved closure plan. The USCG will require the engineer to sign the following statement (or similar statement):

> *The undersigned, a qualified professional engineer, hereby certify that I have reviewed the approved closure plan for the HWSB and, to the best of my information and belief, all closure activities were performed in accordance with the specifications identified in the approved closure plan. (Signature, date, professional engineer license number, business address, and telephone number.)*

In making this statement, the professional engineer will have performed the following specific activities related to closure.

- Reviewed all operation logs and reports from decontamination and sampling
- Reviewed verification concrete and soil sample analyses and verified compliance with closure performance standards
- Reviewed all manifest and accompanying documentation regarding shipment of hazardous wastes offsite from the HWSB.
- Reviewed all historical logs of past spills and releases from the unit which may have entered the environment.

This page intentionally blank

4.0 SURVEY PLAT [40 CFR 270.11(D) AND 264.115]

Since the HWSB is a container storage unit that will be clean closed and will not be closed as a disposal unit, a survey plat is not required.

This page intentionally blank

5.0 POST-CLOSURE PLAN [40 CFR 270.14(B)(13)]

Since all hazardous waste will be removed prior to closure and any residual hazardous chemical contamination will be removed during closure, a Post-Closure Plan is not required. However, if the unit must be closed as a landfill because all waste cannot be removed at closure, then an amendment to this closure plan will be submitted including a post-closure plan pursuant to 40 CFR 254.110.

This page intentionally blank

6.0 NOTICE IN DEED [40 CFR 270.14(B)(14)]

Since all hazardous waste will be removed prior to closure and any residual hazardous chemical contamination will be removed during closure, post-closure notices are not required.

This page intentionally blank

7.0 CLOSURE COST ESTIMATE [40 CFR 270.14(B)(15)]

The Base is owned and operated by the U.S. Government; therefore, the facility is exempt from providing a closure cost estimate.

This page intentionally blank

8.0 FINANCIAL ASSURANCE MECHANISM FOR CLOSURE [40 CFR 270.14(B)(15) AND 264.140(C)]

The Base is owned and operated by the U.S. Government; therefore, the facility is exempt from financial assurance requirements.

This page intentionally blank

9.0 POST-CLOSURE COST ESTIMATE [40 CFR 270.14(B)(16) AND 264.140(C)]

No Post-Closure Plan is required (see Section 6.0); therefore, no post-closure cost estimate is provided.

This page intentionally blank

10.0 FINANCIAL ASSURANCE MECHANISM FOR POST-CLOSURE CARE [40 CFR 270.14(B)(16) AND 264.140(C)]

No Post-Closure Plan is required (see Section 6.0); therefore, no financial assurance mechanism for post-closure care is provided.

This page intentionally blank

11.0 LIABILITY REQUIREMENTS [40 CFR 270.14(B)(17) AND 264.140(C)]

The Base is owned and operated by the U.S. Government; therefore, the facility is exempt from the liability requirements cited above.

This page intentionally blank

12.0 STATE MECHANISMS

12.1 Use of State-Required Financial Mechanisms [40 CFR 270.14(b)(18) and 264.140(c)]

The Base is owned and operated by the U.S. Government; therefore, the facility is exempt from the State-required financial mechanisms.

12.2 State Assumption of Responsibility [40 CFR 270.14(b)(18) and 264.140(c)]

The Base is owned and operated by the U.S. Government; therefore, the facility is exempt from the State assumption of responsibility requirements.

This page intentionally blank

Draft
Attachment 5
Container Storage Area Plans and Specification Process Information

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 DESIGN OF THE HAZARDOUS WASTE STORAGE BUILDING (BUILDING N-48) **1**

1.1 Exterior Features and Foundation 1
1.1.1 Foundation 1
1.1.2 Slab 2
1.1.3 Roof 2
1.1.4 Walls 2
1.1.5 Overhead Door and Loading Dock 2
1.2 Interior Features 3
1.2.1 Sealant 3
1.2.2 Emergency Shower and Eyewash 3
1.2.3 Alarms and Fire Detection System 3
1.2.4 Fire Suppression 4
1.2.5 Ventilation and Heating 5
1.2.6 Communication Systems 5

2.0 CONTAINERS **7**

2.1 Containers with Free Liquids 7
2.2 Description of Containers [40 CFR 264.171 and 264.172] 7
2.3 Labeling System 8
2.4 Container Management Practices [40 CFR 264.173] 8
2.4.1 Moving Containers into the HWSB 8
2.4.2 Storage Configuration within the HWSB 8
2.4.3 Transferring Containers out of the HWSB 9
2.5 Protection of Acutely Hazardous Waste in Containers 9
2.6 Storage of Incompatible Wastes in Containers 9

3.0 SECONDARY CONTAINMENT SYSTEM DESIGN AND OPERATION [40 CFR 270.15(A)(1), 264.175(A), AND 264.175(D)] **11**

3.1 Requirement for Base or Liner to Contain Liquids [40 CFR 264.175(b)(1)] 11
3.2 Containment System Drainage [40 CFR 270.15(a)(2) and 264.175(b)(2)] 11
3.3 Control of Run-On [40 CFR 270.15(a)(4) and 264.175(b)(4)] 12
3.4 Removal of Liquids from Containment System [40 CFR 270.15(a)(5)] 12
3.5 Containment System Capacity [40 CFR 270.15(a)(3) and 264.175(b)(3)] 12

4.0 REQUIREMENTS FOR TANK SYSTEMS [40 CFR 264.191] **15**
5.0 REQUIREMENTS FOR WASTE PILES [40 CFR 264.250] **17**
6.0 REQUIREMENTS FOR SURFACE IMPOUNDMENTS [40 CFR 264.221] **19**
7.0 REQUIREMENTS FOR INCINERATORS [40 CFR 264.340] **21**
8.0 REQUIREMENTS FOR LANDFILLS [40 CFR 264.301] **23**
9.0 REQUIREMENTS FOR LAND TREATMENT UNITS [40 CFR 264.272] **25**

TABLES

Table 1 Typical Containers Used in the Hazardous Waste Storage Building 25

TABLE OF CONTENTS (CONTINUED)

FIGURES

Figure 1 Base Kodiak Hazardous Waste Storage Building Complex
Figure 2 Typical Sump in Northeast Corner of Container Storage Area
Figure 3 North Wall of the Hazardous Waste Storage Building
Figure 4 Emergency Shower and Eye Wash in Room 107
Figure 5 HWSB Fire Detection and Alarm System
Figure 6 Example Hazardous Waste Sticker
Figure 7 Maximum Storage Configuration
Figure 8 Incompatibility Chart for Waste Storage

ACRONYMS AND ABBREVIATIONS

ACI	American Concrete Institute
AMCA	Air Movement and Control Association
ASTM	ASTM International (formerly American Society for Testing and Materials)
BOSS	Base Kodiak Base Operating Support Services
CFR	Code of Federal Regulations
FM	Associated Factory Mutual Laboratories
HWSB	Hazardous Waste Storage Building
NA	Northern American
NFPA	National Fire Protection Association
RCRA	Resource Conservation and Recovery Act
TSDF	Transportation, Storage, and Disposal Facility
UL	Underwriters' Laboratories, Inc.
UN	United Nations

This page intentionally blank

1.0 DESIGN OF THE HAZARDOUS WASTE STORAGE BUILDING (BUILDING N-48)

This chapter discusses the features of the Hazardous Waste Storage Building (HWSB) and the equipment and procedures used for handling and storing hazardous waste in this building. Building design, types of containers used, labeling procedures, container management practices, secondary containment, control of run-on, and management of ignitable and incompatible wastes are addressed in the following sections.

The HWSB (Building N-48) is a 100-foot by 28-foot structure built in 1988, located at the north end of Nyman Peninsula. The structure includes an office (Room 102), a storage room for materials, equipment, supplies, spill response gear, and records (Room 108),a mechanical room - storage space (Room 106), a waste handling and storage room (Room 107), and a 64-foot by 28-foot container storage area (Room 109) where most of the hazardous wastes are stored (Figure 1). The building is surrounded by a gravel storage laydown and parking area where personnel park their vehicles and equipment while at the HWSB, and where delivery vehicles park during waste loading and unloading.

The HWSB adjoins the Base Kodiak Bulk Fuel Farm perimeter fence, a 6-foot-high chain link fence with access and personnel gates that are locked during non-business hours. Gate opening and closing is performed by the Base Kodiak Base Operating Support Services (BOSS) Contractor during normal working hours. Base Military Police, Fire Department, and Senior Facilities Engineering personnel also maintain keys to the Bulk Fuel Farm gates.

1.1 Exterior Features and Foundation

The portions of the HWSB in which hazardous waste are stored are comprised of a 64- foot by 28-foot enclosure, the container storage area (Room 109), and the waste storage and handling room (Room 107). These areas as well as the other rooms in the HWSB, are built on a 6-inch thick concrete slab. The waste storage areas are bounded with a 6-inch high concrete curb.

1.1.1 Foundation

Both column and continuous footings comprise the foundation of the building, detailed in "Foundation Plan and Details," Drawing 17-86-1002 S1, Sheet 9 (Appendix to Attachment 6). Continuous footings extend along the 28-foot long east and west walls, and were constructed on a 6-inch thick layer of granular compacted fill or bedrock. These footings are 14-inches wide, 9-inch thick continuous concrete footings, at a minimum of 3.5 feet below grade. The footing base is reinforced with three continuous horizontal lengths of #4 diameter steel reinforcement bar (rebar) over 3 inches of concrete cover. The footing walls are reinforced with four continuous horizontal lengths of #4 rebar on 12-inch centers, and vertical L-shaped lengths of #4 rebar spaced at 18-inch intervals. The footing walls are 8 inches thick, with the upper 6 inches only 6 inches thick. The top 6 inches of the footing walls forms the curbing for secondary containment within the storage area.

Along the north and south walls of the storage area, the foundation consists of column footings, spaced 12 feet apart. The base of these footings is 30 inches by 30 inches, at a minimum of 3.5 feet below grade, and the walls are 10 inches thick. The column footings were constructed over a 6-inch thick layer of compacted granular fill. The base of the column footings is reinforced with two perpendicular set of three horizontal lengths of #4 rebar each, over 3 inches of concrete cover. The 10-inch square footing columns are reinforced with four L-shaped lengths of #5 rebar which extends vertically in the columns.

These footings were cast in place using concrete meeting the specifications of American Concrete Institute (ACI) 318, with a 28-day comprehensive strength of 3,000 psi, using a maximum aggregate size of 1.5 inches, 4 to 6% air content, and 2- to 4-inch slump. Portland cement was used conforming to ASTM International (ASTM C150) specifications. Reinforcing steel conforms to ASTM A615, Grade 40.

Details of the construction joints, footing designs, and foundation layout are provided in "Foundation Plan and Details," Drawing 17-86-1002 S1, Sheet 9 in the 1998 Resource Conservation and Recovery Act (RCRA) Permit.

1.1.2 Slab

The 6-inch thick concrete slab that comprises the floor of the HWSB is reinforced with 4-inch by 4-inch welded wire fabric conforming to ASTM A185. The ground surface was prepared with 2 inches of sand, a 6-mil-thick polyethylene vapor barrier, and another 2-inch layer of sand before the concrete slab was poured. Portland cement conforming to ASTM C150 specifications was used in the concrete, which was mixed to achieve 28-day comprehensive strength of 3,000 psi, meeting the specifications of ACI 318.

Along the south and north walls of the container storage area, the slab and curb were poured together. Pre-cast concrete sumps were installed at seven locations in the container storage area (Figure 2). These sumps, measuring 2 feet by 2 feet by 3 feet deep, are made of 4-inch thick concrete supplied with cast iron grates and frames, and are rated for H-20 traffic loading, sufficient to withstand the weight of a loaded forklift. Each sump has a minimum of 12 inches of granular material surrounding its walls and base. The concrete floor around each sump is sloped to the sump for drainage. Further design detail on the sumps is provided in "Roof Framing Plan and Details," Drawing 17- 86-1002 S2, Sheet 10 in the 1998 RCRA Permit.

1.1.3 Roof

The peaked roof of the HWSB is made of wooden trusses and rafters, covered with plywood and asphalt shingles. The portion of roof covering the container storage area is not insulated or finished, revealing the rafters and automatic fire suppression equipment. There is an attic over the west portion of the building, insulated with R-30 batts. In Rooms 102, 103, 106, 107, and 108, the ceiling is finished and painted to match the walls.

1.1.4 Walls

The exterior of the HWSB is finished with T1-11 siding (Figure 3). The exterior and interior doors are metal. The walls of the HWSB are constructed of plywood and 2 x 4 studs. Modifications to the building were completed in 1993 to make all exterior walls wood, to provide a man-door on the east end of the south side of the building, to remove the swing gate on the north side, and change the swing gate to a roll-up metal door on the south side of the building. Drawings of these modifications are provided in the 1998 RCRA Permit.

1.1.5 Overhead Door and Loading Dock

The container storage area is equipped with an overhead door at the west end of the south wall (Figure 1). The width of the overhead door is approximately 8 feet. The overhead door is constructed of insulated metal, and rolls up like a garage door (Figure 4). The swing gate on the north side of the building has been eliminated and replaced with wall. A concrete loading dock is located outside the overhead door.

1.2 Interior Features

In the following sections the design and operation of the HWSB alarm systems, fire suppression system, ventilation and heating, communication systems, and floor sealant in the waste storage areas are described.

1.2.1 Sealant

Expansion joints in the concrete slab were filled with premolded expansion joint filler that meets ASTM D1751. The joints were sealed with a standard military specification elastomeric join sealant. The slab and curb were painted with a chemical resistant urethane coating that is resistive to fuel spillage, and can handle forklift traffic and wet maintenance. In September 1992, the concrete floors, curbing, and sump walls and bases were resurfaced in the hazardous waste storage areas. This was accomplished by first sandblasting the surfaces to be coated to remove the previous coating. Once swept clean, the concrete surfaces were cleared with an approved concrete cleaning solution containing phosphoric acid (20/20 Clean-EtchJ).

Two coats of a penetrating epoxy polyamide sealer (Unitile SealerJ) were applied to the freshly cleaned concrete surfaces according to the manufacturer's specifications. The final coating consisted of three coats of Uniflex 455J, a waterproof polyurethane industrial deck coating applied according to the manufacturer's direction. Each of these coats was approximately 11 mils thick (dry), so that the total top coat thickness was not less than 30 mils thick. All concrete floors and curbs are periodically cleaned, prepared and re-surfaced.

1.2.2 Emergency Shower and Eyewash

The waste handling and storage room (Room 107) has an emergency shower and eyewash in the southwest corner (Figure 4). In addition, this room is equipped with a 6- foot wide metal roll-up door that opens into the main container storage area. Personnel access into Room 107 is provided through metal doors located in the east and west walls of the room. A secondary personnel shower is provided across from the bathroom.

1.2.3 Alarms and Fire Detection System

The HWSB is equipped with a low air pressure alarm, water motor alarms, and a fire alarm which is relayed to Base Kodiak centralized fire alarm system. The first two alarms are discussed in the following section on fire suppression. The building fire alarm is a manual and automatic zoned alarm that meets the applicable requirements of National Fire Protection Association (NFPA) 72A, B, D, and E, and uses components approved by Underwriters' Laboratories, Inc. (UL) or Associated Factory Mutual Laboratories (FM). The operation of any manual station, automatic heat detector, or automatic smoke detector causes all building evacuation alarm devices to sound continuously, and mechanical equipment (such as fans) to shut down. Activation of the building fire alarm system automatically transmits trouble and alarm signals to three remote Base Kodiak stations via radio link equipment (labeled King Fischer Unit on as- builts). All operations remain in alarm mode until the control panel is restored to normal.

Power to the fire detection and alarm system is supplied by a 120-volt alternating current (AC) source, transformed and rectified to low voltage direct current (DC). The secondary power supply consists of lead-acid batteries. Should the main power supply be interrupted, the system will transfer automatically to the standby power. The reserve batteries are capable of operating all audible signal devices under alarm conditions for 30 minutes.

The system uses heat detectors at five locations within the HWSB and ionization type smoke detectors at four locations, as shown in Figure 5. The two heat detectors in the container storage area and a third in the waste handling and storage room are of explosion proof design, in accordance with National Electrical Code. Manual "break-glass" rod and pull-activated type fire alarms are located at three points within the building. Surface mounted vibrating type alarm horns are located in the office, the waste handling and storage room, on the west wall of the container storage area, and on the south exterior wall of the supply storage room. The horns have a sound output rating of at least 90 decibels at 10 feet. The fire alarm panel is located just inside the office entryway on the west side.

Installation of the devices and system was performed in accordance with applicable sections of NFPA 70 and 72B. All of the alarms and detectors were tested to ensure that the system was fully operational before the building was occupied. Detectors and alarms are tested on a regular schedule as outlined in the Integrated Emergency Response Plan.

1.2.4 Fire Suppression

The HWSB is equipped with a zoned dry pipe fire extinguishing sprinkler system designed and installed in accordance with NFPA 13, "Sprinkler Systems," and meeting the requirements for extra hazard occupancy. This system provides for the uniform distribution of water to provide complete fire protection coverage throughout the HWSB. The system can deliver a water application rate of 0.35 gallons per minute per square foot in all areas except the office, locker room, shower, and lavatory, where the delivery rate is 0.16 gallons per minute per square foot. The system is designed to withstand earthquakes and is equipped with UL listed or FM approved devices.

The system is activated by heat sensitive sprinkler heads or by a manual switch. The installed sprinkler heads are of the pendent design, have a nominal 0.50-inch orifice, and are 135 degrees Fahrenheit temperature rated. The system includes an automatic 1/2 horsepower electric motor driven air compressor that is capable of charging the complete sprinkler system to normal system air pressure within 30 minutes. Automatic air maintenance devices ensure that each zone of the system is maintained at the proper pressure.

Exterior water motor alarms are mounted on the outside of the building walls. These alarms, of weatherproof and guarded type design, will sound locally on the flow of water in each corresponding sprinkler system zone. Should the air pressure in the system drop to halfway from the normal pressure to the tripping point, visual and audible alarms are activated. An alarm bell, light signal, and cut-off switch for silencing the bell are located on the low air pressure alarm panel.

All of the sprinkler piping, fittings, valves, pipe hangars and supports, and identification signs meet or exceed requirements of NFPA 13. Further detail regarding the sprinkler system is provided on the "Plumbing and Fire Protection Plan and Details" Drawing No. 17-86-1002, Sheet 12, in the 1998 RCRA Permit. A fire department connection is located approximately 3 feet above grade on the exterior of the west wall of the HWSB. This connection is a standard two-way type with 2.5-inch National Standard female hose threads with plugs and chains.

After installation, the sprinkler system was disinfected using a chlorine solution and tested. The testing consisted of a 2-hour hydrostatic test at 200 pounds per square inch gauge, with no leakage or reduction in gauge pressure. Each system was then air tested in accordance with NFPA 13, and the alarms were also tested. A USCG Fire Protection Engineer performed a final inspection and approved the sprinkler system before occupancy of the building.

1.2.5 Ventilation and Heating

Ventilation of the main container storage area (Room 109) is passive ventilation through eight 12-inch by 12-inch aluminum wall louvers, four each on the north and south walls, and two 12-inch wind driven rotary turbines, one on each side of the roof line. Exhaust ventilation in the waste handling and storage room (Room 107) is provided by a 275 cubic feet per minute wall mounted fan, consisting of an aluminum non-sparking propeller and housing with gravity type backdraft damper, discharge sleeve and outlet hood. The fan capacity is adjusted by restricting air flow through the backdraft damper. An Occupational Safety and Health Administration (OSHA) approved fan guard and screen are mounted over the fan, which runs continuously. The fan motor is explosion proof, conforming to NFPA 70, Class 1, Group 1D, Division 1 requirements, and constructed to Air Movement and Control Association (AMCA) 99, Standard 401, Type C, spark-resistant requirements.

Primary heating of the HWSB is accomplished by means of a steam heating system. Overhead unit heaters heat the waste handling and storage room (Room 107) and the supply and storage room (Room 108); the office (Room 102) is heated by means of a fin tube baseboard register mounted along the east wall. The Locker Room/Shower/Restroom (Room 103) and the mechanical and storage room (Room 106) are passively heated by heat migrating from the aforementioned areas. The shower and restroom have time controlled combination lighting/heating lamps in the ceiling. Tempered make-up air is supplied to Room 107, Room 108, and Room 103 via ducts in the attic. In Room 107, the 8-inch duct carried air to a ceiling diffuser equipped with a fire damper. Additional detail regarding the heating and ventilation system for the HWSB is provided in "Heating and Ventilation Plans and Details," Drawing No. 17-86-1002 M3, Sheet 13, in the 1998 RCRA Permit.

1.2.6 Communication Systems

The HWSB is equipped with a single telephone line and a standard touch tone telephone instrument located in the office (Room 102). The terminal cabinet is a surface mounted steel box located on the north wall of the office. The HWSB Operations Manager who is primarily responsible for operation of the HWSB carries a hand-held 2-way radio or cell phone at all times, and can contact emergency services 24 hours per day if needed. Whenever waste is being transferred into or out of the HWSB, contact can be made almost instantly with other personnel at Base Kodiak via the two-way radios or cell phones.

This page intentionally blank

2.0 CONTAINERS

2.1 Containers with Free Liquids

All containers stored within the HWSB are handled as if they contained free liquids. Containers holding only solids are stored within secondary containment, as are the containers whose contents are liquid. Tests for free liquids are thus not required prior to storage.

2.2 Description of Containers [40 CFR 264.171 and 264.172]

Waste stored in the HWSB is contained in a number of different containers, depending on the quantity and characteristics of the waste. A list of the containers used in the HWSB is provided in Table 1. These containers have either ring tops or bungs that remain closed at all times while the waste is stored in the HWSB.

Occasionally, a leaking or damaged drum is discovered. In accordance with the Integrate Emergency Response Preparedness Plan, the leaking or damaged drum is placed in an overpack drum at the location of the leaking drum. The overpack drums contain the leaking waste, protect the drum from further damage, and allow shipment without having to transfer the waste material from one container into another container.

Waste paints and other products that have exceeded their shelf life, been exposed to extreme temperatures, or in some other way lost their utility may be delivered to the HWSB for storage. These products may be stored in their original containers. Compatible paints may be combined into a larger container by loose-packing or bulking. In some cases, the wastes may be shipped in the original containers. Often, for small containers, the waste items will be loose packed in a 5-, 10-, 15-, 30-, or 55-gallon drum, surrounded with absorbent, and sealed in the drum for transport to an offsite Transportation, Storage, and Disposal Facility (TSDF).

All containers used for storing waste in the HWSB are in sound condition, and are compatible with each waste type stored therein. The physical and chemical properties of the waste to be stored determines the container used. Totes used for storing and transporting used batteries or transporting other compatible wastes may be reused. Compatible wastes that are transported to the HWSB in totes will be in their original containers or already in compatible over pack containers. All containers and totes are inspected before use for the following types of damage:

- Drum walls out of round
- Scratches, abrasions, dents, holes, and coating on the surface of walls, bottom, lid/cover, rims of drum
- Scoring on lid and drum gasket
- Cracked and inflexible or missing gasket
- Bent lock ring
- Damaged lock ring bolt
- Damage to wall and bottom seal
- Surface damage to drum coating (steel drums)
- Defects or damage to seams
- Cracks, dents, holes, cuts, scratches or abrasion in the sides or bottom of the tote

- Broken or ill-fitting lid
- Rust or corrosion
- Other damage

Drums or totes not passing the inspection are not used for RCRA regulated waste.

2.3 Labeling System

Wastes generated at Base Kodiak are placed into drums that are labeled before they are transported to the HWSB. Wastes received from offsite are marked prior to receipt at Base Kodiak. If unknown materials are received from, they are marked "HAZARDOUS WASTE, PENDING ANALYSIS", and placed in the less-than-90-day accumulation area. A proper waste determination is made following the procedures outlined in the waste analysis plan. When a determination is made, the waste can be assigned a profile, labeled and stored appropriately.

Every container of hazardous waste that is shipped offsite is marked with a hazardous waste marking containing generating location identification information, accumulation start date, U.S. Environmental Protection Agency waste code, and DOT waste shipping name and United Nations (UN) or North America (NA) number. An example of a hazardous waste sticker is shown in Figure 6. If a sticker is damaged or new information needs to be added, the old sticker is removed or obscured, and a new sticker is affixed to the container.

2.4 Container Management Practices [40 CFR 264.173]

The following sections describe various aspects of container management practices, including packaging waste in containers, transporting containers to and from the HWSB, separating incompatible waste types, configuration of containers within the storage building, and handling and storage methods.

Waste handling, storage, and transfer methods are designed to ensure that waste containers remain closed during storage, and that containers are not opened, handled, or stored in an unsafe manner. HWSB personnel perform daily inspections of the HWSB each regular working day (Attachment 6). Weekly inventories are made of the containers in the HWSB. Damaged or leaking containers are placed in overpack drums at the location of the leaking drum. Spills or leaks from containers are managed in accordance with the Integrated Emergency Response Preparedness Plan. Documentation of these activities is retained in the HWSB operating record in the HWSB office, Room 102.

2.4.1 Moving Containers into the HWSB

Sealed and labeled drums, which are transported from waste accumulation areas at Base Kodiak, are delivered in USCG-owned or contractor-owned and operated vehicles. Once loaded on a vehicle, the drum(s) are secured so that they remain in an upright position during transport. The vehicle is driven to the loading area on the south side of the HWSB. The drums are offloaded in the same way they were loaded. All incoming waste is logged into the HWSB field logbook.

2.4.2 Storage Configuration within the HWSB

There are seven discrete storage bays within the main container storage area (Room 109). Three of the seven are located along the east wall. Each of these storage areas along the east wall of the building is approximately 14 feet by 9 feet. Two storage areas are each located along the north and south walls. The discrete storage areas located against the north and south walls are each approximately 13 feet by 8 feet.

Each discrete storage area in Room 109 consists of concrete flooring sloped (with a 1% slope) to a central sump. Preserving the forklift aisles and a minimum 30-inch aisle space between rows of double drums, the maximum number of pallets that can be stored within each of the discrete storage areas along the east wall is eight, with pallets and drums stacked two high (Figure 7). However, usually a maximum of six pallets is used in middle discrete storage area along the east wall. For the discrete storage areas along the north and south walls, the maximum number of pallets with drums that can be stored is eight, with pallets and drums stacked two high. The total number of 55-gallon drums that can be stored in this manner, maintaining a 30-inch aisle space or greater, is 216. In addition, two totes stacked two high can be stored along the north wall (Figure 7). This adds an additional 440 gallons of storage. Thus, the total volume that can be stored in the container storage area (Room 109) is 12,320 gallons.

The small containment area in Room 107 can hold a maximum of 8 drums, stacked on pallets two high. The total volume of this storage area is 440 gallons. The capacity of the remainder of Room 107, preserving the walkway, space for the emergency shower, and space for the door, is the equivalent of 8 pallets, again stacked two high (Figure 7). This provides a storage volume of 32 55-gallon drums, or 1,760 gallons. Therefore, the total storage capacity of the HWSB is 14,080 gallons.

HWSB personnel ensure that a sign is placed on the wall above each discrete storage area indicating the hazard classification of the waste stored there. These placards might read, for example, "FLAMMABLE," "ACID," "POISON," "BASES", or some other hazard classification (Figure 7). Incompatible wastes are segregated to prevent commingling of any spilled materials. The storage of incompatibles is further discussed in Section 2.6.

2.4.3 Transferring Containers out of the HWSB

HWSB personnel inspect the containers to ensure that the drums are properly labeled for transport and are in sound condition. Improperly labeled containers are relabeled prior to transport. Containers found in inadequate condition for transport are placed in appropriately labeled overpack drums. The containers are carefully loaded onto the transport vehicle, packed as closely together as possible, and restrained with a rope or other means across the end of the van as needed to keep the drums from falling over or shifting during transport. The total load weight is not permitted to exceed vehicle capacity.

The loaded shipping vehicle is driven from the HWSB to a loading dock specified by the barge company. The shipping container is loaded onto a barge, and transported to the receiving transporter's dock in Alaska or the lower 48 states. Some materials may be delivered to the airport for air transport. This may be accomplished by a designated contractor or USCG personnel.

2.5 Protection of Acutely Hazardous Waste in Containers

Acutely hazardous (P-listed) wastes are not stored at N-48.

2.6 Storage of Incompatible Wastes in Containers

Typical incompatible wastes received include acids, bases, oxidizers, and some reactive wastes. Incompatible wastes are separated by at least one of the following methods: placement in separate rooms, separate sumps, and secondary containment such as totes and overpacks. If Room 109 is used for the storage of incompatibles, these wastes are separated by at least one discrete storage area. Compatibility is determined for each waste type received using the incompatibles chart located at the building. A typical storage configuration is shown in Figure 7. The incompatibility chart referenced by Base Kodiak personnel for waste storage is included as Figure 8.

This page intentionally blank

3.0 SECONDARY CONTAINMENT SYSTEM DESIGN AND OPERATION [40 CFR 270.15(A)(1), 264.175(A), AND 264.175(D)]

There are nine separate secondary containment areas within the HWSB. Figure 1 indicates the relative locations and dimensions of these containment areas. Within Room 109, the concrete floor within each discrete storage area is sloped to a separate containment sump. In addition, the container storage area floor is completely surrounded with a 6-inch high curb. Within Room 107, there is one area with separate 6-inch high curbing, measuring 5 feet by 5 feet. The remainder of the floor area in the waste handling room (255 square feet) is surrounded by a 6- inch high curb.

The concrete floor, curbing, and sumps in these areas are constructed according to the specifications provided in Section 1.1.2. The chemical resistant coating on the concrete floor, sumps, and curbs is described in Section 1.1.1.

Incompatible waste is stored over separate containment sumps and separated by at least one discrete storage area within the covered storage area (Room 109). Incompatible wastes are not stored in adjoining discrete storage areas. This separation effectively isolates any potential spillage from commingling with incompatible materials.

3.1 Requirement for Base or Liner to Contain Liquids [40 CFR 264.175(b)(1)]

The floors of the storage rooms in the HWSB are constructed of 6-inch thick concrete conforming to ACI 318, reinforced with 4-inch by 4-inch welded wire fabric, as described in Section 1.1.2. To ensure the impermeability of the flooring and curbing, all of the joints have been sealed with a chemical resistant joint sealant material. The floors have been coated with a chemical resistant epoxy coating as described in Section 1.2.1.

The concrete floors in Rooms 109 and 107 of the HWSB are smooth finished concrete. They are free of cracks, gaps, pits, holes, gouges, or other imperfections that could become avenues for transport of spilled waste material. Concrete is not combustible or flammable and is impervious to most chemicals. The epoxy coating provides an extra measure of protection, particularly from acidic material that could, at high concentration over a period of time, eventually damage the concrete surface.

The concrete sumps are of one-piece, prefabricated design. The walls and base of the sumps are 4 inches thick. The walls and base of all the sumps have also been coated with a chemical resistant epoxy sealant to ensure their imperviousness to any spilled chemicals.

3.2 Containment System Drainage [40 CFR 270.15(a)(2) and 264.175(b)(2)]

Should a leak or spill of liquid waste occur in the container storage area, the spilled waste would travel down slope toward the nearest sump. The waste would be removed from the sump and the floor using absorbent pads or a portable pump, depending on the volume of the leak or spill. The absorbent material would be placed in an appropriate waste container. Retrieved liquid would be pumped into a new drum. Any residue after pumping would be removed by using absorbents. The sump and floor area would be steam cleaned or washed with an appropriate decontamination solution.

Each discrete storage area in Room 109 is equipped with a dedicated sump. A 6-inch high curb surrounds Room 109. Any spilled liquid will drain to the nearest sump. All of the drums in the HWSB are stored on pallets, in totes or in overpacks, so that spilled material would not come in contact with other drums or

pool under or around containers. Each sump can hold approximately 90 gallons, equivalent to 164% of the volume of a typical (55-gallon) drum.

Neither storage area in Room 107 has sumps. Containers stored in these areas are placed on pallets or in separate secondary containers. Should a liquid spill occur in either of these two areas, absorbent pads or a drum pump will be used to remove the spilled material. Spilled solid material such as powder will be swept up or vacuumed. Waste removal procedures and decontamination activities will be conducted according to the Integrated Emergency Response Preparedness Plan.

3.3 Control of Run-On [40 CFR 270.15(a)(4) and 264.175(b)(4)]

The HWSB has solid walls on all sides now that the modifications to the walls have been completed. No surface run-on enters the building.

The HWSB is not located in a floodplain. The only major run-on event foreseen would be the rare occurrence of a tsunami due to the seismic activity in the North Pacific area and Alaska. A detailed discussion of recent tsunami experience and probability of another such event is provided in Attachment 1 of the RCRA Permit.

3.4 Removal of Liquids from Containment System [40 CFR 270.15(a)(5)]

A hand-held pump or vacuum truck is used for removal of large quantities of liquid spilled in the containment basins. Absorbents are used for removal of small quantities of liquid. In the event of a spill, a recovery plan will be developed based on input from the HWSB operator and the hazardous waste coordinator. Within 24 hours of discovery of the spill, the spilled material will be removed from the containment system according to the HWSB Integrated Emergency Response Preparedness Plan. If the source of spilled material is unknown, sampling will be performed and the material will be stored in container(s) in a less-than-90-day accumulation area until analytical results are received.

3.5 Containment System Capacity [40 CFR 270.15(a)(3) and 264.175(b)(3)]

The secondary containment for each of the discrete storage areas in Rooms 109 and 107 is designed to contain 10% or more over the volume of the largest container stored in the area. In addition, the total containment volume of the container storage area is well over 10% of the total volume of liquid waste that could be stored in the HWSB.

Each of the sumps in Room 109 is capable of containing approximately 90 gallons. The concrete around each of the sumps is sloped at 1 %, providing an estimated additional 10 gallons of containment capacity. The total containment volume provided by the sump and the sloped floor within each discrete storage area is approximately 100 gallons, more than 180% of a 55-gallon drum.

Each of the seven sumps in Room 109 can contain approximately 90 gallons (total: 630 gallons). Curbing around the floor of this room provide another 6,700 gallons of containment capacity (51.5 ft x 27 ft x 0.5 ft). Neglecting the additional volume provided by the sloped floor, the total secondary containment capacity of the Room 109 container storage area is 5,830 gallons. This volume represents 47% of the total liquid storage capacity of the container storage area.

The small storage area in Room 107 measures 5 feet by 5 feet, surrounded by a 6-inch high curb. The capacity of this containment area is 93.5 gallons, which is equal to 170% of the volume of a 55-gallon

drum. The total quantity of liquid waste that could be stored in this area is 8 55-gallon drums, or 440 gallons. Secondary containment of 93.5 gallons represents 21% of this total storage volume.

The larger storage area in Room 107 measures 20 feet by 14 feet, less the 25 square feet occupied by the small storage area. The containment capacity of the larger storage area, surrounded by a 6-inch high curb, is 1,040 gallons, which represents 59% of the total volume of liquid waste that could be stored in this area.

This page intentionally blank

4.0 REQUIREMENTS FOR TANK SYSTEMS [40 CFR 264.191]

This unit is a storage area; therefore, these requirements do not apply.

This page intentionally blank

5.0 REQUIREMENTS FOR WASTE PILES [40 CFR 264.250]

This unit is a storage area; therefore, these requirements do not apply.

This page intentionally blank

6.0 REQUIREMENTS FOR SURFACE IMPOUNDMENTS [40 CFR 264.221]

This unit is a storage area; therefore, these requirements do not apply.

This page intentionally blank

7.0 REQUIREMENTS FOR INCINERATORS [40 CFR 264.340]

This unit is a storage area; therefore, these requirements do not apply.

This page intentionally blank

8.0 REQUIREMENTS FOR LANDFILLS [40 CFR 264.301]

This unit is a storage area; therefore, these requirements do not apply.

This page intentionally blank

9.0 REQUIREMENTS FOR LAND TREATMENT UNITS [40 CFR 264.272]

This unit is a storage area; therefore, these requirements do not apply.

Table 1 Typical Containers Used in the Hazardous Waste Storage Building

CONTAINER SIZE	TYPE	CLOSURE TYPE
55 gallon	Steel drum	Bung top
55 gallon	Steel drum	Ring top
15 gallon	Steel drum	Bung top
15 gallon	Steel drum	Ring top
5 gallon	Steel drum	Bung top
5 gallon	Steel drum	Ring top
85 gallon	Steel salvage drum	Ring top
5 gallon	Polyethylene drum	Screw lid
55 gallon	Polyethylene drum	Screw lid
85 gallon	Polyethylene drum	Screw lid
4 x 4 x 3 feet high	Polyethylene tote	Attached lid
4 x 2.5 x 3 feet high	Polyethylene tote	Attached lid
10 mil	Polyethylene liner	Twist tie or horse tail
1 cubic yard	Tri-wall box	Straps
1- to 10-gallon	Cardboard box	Tape
1 cubic yard	Supersack	Straps
275-gallon	Intermediate bulk container (IBC) tank	Screw lid/ball valve and camlock

Figure 1 **Base Kodiak Hazardous Waste Storage Building Complex**

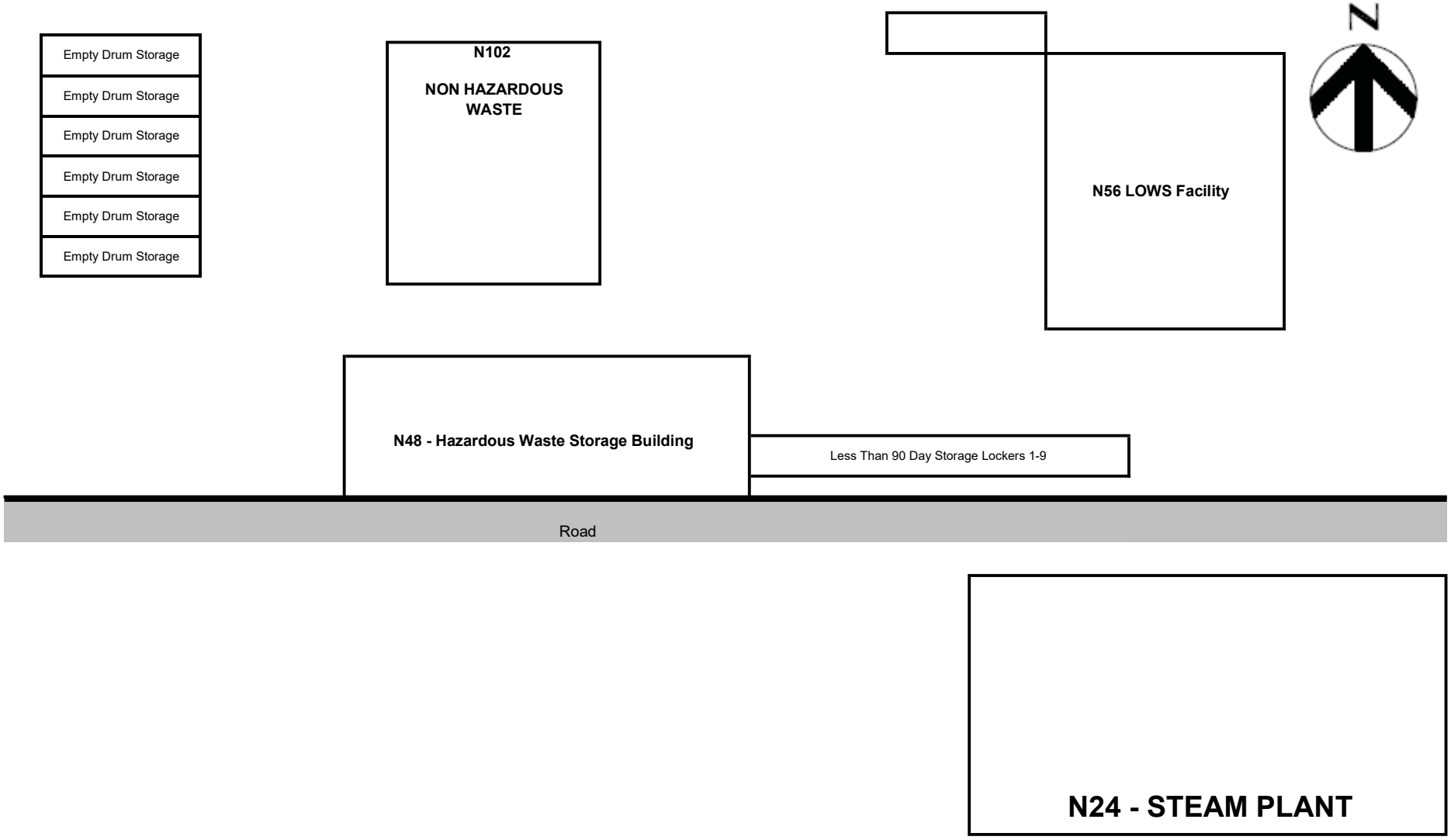


Figure 2 Typical Sump in Northeast Corner of Container Storage Area

Figure 3 North Wall of the Hazardous Waste Storage Building

Figure 4 Emergency Shower and Eye Wash in Room 107

Figure 5 HWSB Fire Detection and Alarm System

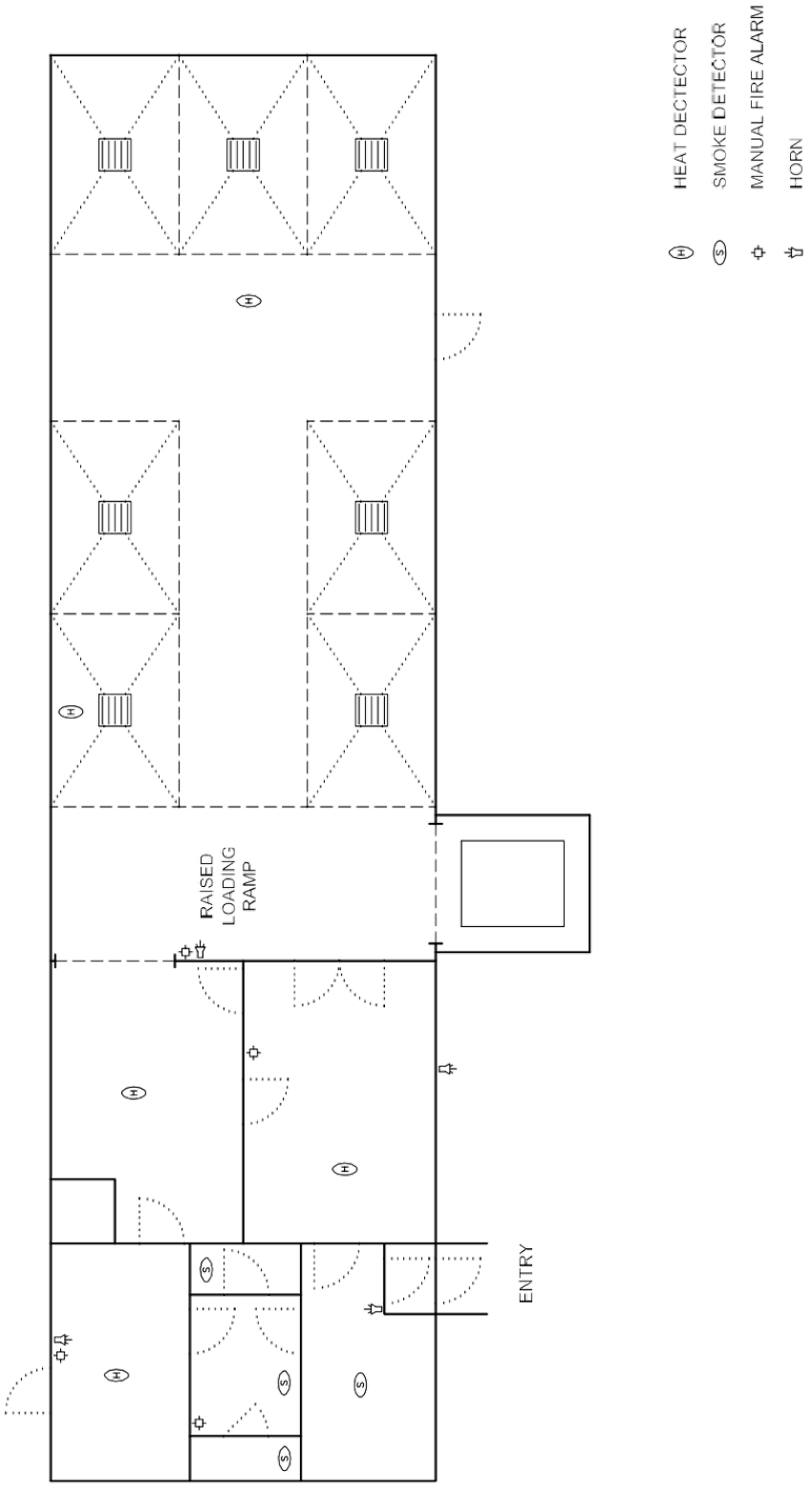


Figure 6 Example Hazardous Waste Sticker

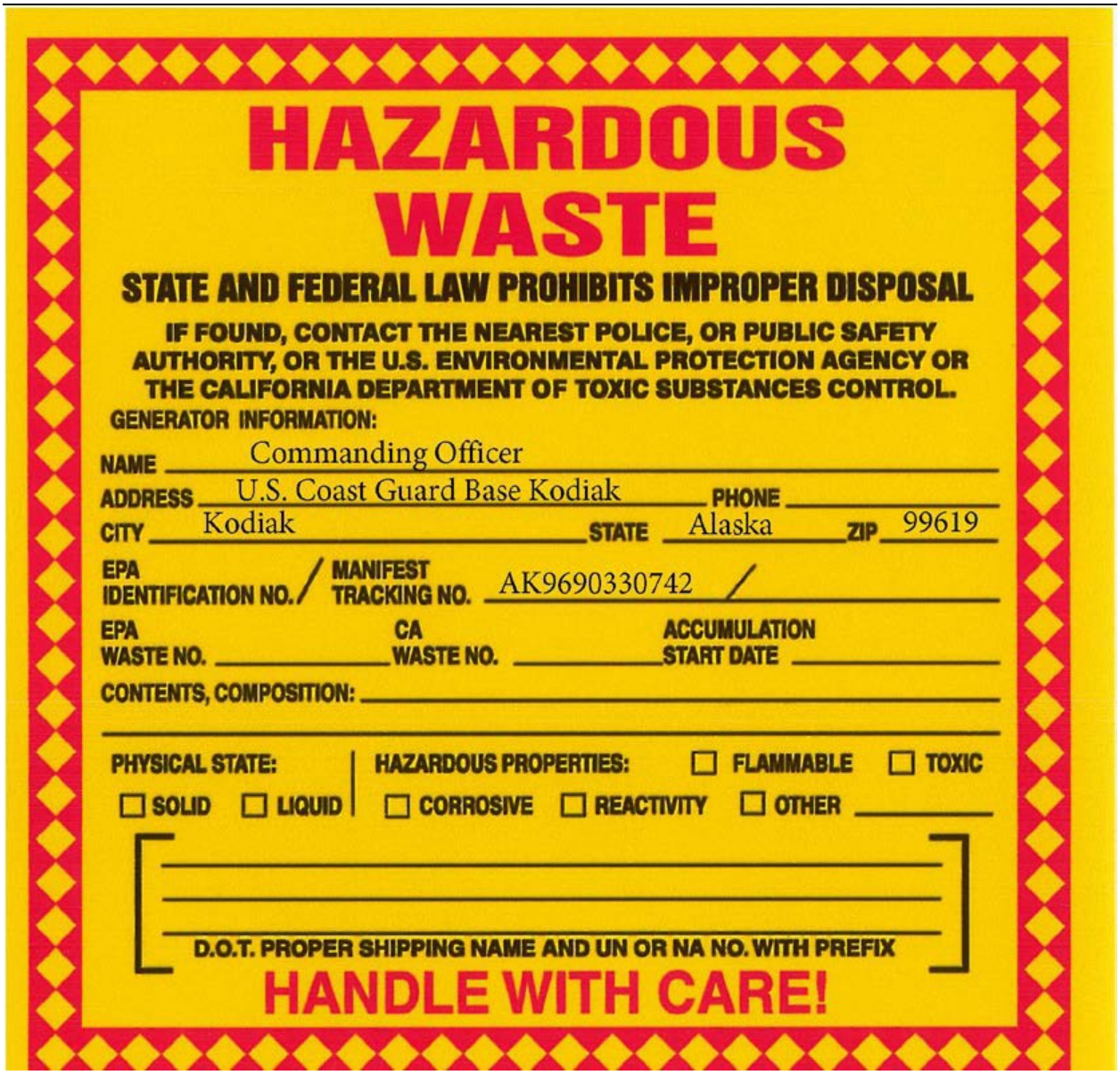


Figure 7 Maximum Storage Configuration

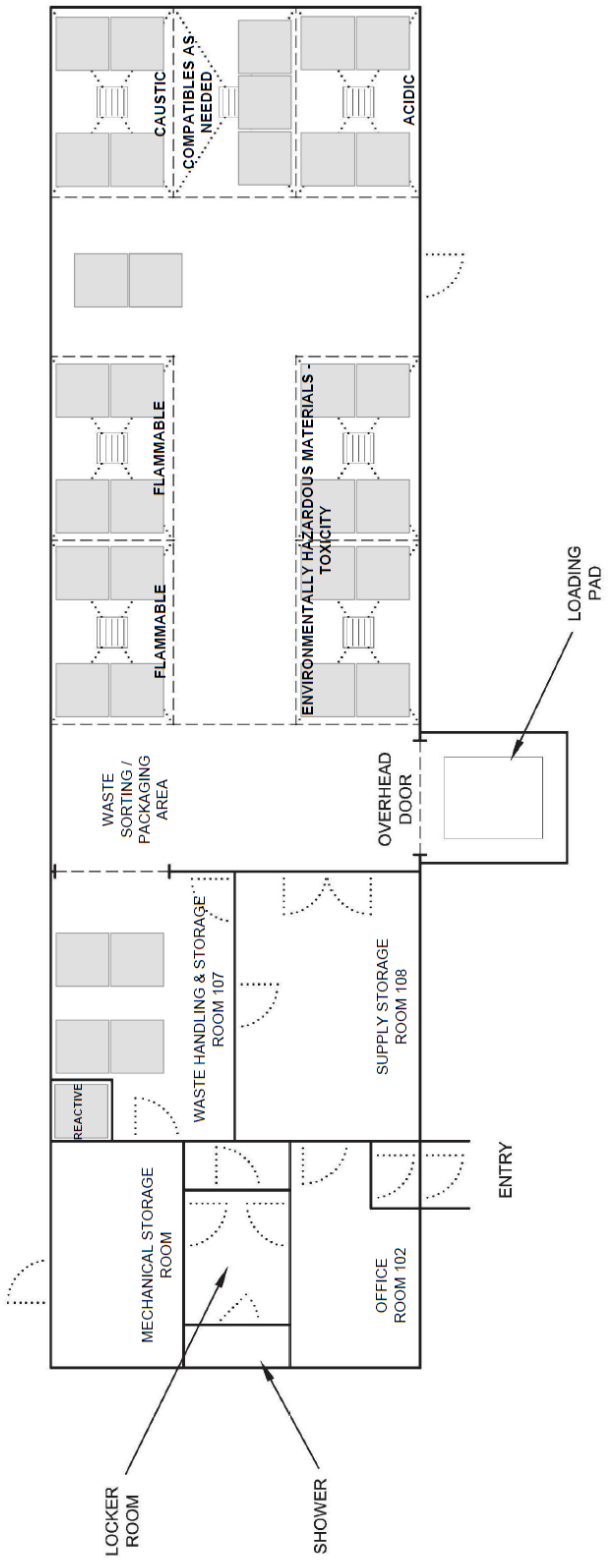
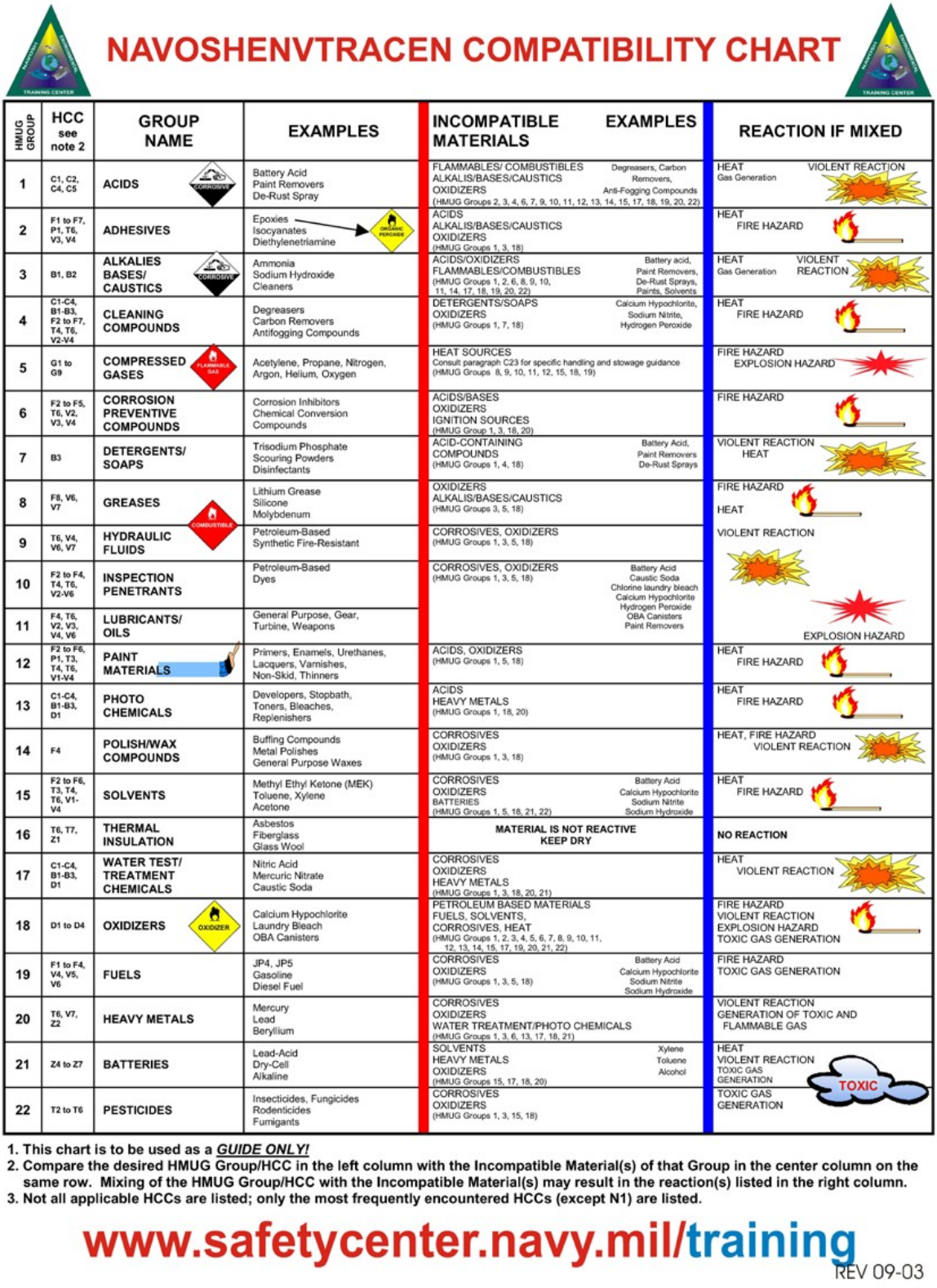


Figure 8 Incompatibility Chart for Waste Storage



HMUG GROUP	HCC see note 2	GROUP NAME	EXAMPLES	INCOMPATIBLE MATERIALS	EXAMPLES	REACTION IF MIXED
1	C1, C2, C4, C5	ACIDS	Battery Acid Paint Removers De-Rust Spray	FLAMMABLES/ COMBUSTIBLES ALKALIS/BASES/CAUSTICS OXIDIZERS (HMUG Groups 2, 3, 4, 6, 7, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 22)	Degreasers, Carbon Removers, Anti-Fogging Compounds	HEAT Gas Generation VIOLENT REACTION
2	F1 to F7, P1, T6, V3, V4	ADHESIVES	Epoxies Isocyanates Diethylenetriamine	ACIDS ALKALIS/BASES/CAUSTICS OXIDIZERS (HMUG Groups 1, 3, 18)		HEAT FIRE HAZARD
3	B1, B2	ALKALIES BASES/ CAUSTICS	Ammonia Sodium Hydroxide Cleaners	ACIDS/OXIDIZERS FLAMMABLES/COMBUSTIBLES (HMUG Groups 1, 2, 6, 8, 9, 10, 11, 14, 17, 18, 19, 20, 22)	Battery acid, Paint Removers, De-Rust Sprays, Paints, Solvents	HEAT Gas Generation VIOLENT REACTION
4	C1-C4, B1-B3, F2 to F7, T4, T6, V2-V4	CLEANING COMPOUNDS	Degreasers Carbon Removers Antifogging Compounds	DETERGENTS/SOAPS OXIDIZERS (HMUG Groups 1, 7, 18)	Calcium Hypochlorite, Sodium Nitrite, Hydrogen Peroxide	HEAT FIRE HAZARD
5	G1 to G9	COMPRESSED GASES	Acetylene, Propane, Nitrogen, Argon, Helium, Oxygen	HEAT SOURCES Consult paragraph C23 for specific handling and stowage guidance (HMUG Groups 8, 9, 10, 11, 12, 15, 18, 19)		FIRE HAZARD EXPLOSION HAZARD
6	F2 to F5, T6, V2, V3, V4	CORROSION PREVENTIVE COMPOUNDS	Corrosion Inhibitors Chemical Conversion Compounds	ACIDS/BASES OXIDIZERS IGNITION SOURCES (HMUG Group 1, 3, 18, 20)		FIRE HAZARD
7	B3	DETERGENTS/ SOAPS	Trisodium Phosphate Scouring Powders Disinfectants	ACID-CONTAINING COMPOUNDS (HMUG Groups 1, 4, 18)	Battery Acid, Paint Removers De-Rust Sprays	VIOLENT REACTION HEAT
8	F8, V6, V7	GREASES	Lithium Grease Silicone Molybdenum	OXIDIZERS ALKALIS/BASES/CAUSTICS (HMUG Groups 3, 5, 18)		FIRE HAZARD HEAT
9	T6, V4, V6, V7	HYDRAULIC FLUIDS	Petroleum-Based Synthetic Fire-Resistant	CORROSIVES, OXIDIZERS (HMUG Groups 1, 3, 5, 18)		VIOLENT REACTION
10	F2 to F4, T4, T6, V2-V6	INSPECTION PENETRANTS	Petroleum-Based Dyes	CORROSIVES, OXIDIZERS (HMUG Groups 1, 3, 5, 18)	Battery Acid Caustic Soda Chlorine laundry bleach Calcium Hypochlorite Hydrogen Peroxide OBA Canisters Paint Removers	EXPLOSION HAZARD
11	F4, T6, V2, V3, V4, V6	LUBRICANTS/ OILS	General Purpose, Gear, Turbine, Weapons			
12	F2 to F6, P1, T3, T4, T6, V1-V4	PAINT MATERIALS	Primers, Enamels, Urethanes, Lacquers, Varnishes, Non-Skid, Thinners	ACIDS, OXIDIZERS (HMUG Groups 1, 5, 18)		HEAT FIRE HAZARD
13	C1-C4, B1-B3, D1	PHOTO CHEMICALS	Developers, Stopbath, Toners, Bleaches, Replenishers	ACIDS HEAVY METALS (HMUG Groups 1, 18, 20)		HEAT FIRE HAZARD
14	F4	POLISH/WAX COMPOUNDS	Buffing Compounds Metal Polishes General Purpose Waxes	CORROSIVES OXIDIZERS (HMUG Groups 1, 3, 18)		HEAT, FIRE HAZARD VIOLENT REACTION
15	F2 to F6, T3, T4, T6, V1-V4	SOLVENTS	Methyl Ethyl Ketone (MEK) Toluene, Xylene Acetone	CORROSIVES OXIDIZERS BATTERIES (HMUG Groups 1, 5, 18, 21, 22)	Battery Acid Calcium Hypochlorite Sodium Nitrite Sodium Hydroxide	HEAT FIRE HAZARD
16	T6, T7, Z1	THERMAL INSULATION	Asbestos Fiberglass Glass Wool	MATERIAL IS NOT REACTIVE KEEP DRY		NO REACTION
17	C1-C4, B1-B3, D1	WATER TEST/ TREATMENT CHEMICALS	Nitric Acid Mercuric Nitrate Caustic Soda	CORROSIVES OXIDIZERS HEAVY METALS (HMUG Groups 1, 3, 18, 20, 21)		HEAT VIOLENT REACTION
18	D1 to D4	OXIDIZERS	Calcium Hypochlorite Laundry Bleach OBA Canisters	PETROLEUM BASED MATERIALS FUELS, SOLVENTS, CORROSIVES, HEAT (HMUG Groups 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 20, 21, 22)		FIRE HAZARD VIOLENT REACTION EXPLOSION HAZARD TOXIC GAS GENERATION
19	F1 to F4, V4, V5, V6	FUELS	JP4, JP5 Gasoline Diesel Fuel	CORROSIVES OXIDIZERS (HMUG Groups 1, 3, 5, 18)	Battery Acid Calcium Hypochlorite Sodium Nitrite Sodium Hydroxide	FIRE HAZARD TOXIC GAS GENERATION
20	T6, V7, Z2	HEAVY METALS	Mercury Lead Beryllium	CORROSIVES OXIDIZERS WATER TREATMENT/PHOTO CHEMICALS (HMUG Groups 1, 3, 6, 13, 17, 18, 21)		VIOLENT REACTION GENERATION OF TOXIC AND FLAMMABLE GAS
21	Z4 to Z7	BATTERIES	Lead-Acid Dry-Cell Alkaline	SOLVENTS HEAVY METALS OXIDIZERS (HMUG Groups 15, 17, 18, 20)	Xylene Toluene Alcohol	HEAT VIOLENT REACTION TOXIC GAS GENERATION TOXIC
22	T2 to T6	PESTICIDES	Insecticides, Fungicides Rodenticides Fumigants	CORROSIVES OXIDIZERS (HMUG Groups 1, 3, 15, 18)		TOXIC GAS GENERATION

1. This chart is to be used as a ***GUIDE ONLY!***
2. Compare the desired HMUG Group/HCC in the left column with the Incompatible Material(s) of that Group in the center column on the same row. Mixing of the HMUG Group/HCC with the Incompatible Material(s) may result in the reaction(s) listed in the right column.
3. Not all applicable HCCs are listed; only the most frequently encountered HCCs (except N1) are listed.

www.safetycenter.navy.mil/training

REV 09-03

Draft
Attachment 6
Procedures to Prevent Hazards

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 SECURITY [40 CFR 264.14(B) AND 264.14(C)] **1**

1.1 Security Procedures and Equipment [40 CFR 270.14(b)(4) and 264.14] 1
1.1.1 24-Hour Surveillance System [40 CFR 264.14(b)(1)] 1
1.1.2 Barrier [40 CFR 264.14(b)(2)(i)] 2
1.1.3 Means to Control Entry [(40 CFR 264.14(b)] 2
1.1.4 Warning Signs [40 CFR 264.14(c)] 2
1.2 Waiver [40 CFR 264.14(a)] 3

2.0 INSPECTION SCHEDULE [40 CFR 270.14(B)(5) AND 264.15] **5**

2.1 General Inspection Requirements [40 CFR 270.14(b)(5), 264.15(a), 264.15(b), and 264.33] 5
2.1.1 Types of Problems [40 CFR 264.15(b)(3)] 6
2.1.2 Frequency of Inspections [40 CFR 264.15(b)(4)] 6
2.2 Specific Inspection Requirements 7
2.2.1 Container Inspection [40 CFR 264.15(b)(4) and 264.174] 7
2.2.2 Tank System Inspection 7
2.2.3 Waste Pile Inspection 7
2.2.4 Surface Impoundment Inspection 7
2.2.5 Incinerator Inspection 7
2.2.6 Landfill Inspection 7
2.2.7 Land Treatment Facility Inspection 7
2.2.8 Miscellaneous Unit Inspection 7

3.0 WAIVER OR DOCUMENTATION OF PREPAREDNESS AND PREVENTION REQUIREMENTS **9**

3.1 Equipment Requirements [40 CFR 270.14(b) and 264.32] 9
3.1.1 Internal Communications [40 CFR 264.32(a)] 9
3.1.2 External Communications [40 CFR 264.32(b)] 9
3.1.3 Emergency Equipment [40 CFR 264.32(c)] 10
3.1.4 Water for Fire Control [40 CFR 264.32(d)] 10
3.2 Aisle Space Requirement [40 CFR 264.35] 11

4.0 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT **13**

4.1 Loading and Unloading Operations [40 CFR 270.14(b)(18)(i)] 13
4.2 Run-Off Controls [40 CFR 270.14(b)(8)(ii)] 14
4.3 Contamination of Water Supplies [40 CFR 270.14(b)(8)(iii)] 14
4.4 Equipment and Power Failure [40 CFR 270.14(b)(8)(iv)] 15
4.5 Personnel Protective Equipment 15

5.0 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTES [40 CFR 270.14(B)(9)] **17**

5.1 Precautions to Prevent Ignition or Reaction of Ignitable or Reactive Wastes [40 CFR 264.17(a) and 40 CFR 270.14(b)(9)] 17

TABLE OF CONTENTS (CONTINUED)

5.2 General Precautions for Handling Ignitable or Reactive Wastes and Mixing Incompatible Wastes [40 CFR 264.17(b)] 17
5.3 Management of Ignitable or Reactive Waste [40 CFR 270.15(c) and 264.176] 18
5.4 Management of Incompatible Wastes in Containers [40 CFR 270.15(d) and 264.177] 18

TABLES

Table 1 Posted Warning Signs 2
Table 2 HWSB Weekly Inspection Log Sheet 19
Table 3 HWSB Monthly Inspection Log Sheet: Month Of: 21
Table 4 BOSS Contractor HAZMAT Response Truck 23
Table 5 HWSB Emergency Response Equipment 24

ACRONYMS AND ABBREVIATIONS

BOSS	Base Operating Support Services
CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HAZMAT	hazardous materials
HWSB	Hazardous Waste Storage Building
NFPA	National Fire Protection Association
OOD	Officer of the Day
PPE	personal protective equipment
QI	Qualified Individual
RCRA	Resource Conservation and Recovery Act
TSDF	Treatment, Storage, and Disposal Facility
USCG	U.S. Coast Guard

This page intentionally blank

1.0 SECURITY [40 CFR 264.14(B) AND 264.14(C)]

The Hazardous Waste Storage Building (HWSB) is designed and operated to minimize exposure of the general public, operating personnel, and the environment to the hazardous waste stored therein. This section describes the procedures and equipment/structures at the HWSB to help prevent, mitigate, or respond to environmental or human health hazards. Also described are the inspection procedures and schedule followed at the HWSB to ensure that this waste management unit and its associated equipment are properly maintained and operated.

Section 1.0 describes security measures in place at the HWSB to prevent unauthorized access. Section 2.0 describes the inspection program and schedule for the HWSB. Section 3.0 describes the emergency preparedness and prevention measures. Section 4.0 describes preventive procedures, structures, and equipment at the HWSB. Section 5.0 describes methods for management of ignitable, reactive, or incompatible waste.

Security at Base Kodiak is maintained 24 hours a day, 7 days per week, including holidays, by U.S. Coast Guard (USCG) security personnel whose duties include monitoring entry and exit from Base Kodiak and providing security control for the various Base Kodiak buildings, operations, and activities. Security at Base Kodiak is maintained by the following: (1) a 6-foot-high chain link fence surrounds the HWSB and several other Base Kodiak Facilities, (2) property warning signs, (3) surveillance patrols by USCG Military Police, 24 hours per day, 7 days per week, (4) security measures specific to the HWSB, such as warning signs and building security (administrative and physical controls). The sections that follow describe the security control at Base Kodiak in detail.

In addition to the general security provisions (fencing, gates, and security personnel), several other features contribute to the security of Base Kodiak. Ample lighting is provided throughout Base Kodiak, and Military Police, HWSB personnel, Base Operating Support Services (BOSS) contractor personnel, and Facilities Engineering Contracting Officer's Technical Representative personnel are equipped with hand-held and/or vehicle two-way radios to report upset or trespass conditions immediately. An internal telephone system encompasses Base Kodiak and is used for communication outside Base Kodiak premises as necessary.

1.1 Security Procedures and Equipment [40 CFR 270.14(b)(4) and 264.14]

USCG Military Police provide 24-hour surveillance to the base and check the HWSB during periodic rounds of Base Kodiak. The HWSB also has barriers to prevent the unknowing entry, and minimize the possibility of unauthorized entry, of persons or livestock.

1.1.1 24-Hour Surveillance System [40 CFR 264.14(b)(1)]

The HWSB is located within the confines of Base Kodiak and is therefore subject to, and receives the benefits of, the base security program. Military Police conduct 24-hour surveillance throughout the Base Kodiak Complex each day of the year. The security rounds are conducted in specially equipped, including two-way radios, military police vehicles. Each designated area of the base, including the facilities therein, such as the HWSB, are checked a minimum of once per 12-hour shift. If Military Police discover or observe the unknowing or unauthorized entry of persons onto Base Kodiak property, they immediately investigate and take action appropriate for the situation.

Base Kodiak has no grazing requests or policies. Domestic pets are required to be controlled at all times Routine deer and bear sightings are common. In the event that uncontrolled domestic or problematic wild animals are observed, the observing person contacts Military Personnel. Military Police contacts the Kodiak Borough Animal Control Officer or the Alaska Department of Fish and Game as appropriate for situations beyond the scope/capabilities of Military Police.

1.1.2 Barrier [40 CFR 264.14(b)(2)(i)]

A 6-foot-high chain link fence surrounds several Base Kodiak facilities on Nyman's Peninsula. This fence is the primary barrier for the HWSB. The walls of the HWSB are wood, and the north side wall acts as part of the fence line. The walls are broken by a personnel emergency exit door on the north side, and a personnel entrance door, an emergency exit door, and overhead roll door on the south side. The overhead roll door provides access into the HWSB container storage area. The overhead door is locked at all times when not in use. These building structures preclude unauthorized entry into the HWSB.

1.1.3 Means to Control Entry [(40 CFR 264.14(b)]

Entry to the HWSB is maintained by both administrative and physical controls. As discussed in Sections 1.1.1 and 1.1.2, the same 24-hours surveillance system and barrier that provide security for Base Kodiak protects the HWSB. Keys to the HWSB are controlled, and assigned to a limited number of personnel: the HWSB Operations Manager and staff; Base Facilities Engineering Supervisory personnel, Base Environmental Protection Specialist, Base Fire Department, and the BOSS Contractor Hazardous Materials Technician and after-hours response key-locker. All personnel not assigned to the HWSB and visitors must request authorization to enter the HWSB from the HWSB Operations Manager. Locked doors provide a physical means to control entry and the HWSB is posted with exterior warning signs as discussed below in Section 1.1.4.

1.1.4 Warning Signs [40 CFR 264.14(c)]

Entry to the HWSB is further controlled by warning signs posted on the exterior of the building. Warning signs which read "DANGER - UNAUTHORIZED PERSONNEL KEEP OUT" are posted on all the HWSB exterior doors. These warning signs are written in English and are legible from a distance of 25 feet. The following additional warning signs are also posted at the HWSB:

Table 1 Posted Warning Signs

SIGN	LOCATION
"NO SMOKING WITHIN 50 FEET"	All four sides of the HWSB
"NO PARKING ANY TIME"	West and south exterior walls
"NFPA"	North exterior wall adjacent to entrance door to mechanical room and south exterior wall adjacent to overhead door.
"NO SMOKING"	All rooms in the HWSB except the restroom and shower room

Notes:
HWSB = Hazardous Waste Storage Building
NFPA = National Fire Protection Association

1.2 Waiver [40 CFR 264.14(a)]

Unknown entry or access by unauthorized persons at the HWSB is precluded by a barrier, warning signs, and a means to control entry via a guarded Base and entry gate, locked perimeter fencing for the facilities of the HWSB, and locked doors with limited key access for the Treatment, Storage, and Disposal Facility (TSDF) and its facilities. Therefore, no waiver of security or equipment requirements is requested.

This page intentionally blank

2.0 INSPECTION SCHEDULE [40 CFR 270.14(B)(5) AND 264.15]

Various inspection programs are in place at Base Kodiak to ensure the proper and safe operation of the HWSB and its associated waste handling equipment. These inspections provide the mechanism for early detection, prevention, and expeditious correction of events that may cause or lead to the release of hazardous materials to the environment or pose a threat to human health. Types of problems looked for during inspections include equipment malfunctions, building deterioration, and human errors. The inspection program includes regular inspection, testing, and maintenance of HWSB emergency equipment, spill control equipment, and decontamination equipment to ensure that it is complete, available, ready for use, and in good condition and that communications and alarms systems will operate properly during an emergency.

HWSB personnel conduct inspections. The "HWSB Inspection Log Sheet" identifies the item to be inspected, the various elements to be checked and the type of problems to be checked for. The log sheet includes the containers, associated containment and control systems, and other factors that could result in the release of hazardous materials. All items observed during an inspection that require repair, replacement, corrective action, or other attention are documented on the inspection log sheet and corrective actions are initiated. Problems and deficiencies are tracked from initial observation to final resolution. Inspection log sheets have a space for recording the corrective action taken and the date the corrective action was completed. Table 2 shows a typical “HWSB Inspection Log Sheet;” this log sheet may be revised as necessary.

The HWSB Operations Manager, as part of the continuing inspection process, checks to ensure that all items previously noted have been satisfactorily resolved. The HWSB inspection program, including the use of inspection logs, ensures that deficiencies in operational equipment or procedures are identified and corrected on a timely basis.

The following sections describe in more detail the structure of the inspection program, the inspection schedule, and the inspection logs. Section 2.2 discusses specific inspection requirements.

2.1 General Inspection Requirements [40 CFR 270.14(b)(5), 264.15(a), 264.15(b), and 264.33]

HWSB personnel routinely conduct inspections of the HWSB. Inspections are conducted weekly, and monthly, with areas subject to spills (loading dock) inspected daily when in use. These inspections verify the physical condition of the HWSB including doors, and locks, warning signs, blockage of access areas into the waste storage areas through snow buildup or other causes, and the status of the operation of key emergency equipment. The inspection also ensures that releases are prevented by having the inspector verify all containers are closed when they are not actively adding or removing waste. The monthly inspection is a comprehensive review of the physical condition of the HWSB, emergency equipment, and the containers in storage. These inspections satisfy the Resource Conservation and Recovery Act (RCRA) required inspections for container storage units and ensure that the HWSB is in good repair, HWSB security systems are in place, and waste containers have not been breached, thereby minimizing the potential for a release of waste materials to the environment. Additionally, HWSB personnel conduct inspections every month of emergency and spill control equipment for completeness, condition, and readiness.

Inspections are recorded on the "HWSB Inspection Log Sheet" which becomes part of the HWSB Operating Record. All entries on the inspection log sheet are made in permanent ink. The inspection log sheet is signed and dated by the individual performing the inspection. The time of the inspection is also recorded on the inspection log sheet. Inspection log sheets, HWSB Operating Log, and all support information are maintained on file at the HWSB for a minimum of 3 years.

The inspection program described above is enhanced by random inspections conducted by the Government Management. These inspections are informal and are conducted on a non-routine basis and serve as an oversight inspection to ensure that the HWSB Operations Manager is operating the HWSB in accordance with federal and state regulations and USCG requirements.

2.1.1 Types of Problems [40 CFR 264.15(b)(3)]

The key items evaluated by the inspection program for the HWSB include:

- Structural integrity of the waste management unit and containers
- Evidence of release
- Equipment and systems in operating condition
- Presence of emergency equipment in required quantity and condition
- Fire hazards and accessibility to fire extinguishers
- Presence of warning signs and other equipment in the required number and in good condition
- Properly function security devices and intrusion barriers
- Record keeping.

All problems and deficiencies that are noted during an inspection are recorded on the applicable inspection log. Inspection logs include space for the date, time, and the name of the individual performing the inspections as well as the location of items to be inspected, observations, RCRA operating condition, and corrective actions or repairs that are required. If a problem or deficiency presents a situation where a RCRA operating condition is or could be violated, HWSB operations will be secured as quickly as possible without undue risk or spreading contamination, personnel exposure, or other environmental or personnel hazards. Operations are resumed when RCRA operating conditions are reestablished.

2.1.2 Frequency of Inspections [40 CFR 264.15(b)(4)]

HWSB personnel inspect the following items each week (at least every 7 days):

- Communications Equipment: Radio and telephone
- Waste storage area condition
- Waste containers condition
- Areas subject to spills
- Ventilation fan

Table 2 is the "HWSB Weekly Inspection Log Sheet."

With the exception of the fire hydrant near the HWSB (inspected annually by the Fire Department), the fire extinguishers (inspected monthly by the Fire Department), and the Fire Detection and alarm system (inspected by a Certified Fire Alarm Technician), HWSB personnel inspect all other items on a monthly basis. Table 3 is the "HWSB Monthly Inspection Log Sheet."

2.2 Specific Inspection Requirements

2.2.1 Container Inspection [40 CFR 264.15(b)(4) and 264.174]

Hazardous wastes are temporarily stored at the HWSB in 55-gallon drums or other U.S. Department of Transportation (DOT)-approved shipping containers until they are shipped to an offsite Transportation, Storage, and Disposal facility. As required by 40 CFR 264.174, containers holding hazardous waste are inspected weekly during the period they are in storage. Container storage inspection items are listed and recorded on the "HWSB Inspection Log Sheet" shown in Table 2.

HWSB personnel perform walk-through inspections of the HWSB. The inspector looks for any signs of leaking or breached containers and any signs of building deterioration, damage, or malfunction. The inspector also checks containers labels to ensure they are in place, legible, and accurate. Containers are positioned such that labels face an access aisle and are easily visible. The inspector also inspects the sumps in Room 109 for signs of liquid accumulation that may be indicative of a release of waste from a container.

2.2.2 Tank System Inspection

Tank systems are not addressed in this permit application; therefore, this section is not applicable.

2.2.3 Waste Pile Inspection

Waste piles are not addressed in this permit application; therefore, this section is not applicable.

2.2.4 Surface Impoundment Inspection

Surface impoundments are not addressed in this permit application; therefore, this section is not applicable.

2.2.5 Incinerator Inspection

Incinerators are not addressed in this permit application; therefore, this section is not applicable.

2.2.6 Landfill Inspection

Landfills are not addressed in this permit application; therefore, this section is not applicable.

2.2.7 Land Treatment Facility Inspection

Land treatment is not addressed in this permit application; therefore, this section is not applicable.

2.2.8 Miscellaneous Unit Inspection

Miscellaneous units are not addressed in this permit application; therefore, this section is not applicable.

This page intentionally blank

3.0 WAIVER OR DOCUMENTATION OF PREPAREDNESS AND PREVENTION REQUIREMENTS

This section discusses the emergency preparedness and prevention measures for the HWSB. No waiver from the requirements of 40 CFR 264, Subpart C, is requested.

3.1 Equipment Requirements [40 CFR 270.14(b) and 264.32]

The following sections describe the internal and external communication systems and emergency equipment at the HWSB. Water for fire control is also described.

3.1.1 Internal Communications [40 CFR 264.32(a)]

The HWSB is equipped with a commercial telephone system that is an extension of Base Kodiak commercial telephone system. The telephone system provides internal, external, and long-distance communication capabilities. A telephone is located in the HWSB office (Room 102). A two-way radio is located in the HWSB office. The HWSB Operations Manager or one of the other HWSB personnel carries the radio or a cell phone when working in the waste storage areas.

While working at the HWSB, personnel can be informed of emergency situations (building and/or area evacuations, fires, etc.) by two-way radio, telephone, cell phone, or alarms (fire, tsunami, evacuation). Personnel working at the HWSB typically transfer information and notify personnel of emergencies verbally.

3.1.2 External Communications [40 CFR 264.32(b)]

The telephone is the primary mechanism utilized at Base Kodiak to summon emergency assistance from USCG Military Police, Fire and Rescue Department, Officer of the Day (OOD), onsite response teams, and offsite police, fire department, and emergency response teams. The Base OOD and/or Military Police Watchstander is responsible for notifying the USCG Qualified Individual (QI). The QI is responsible for ensuring that the proper notifications are made to onsite response teams and offsite authorities and response agencies.

The HWSB is equipped with a low air pressure alarm, water motion alarms, and a fire alarm that is tied into Base Kodiak fire alarm system. The operation of any manual station, automatic heat detector, or automatic smoke detector causes all building evacuation alarm devices to sound continuously and mechanical equipment (such as ventilation fans) to shut down. Activation of the building fire alarm system automatically transmits trouble and alarm signals to three remote Base Kodiak stations via radio link equipment.

Base Kodiak is equipped with a tsunami evacuation alarm system consisting of sirens located throughout the Base Kodiak complex. Besides tsunamis, the evacuation alarms can be sounded for any emergency that necessitates an evacuation. The audible evacuation signal emitted by the sirens is as follows:

Evacuation signal – A rising and falling siren alarm sounded continuously. The sirens can be heard throughout Base Kodiak. The Integrated Emergency Response Preparedness Plan discusses personnel response to these sirens.

3.1.3 Emergency Equipment [40 CFR 264.32(c)]

The Base BOSS Contractor and the Base Kodiak Fire and Rescue Department are trained and may be required to respond to all emergency spill events. If the response involves unknown chemicals or requires a Level A personal protection, the Fire Department will serve as the main responder and the BOSS contractor will provide back-up. The Base Kodiak Fire and Rescue Department maintains adequate and sufficient emergency response equipment to enable them to provide First Responder HazMat Technician Level emergency response and support. The Fire Department can also provide technician level emergency response. If the response involves known chemicals and requires Level B, C, or D personal protection, the BOSS contractor will be the main responder and the Fire Department will provide back-up.

Per BOSS Contract requirements, the BOSS Contractor is required to have a Hazardous Materials (HAZMAT) Response crew of sufficient size and capability on standby at all times sufficient to respond to most probable spills at Base Kodiak. The BOSS Contractor Hazardous Materials crew is outfitted with adequate and sufficient personal protective equipment and emergency response equipment and supplies to respond to any Base Kodiak emergency including an emergency involving the HWSB. Typical emergency equipment and supplies maintained and utilized by the BOSS Contractor include:

- Personal protective equipment (PPE) for Level B, C, or D response
- First aid equipment
- Spill control and cleanup equipment
- Decontamination supplies and equipment
- Communication
- Fire control equipment

The BOSS Contractor maintains an appropriate inventory of emergency response equipment in its operations storage facilities. In addition, the BOSS contractor operates and maintains a dedicated HAZMAT Response Truck that contains a ready stock of emergency response materials and equipment at all times. Typical emergency response equipment maintained on the BOSS Contractor HAZMAT truck is listed on Table 4.

In addition to the emergency response equipment and materials that the BOSS Contractor maintains, they also maintain basic emergency response gear at the HWSB. Table 5 lists the typical emergency response gear maintained at the HWSB.

3.1.4 Water for Fire Control [40 CFR 264.32(d)]

Water for fire control for the HWSB is provided by Base Kodiak water supply system. Base Kodiak water supply system consists of three water storage tanks fed by three intake pumps that pump water from the Buskin Lake. The water storage tanks feed both the domestic (potable) and fire water systems. The fire water system runs throughout Base Kodiak to supply fire water to all buildings including the HWSB. Base Kodiak can provide water through its fire water supply system at adequate volume and pressure to supply Base Kodiak Fire Department hose streams to successfully fight fires at the HWSB. Details of the fire water system are provided below.

Water Storage Tanks - A 750,000-gallon water storage Tank (N8) and a 250,000-gallon water storage Tank (N9) provide potable and fire water for all building and areas at Base Kodiak with the exception of the aircraft hangers. A separate and dedicated deluge system provides fire water for the aircraft hangers. Water for the deluge system is stored in two dedicated water storage tanks.

Water storage tanks N8 and N9 are constructed of carbon steel and are painted inside and outside. Tank N8 is 32 feet in height and 60 feet in diameter. Tank N9 is 31 feet in height and 40 feet in diameter. The water level in Tank N8 is monitored by a float valve. If the water level in Tank N8 reaches 22 feet, the supply pump automatically turns on. When the water level reaches 30 feet the pump automatically shuts off. The water level in Tank N8 is monitored by an altitude valve. When the supply pump automatically shuts on to fill Tank N8 is simultaneously fills Tank N9. Neither tank is monitored for water temperature as the water supply in both tanks completely turns over every 18 hours. If the water level in the Tank N8 gets too low (below 20 feet), an emergency water alarm sounds at Base Kodiak Steam Plant. The Steam Plant is staffed 24 hours a day, 7 days a week.

Water Storage Tank Feed - The water storage tanks are fed from the three intake pumps at Buskin Lake. Each pump is capable of providing water at 1,300 gallons per minute. Normal water pressure is 55 pounds per square inch. All three pumps are electric motor-driven and are housed in Building 559. Only one pump operates at a time. Pump operation is alternated weekly basis in order to extend the life of the pumps. Pumps start automatically as discussed above or can be operated manually from the Steam Plant.

Fire Water Distribution System - Water is fed from the pumps at Buskin Lake to the water storage tanks through a 16-inch water main that runs from the pumps to Base Kodiak Main Gate. The water main branches at the Main Gate to supply potable and fire water throughout Base Kodiak. Water for firefighting is supplied through 6-inch lines that are connected to Base Kodiak fire hydrants. A fire hydrant is located approximately 200 feet west of the HWSB. The fire hydrant is equipped with a 2.5-inch and 4.5-inch suction hose connections.

Fire Suppression System - The HWSB is equipped with a zoned dry pipe sprinkler system for fire suppression. The sprinkler heads are temperature rated for 135 °F. The system meets the requirements of National Fire Protection Association (NFPA) code 13 and provides uniform distribution of water throughout the HWSB. This system is described in detail in Attachment 5 of the RCRA permit.

3.2 Aisle Space Requirement [40 CFR 264.35]

The container storage area (Room 109) has a main access aisle approximately 10 feet wide, running the length of the room (west to east). This aisle provides access and maneuvering room for forklifts or other equipment used to move containers or pallets of containers and for emergency equipment. There are seven discrete storage areas in Room 109. Three are located along the east wall of Room 109; each is approximately 14 feet by 9 feet. Two each storage areas are located along the north and south walls; each is approximately 13 feet by 8 feet. The discrete storage areas along the east wall are capable of holding 8 pallets each as are the discrete storage areas along the north and south walls. No more than four 55-gallon drums are stored on a pallet. Pallets are stacked two deep and two high within each of the discrete storage areas. A minimum of 30 inches of aisle space is maintained between rows of pallets. A minimum of 6 inches is maintained between pallets, storage area separators, and walls.

The waste handling and storage room (Room 107) is capable of holding a maximum of 10 pallets, two in the bermed containment area, and eight in the remaining area. Pallets stored in the small containment area are stacked one deep and two high. Pallets of waste stored in the remaining area are stacked two high. A minimum of 30 inches of aisle space is maintained around the pallets stored in the small containment area and between rows of pallets and/or equipment and structures in the remaining area. A minimum of 6 inches is maintained between pallets and walls in Room 107.

This page intentionally blank

4.0 PREVENTIVE PROCEDURES, STRUCTURES, AND EQUIPMENT

This section describes the specific procedures, structures, and equipment used at the HWSB for the prevention of:

- Hazards in loading and unloading operations
- Run-off from waste handling areas, and rainwater run-on to, or flooding of, those areas
- Contamination of water supplies
- Hazardous situations caused by equipment or power failure
- Undue exposure of personnel to waste constituents.

The following sections describe the preventive procedures, structures, and equipment used at the HWSB to prevent the occurrence of hazardous circumstances.

4.1 Loading and Unloading Operations [40 CFR 270.14(b)(18)(i)]

The HWSB loading and unloading operations include:

- Unloading containers of waste that have been transported by vehicle to the HWSB
- Moving containers of waste from the unloading/loading area outside the HWSB to inside the HWSB
- Moving containers of waste from inside the HWSB to the unloading/loading area outside the HWSB
- Loading containers onto trucks to be transported from the HWSB
- Operating other container handling equipment

The HWSB stacking procedures include:

- Inspection of the container handling equipment for operability, cracks, and visual signs of abnormal wear
- Inspection of the upper and base pallets to ensure good condition
- Inspection of containers to ensure container integrity (corrosion, breaches, leaks, etc.) to ensure base containers are of adequate strength considering the size, weight, materials of construction, and specifications of all containers (on upper and base pallets)
- Securing containers on pallets or container handling equipment during lifting and moving operations, if necessary
- Movement of the base pallet (with containers) into the 10-foot main aisle by forklift or other container handling equipment
- Lifting, moving, and stacking, by forklift, the upper pallet (with containers) on the base pallet (with containers) positioned in the 10-foot main aisle of the HWSB
- Movement of the stacked pallets (with containers) from the 10-foot main aisle into the assigned discrete storage area by forklift of other container handling equipment

Small containers (less than 30 gallons) may be stacked manually. Once stacked and placed in storage, the containers are inspected every normal working day as described in Section 2.0 to ensure container

integrity on the base pallet and stability of the stacked waste, if any. Waste are inspected each normal working day for signs of leaks or spills from containers.

Hazards in loading and unloading operations and waste movement at the HWSB are minimized through the following provisions:

- HWSB personnel inspect containers at the waste accumulation area prior to transport to the HWSB to ensure there is no leakage and the containers are intact; if container integrity is unacceptable, the waste is not transported to the HWSB until the problem has been corrected.
- For easy movement and stacking, containers are generally handled on pallets that are secured around the sides and the top; this reduces the chance of containers being dropped when they are stacked or moved. Individual containers may be moved by hand-operated equipment.
- Each of the discrete storage areas is equipped with a dedicated sump that provides secondary containment to isolate and contain leaks and spills. The floor in each discrete storage area slopes to a sump. As each sump is dedicated to a specific storage area, there is no chance for commingling of materials that leak or spill. Each discrete storage area is marked with changeable signs indicating the type of waste stored therein. This ensures that wastes are segregated according to compatibility. The signs can be changed according to the specific waste being stored in each discrete storage area at any given time.
- Spills, leaks, and unplanned releases are cleaned up upon detection and in accordance with the HWSB Integrated Emergency Response Preparedness Plan.
- The floors in Room 107 and 109 and the containment systems (sumps) are composed of concrete which is coated with an impervious chemically-resistant epoxy coating to prevent infiltration of spilled/leaked materials.
- The main aisle space and the aisle space between rows of pallets and pallets and the walls is maintained such that there is easy access to emergency and safety equipment and to facilitate the access by emergency equipment to a leaking container.
- Personnel are trained in hazardous waste loading/unloading procedures.

4.2 Run-Off Controls [40 CFR 270.14(b)(8)(ii)]

The HWSB is a closed building. Run-off controls are not necessary because precipitation has no way to enter the building.

4.3 Contamination of Water Supplies [40 CFR 270.14(b)(8)(iii)]

The water supply at Base Kodiak is provided by three intake pumps that draw water from the Buskin Lake. The water is stored in five separate aboveground water storage tanks (two for the aircraft hangar deluge system; three for Base Kodiak potable and fire water supply). Contamination of water supplies by hazardous waste management operations at the HWSB is highly unlikely as the HWSB is located approximately 3 miles south of the water intakes (see Attachment 1 of the RCRA Permit). The HWSB is not within the watershed of Buskin Lake.

4.4 Equipment and Power Failure [40 CFR 270.14(b)(8)(iv)]

The HWSB is connected to an emergency generator installed at the Central Steam Plant (approximately 200 feet north of the HWSB). The emergency generator is equipped with an automatic start/transfer switch mechanism that will instantaneously provide power to the HWSB when commercial power is lost. The emergency generator is of sufficient capacity to supply all systems in the HWSB. In the highly unlikely event of a loss of commercial power and failure of the emergency generator, the lighting and ventilation systems within the HWSB would be affected; however, this is not expected to create a situation wherein HWSB operations would need to be discontinued until power was restored. Initially, operations would cease in order to assess the situation. If power failure were to occur during waste handling operations, the BOSS Contractor has portable lighting equipment that is available to provide light. Container handling equipment is manually operated, and therefore would be unaffected by a power failure. In order to provide ventilation, all of the doors at the HWSB would be opened. The air within the HWSB will be monitored prior to resuming operations to determine if sufficient ventilation has been provided by opening the doors. If the natural ventilation (open doors) and portable lighting are sufficient, operations will resume as normal.

4.5 Personnel Protective Equipment

HWSB personnel are trained in the proper handling of waste, HWSB operations, and response to emergency events (see Attachment 3 of the RCRA Permit). The employer is responsible for training HWSB personnel and maintaining their currency for all items in Table 4 and daily HWSB operations. Additionally, personnel are protected from direct contact with wastes as the wastes are containerized and container handling equipment is used to move waste containers in or about the HWSB. During routine operations involving inspections, inventories, or movement of closed containers within the HWSB, protective clothing is not required. In the event that a sample may need to be obtained from a container, a PPE determination will be made based on the physical and chemical properties of the waste. In the event of an emergency response, a PPE determination will be made on a case-by-case basis in order to address event specific PPE requirements. Table 5 lists the PPE equipment that is available at the HWSB.

This page intentionally blank

5.0 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTES [40 CFR 270.14(B)(9)]

The HWSB is utilized for the storage of ignitable, reactive, and incompatible wastes. Due to the inherent potential hazard of storing these types of wastes together within a single waste management unit, special precautionary measures are taken at the HWSB. The following sections describe handling procedures and specific precautions taken to prevent waste- ignition/reaction/mixing of these wastes.

5.1 Precautions to Prevent Ignition or Reaction of Ignitable or Reactive Wastes [40 CFR 264.17(a) and 40 CFR 270.14(b)(9)]

Base Kodiak routinely generates ignitable waste, primarily contaminated fuels or fuel contaminated booms, spent solvents, absorbents, solvent soaked rags, etc. The HWSB was designed and constructed to meet NFPA and Uniform Building Codes building requirements for the storage of ignitable materials.

The only reactive wastes generated on a routine basis are oxygen breathing apparatus or Emergency Escape Breathing Device canisters and lithium batteries. Ignitable and reactive wastes are packaged separately in containers that are DOT approved. The following precautionary measures are used at the HWSB to prevent the ignition or reaction of ignitable or reactive wastes:

- Flammable/ignitable waste is stored in a dedicated discrete storage area
- Reactive and nonflammable ignitable (e.g., oxidizers) waste is not stored in the same discrete area as flammable waste
- Waste in storage is separated and protected from ignition sources
- No smoking is allowed inside or within 50 feet of the HWSB
- All electrical wiring and equipment comply with applicable NFPA codes.
- All containers are closed when not actively adding or removing waste.

The loading and unloading of ignitable, flammable, or reactive wastes in containers that are secured on pallets minimizes the chance of ignition from friction spark; puncture of a container, which might cause a reaction if container contents react with air; or frictional heat, which is more likely to happen if the containers are not on pallets and are lifted individually by forklifts.

5.2 General Precautions for Handling Ignitable or Reactive Wastes and Mixing Incompatible Wastes [40 CFR 264.17(b)]

The HWSB has a combination of design and procedural measures in place to prevent accidental ignition and reaction of ignitable and reactive wastes and the accidental mixing of incompatible wastes. These measures are:

- All waste containers are clearly marked as to their contents.
- Containers holding flammable wastes are stored in a dedicated discrete storage area.
- Reactive, nonflammable ignitable (e.g. oxidizer, combustible) and incompatible wastes are not stored in the same discrete storage area as flammables.
- Each discrete storage area is equipped with a dedicated sump. The dedicated sumps prevent the commingling of released materials that may react with one another.

- Waste incompatibility is evaluated prior to acceptance at the HWSB for storage.
- Smoking is prohibited everywhere inside the HWSB and within 50 feet of the building. No smoking signs are posted inside and outside of the building.
- No cutting, welding, or other open flames are permitted within the HWSB.
- Unloading/loading of drums on pallets minimizes the changes of ignition or reaction from friction spark, puncture of a container, and frictional heat.
- Routine inspections of containers and the container storage areas provide a means of quick detection and mitigation of leaks or container integrity deterioration.
- All containers are closed when not actively adding or removing waste.

These measures have been implemented at the HWSB to prevent the accidental ignition or reaction of ignitable, reactive, or incompatible wastes.

5.3 Management of Ignitable or Reactive Waste [40 CFR 270.15(c) and 264.176]

The HWSB is approximately 500 feet from the closest Base Kodiak boundary. Thus, the hazardous wastes stored at the HWSB are more than 50 feet from Base Kodiak boundary.

No public roads run through the controlled access portion of Base Kodiak. Access to Base Kodiak Main Gate is provided from Rezanof Highway that is approximately 1 mile from the HWSB.

5.4 Management of Incompatible Wastes in Containers [40 CFR 270.15(d) and 264.177]

Prior to waste transfer to the HWSB, the HWSB Operations Manager reviews the information regarding the waste composition submitted by the generating location. This information is submitted by onsite generating locations on a Form DD-1149, and by offsite generating locations on a Hazardous Waste Manifest or a Form DD-1149 (if the generator is conditionally exempt). The HWSB Operations Manager reviews the submitted information to ensure that the generator is not mixing incompatible wastes in containers. A mixture of incompatible waste is not accepted at the HWSB, and the generator can be required to repackage the waste. Should a mixture of incompatible wastes be received at the HWSB, the waste will be immediately repackaged. In addition, the forms are reviewed to ensure that the waste can be safely stored in the HWSB, considering the inventory present at the time it is to be accepted.

Waste received at the HWSB is packaged by the generator. Any waste repackaged at the HWSB would be the result of a spill, leak, or container deterioration, or would result from a generator packaging problem, or the need to loose pack or bulk waste into larger containers. At times a contracted transporter may also repackage in order to consolidate the materials as lab packs. This generally done on the day of shipment to another TSDF. In any of these cases, the waste or the container holding the waste would be placed in new containers, clean reused containers, or new overpack containers at the location of the deteriorating or leaking container.

Incompatible wastes are segregated in accordance with their physical and chemical properties and the DOT hazard class of the waste. The HWSB Operations Manager ensures that a safe storage configuration is maintained. Room 107 can be used to segregate incompatible wastes.

Table 2 HWSB Weekly Inspection Log Sheet

DATE:		TIME:	INSPECTOR:		
ITEM	**LOCATION**	**INSPECTION CRITERIA**	**OBSERVATION (SAT/UNSAT)**	**COMMENTS/CORRECTIVE ACTION NEEDED**	**DATE CORRECTED**
Communications Equipment					
Telephone	Room 102	• Working properly			
Radio	Room 102	• Working properly • Sending/receiving			
Building Infrastructure					
Ventilation Fan	Room 107	• Operating properly			
Waste Storage Areas	Room 107 Room 109	• Free of cracks, gaps • Floor coating			
Waste Storage Areas	Room 107 Room 109	• No evidence of spills • Stains, leaks			
Waste Storage Areas	Room 109	• Sump condition			
Areas subject to spills (inspected DAILY when in use)	Loading / unloading areas	• No evidence of spills • Stans, leaks			
Waste Containers					
Quantities / Layout	Room 107 Room 109	• Location / storage • Configuration • Proper segregations			
Labels	Room 107 Room 109	• Proper type / legible • Markings Correct			
Aisle Space	Room 107 Room 109	• 30 inches between pallets • 6 inches between pallets / walls / sump separate markers • Unobstructed			
Integrity	Room 107 Room 109	• Containers closed / sealed • No leaks, condition ok, not breached			

This page intentionally blank

Table 3 HWSB Monthly Inspection Log Sheet: Month Of:

DATE:		TIME:	INSPECTOR:		
ITEM	**LOCATION**	**INSPECTION CRITERIA**	**OBSERVATION (SAT/UNSAT)**	**COMMENTS/CORRECTIVE ACTION NEEDED**	**DATE CORRECTED**
Building Infrastructure					
Fire Extinguishers	Rooms 106, 107,108,109	• Current inspection • Pressure OK • Tamper seal intact			
Safety Shower	Room 107	• Functional, water flowing, clean			
Safety Eye Wash	Room 107	• Functional, water flowing, clean			
Emergency Lights	Throughout HWSB	• Operability • Battery backup			
Exit Lights	Throughout HWSB	• Operability • Battery backup			
Fire Detection System	Throughout HWSB	• Operability or current inspection			
Lighting	Interior & Exterior	• Operability			
Building Warning Signs	Interior/ Exterior	• Legible • Appearance OK • Correct type/quantity			
Exterior Grounds	Adjacent Grounds	• No debris / trash • Proper maintenance			
Building Condition	Throughout HWSB	• Roof, windows, doors / locks, walls • Foundation berms			

Table 3 HWSB Monthly Inspection Log Sheet: Month Of:

DATE:		TIME:	INSPECTOR:		
ITEM	**LOCATION**	**INSPECTION CRITERIA**	**OBSERVATION (SAT/UNSAT)**	**COMMENTS/CORRECTIVE ACTION NEEDED**	**DATE CORRECTED**
Container Storage					
Container Handling Equip (Pallet Jack, Drum sling, Hand Trucks, Overpack Lifter Scale) Emergency Response Equipment	Room 109	• Operable • No deterioration			
Emergency Response Equipment					
First Aid Kits	Room 102 Room 109	• Location / quantity • Inventory correct			
Spill Kits & Materials	Room 109	• Quantity / types • Condition/shelf life			
Emergency Response Equip	Room 108	• Inventory / type • Condition			
Emergency Notification List	Room 102	• Posted • Current / accurate			
General Comments:					

Table 4 BOSS Contractor HAZMAT Response Truck

PERSONAL PROTECTIVE EQUIPMENT (PPE)
• Tyvek Suits • Saranex Tyvek Suits • Scott Air Packs, Type IIA (2 each) • Full-Face Respirators • Half-Face Respirators • Acid Gas Canisters • Organic Vapor Canisters • Combination/HEPA Canisters • Silver Shield Gloves • Nitrile Gloves • Latex Gloves • Safety Goggles
SAMPLING EQUIPMENT
• Grab Sampler (3-foot handle) • Roll pH Paper • Sample Jars (8-ounce) • Sampling Tubes
SPILL KITS AND CLEAN-UP MATERIALS
• Sorbent Pads • Sorbent Boom • Acid Spill Kit • Bags Oil-A-Way • Drum and Tank patch kit • Drum – 20-gallon
FIRE PROTECTION EQUIPMENT
• Clean Agent Fire Extinguisher • Dry Chemical Fire Extinguisher • Fire Blanket
TOOLS AND MISCELLANEOUS EQUIPMENT
• Hydrant Wrench • Decontamination Pool • Barricade Tape/Rolls Duct Tape • Traffic Cones • Sounding Tape • Non-Sparking Hammers/Wrench/Shove • Pick/Shovel • Miscellaneous Reference Books

Table 5 HWSB Emergency Response Equipment

HWSB EMERGENCY RESPONSE GEAR
• Tyvek Suits • Tyvek QC Suits • Tyvek Saranex Suits • Latex Gloves • Nitrile Gloves • Butyl Rubber Gloves • Neoprene Gloves • Half-Face mask respirators • Full-Face Respirators • Organic Vapor Respirator Cartridges • Acid Gas/Formaldehyde Respirator Cartridges • Organic Vapor/Acid Gas Respirator Cartridges • Ammonia/Methyl Amine Respirator Cartridges • Asbestos, Organic Vapor, Dust Mist, Radionuclides, and Radon Daughters Respirator Cartridges • Hard Hats • Safety Goggles
SPILL KITS AND CLEAN-UP MATERIALS
• Acid Spill Kit • Caustic Spill Kit • Mercury Spill Kit • Oil absorbent booms and pads • Clay absorbent
MONITORING EQUIPMENT
• MSA Orion 3 Gas Meter • HAZCAT Kit
WASTE CONTAINER HANDLING EQUIPMENT
• Pallet Jack • Drum Sling • Overpack Lifter • Non-Sparking Drum Wrench • Drum Hand Truck
FIRE PROTECTION EQUIPMENT
• Fire Detection/Alarm System • Dry Chemical Fire Extinguishers
ADDITIONAL SAFETY EQUIPMENT
• Emergency Eye Wash Station • Emergency Shower Station • First Aid Kit
WASTE CONTAINERS
• 55-gallon drum (2 each) • 85-gallon overpack (2 each) • Drip pan (2 each)

Draft
Attachment 7
Solid Waste Management Units and Schedule of Compliance

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

Attachment 7 Solid Waste Management Units and Schedule of Compliance

SITE NUMBER	SITE NAME	MILESTONE	MILESTONE DATE
2	Navy Landfill	Final RFI Report	12/31/2022
3	Laundry	Supplemental RFI/CMS Report	12/31/2022
6B	Nyman Peninsula Fuel Farm	Supplemental RFI Work Plan	09/30/2021
9	AVGAS	Final Phase IV RFI Work Plan	06/30/2022
18	Drury Gulch	Five-Year Review and Screening Level Ecological Risk Assessment	12/31/2021
22	AKDOT Maintenance Area	RFI Work Plan	TBD
23	Old Power Plant	Final RFI Report	12/31/2022
32	Marine Sediments	Human Health Risk Assessment Work Plan	09/30/2022
34	A-711	Final Compilation Report RFI Data Gap Work Plan	02/28/2021 03/31/2022
35	Fire Training Pit	Final RFI Report	12/31/2021
37	Former Building 28	Final RFI Work Plan	9/30/2022

This page intentionally blank

Draft
Attachment 8
RCRA Corrective Action Plan

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

ATTACHMENT 8 - RCRA CORRECTIVE ACTION PLAN

Please see https://www.epa.gov/sites/production/files/2013-10/documents/rcracactionpln-rpt.pdf for the Corrective Action Plan.

This page intentionally blank

Draft
Attachment 9
Well Decommissioning Plan

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 INTRODUCTION **1**

2.0 WELL LOCATIONS AND DESCRIPTIONS **3**

2.1 Pre-1990 Well Installations 3
2.2 Post-1990 Well Installations 3
2.3 State of Alaska Well Construction Guidelines 3

3.0 WELL DECOMMISSIONING CRITERIA **5**

3.1 RCRA-Specification Wells 5
3.2 Other Operational Wells 5
3.3 Wells Which Must be Decommissioned 6

4.0 WELL DECOMMISSIONING PROCEDURES **7**

4.1 Methods 7
4.1.1 Removal of Well Casing 7
4.1.2 Decommissioning in Place 8
4.1.3 Re-Drilling the Well 8
4.1.4 Other Procedures 8
4.2 Exceptions 8
4.3 Documentation 9

5.0 WELL DECOMMISSIONING SCHEDULE **11**

6.0 REFERENCES **13**

This page intentionally blank

ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
EPA	U.S. Environmental Protection Agency
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey

This page intentionally blank

1.0 INTRODUCTION

The U.S. Coast Guard (USCG) is currently performing numerous environmental investigations at Base Kodiak in Kodiak, Alaska. Investigations are being performed under the auspices of the Resource Conservation and Recovery Act (RCRA) and require the implementation of numerous field investigation methods. These methods include drilling boreholes and installing monitoring wells as part of subsurface investigations. To date, over 150 environmental monitoring wells have been installed at the Base in support of various investigations.

When a well, regardless of past uses, is unusable, damaged to a degree where safe use of the well is no longer possible, known or suspected of leaking (as a result of damaged annular seals) or permanently discontinued for any reason (such as the end of the post-closure care period), the well must be decommissioned in accordance with applicable regulations.

This page intentionally blank

2.0 WELL LOCATIONS AND DESCRIPTIONS

2.1 Pre-1990 Well Installations

In the late 1980s, the U.S. Geological Survey (USGS) installed 96 environmental monitoring wells under contract to the USCG. USGS-installed wells were generally completed as above-grade, 2-inch polyvinyl chloride (PVC) wells having 10-foot screened intervals, and were installed to depths typically less than 30 feet below ground surface. The above-grade PVC, or well stickups, are protected by steel outer casings with lockable caps. The annular space around the well casings was filled with either sand or gravel to just beneath land surface. A concrete surface seal was installed extending from just below grade to a few inches above grade.

2.2 Post-1990 Well Installations

Since 1990, more than 150 stainless steel and PVC wells have been installed by various contractors. These wells have generally been installed in compliance with State of Alaska Well Construction Guidelines (see Section 2.3).

2.3 State of Alaska Well Construction Guidelines

Formal well construction regulations have been promulgated by the Alaska Department of Environmental Conservation (ADEC) *Monitoring Well Guidance* (September 2013). In this document, ADEC provides recommendations for installation and decommissioning of monitoring wells. However, the agency has indicated in the document that climatic, regional, and geographic conditions affect well design. While each monitoring well installation may differ, site-specific application should be technically sound. All monitoring wells at Base Kodiak meet these conditions.

This page intentionally blank

3.0 WELL DECOMMISSIONING CRITERIA

In general, ADEC recommends decommissioning of any well that is unusable, is damaged to a degree where continued use is impractical or is an environmental, safety, or public health hazard, or when use has been permanently discontinued. In considering a well for decommissioning, it is necessary to review the well's intended use versus decommissioning guidelines to determine if the well is still of use. For example, a well may be damaged to a point where collection of groundwater samples would not be representative. However, the well may still be used to gather hydrologic data rather than being decommissioned. Wells at Base Kodiak have been categorized as RCRA-specification wells, other operational wells, or wells to be decommissioned.

3.1 RCRA-Specification Wells

RCRA-specification wells are required to meet RCRA specifications as stated in RCRA Ground-Water Monitoring Technical Guidance (EPA 1992). These wells are typically used for some type of compliance monitoring (e.g. closure, assessment, detection, etc.). Some situations which may require a RCRA-specification well to be repaired or reevaluated are:

- Completion of monitoring requirements
- Leaking surface seals (often caused by frost heave)
- Lack of security (damage to lockable covers)
- Unknown (not documented) well construction
- Improper materials for present contaminants (collection of groundwater samples may indicate the groundwater contains contaminants which will chemically attack, adhere to, or leach from the well material)
- Ineffective filter pack
- Physical well damage (for example, a bend in casing, preventing bailers or probes from being lowered into the well).

Other situations not mentioned here may be encountered and should be evaluated on a case-by-case basis.

If construction precludes the well from use at RCRA-regulated units but the damage or installation still meets requirements for other uses, (such as collection of piezometric data), the well may not need to be decommissioned (Section 3.2). If the damage is too severe or if there are no other uses, the well should be decommissioned.

3.2 Other Operational Wells

Wells which do not meet or are not required to meet RCRA construction specifications but are used for other purposes should meet ADEC recommendations for construction standards, as specified in Monitoring Well Guidance (ADEC 2013). Typical uses for wells in this category include sampling for contaminants, collection of hydrologic data, product recovery, and pilot testing of remedial options.

Some situations that may require a well to be repaired or considered for decommissioning include:

- Completion of monitoring requirements

- Physical damage which prevents insertion of sampling or devices used for gathering hydrologic data
- Frost heave damage to surface seals or to the well itself
- Ineffective filter pack (if well is used for sampling)
- Ineffective annular seal
- Frost-jacking of the well itself
- Questionable security.

3.3 Wells Which Must be Decommissioned

Wells which must be decommissioned include:

- Any well that is not longer used (for practical or regulatory reasons)
- Any well that is damaged beyond use
- Any well that is damaged to a degree which may allow hazardous contaminants to enter the subsurface
- Any well that poses a health hazard.

Other practical considerations, such as Base Kodiak building construction projects, may also result in the need for decommissioning a well. All well decommissioning activities should be in accordance with the procedures set forth in Section 4, Well Decommissioning Procedures.

4.0 WELL DECOMMISSIONING PROCEDURES

Wells and boreholes are decommissioned to prevent the entrance of surface contaminants into the subsurface environment, to prevent the vertical migration (upward or downward) of water or contaminants between distinct water-bearing formations, and to eliminate potential physical hazards to people and wildlife. ADEC's Monitoring Well Guidance details ADEC's recommended methods for decommissioning wells (ADEC 2013). The procedures given below meet or exceed all ADEC recommendations.

4.1 Methods

Depending on well construction materials and installation depth, one of three methods may be employed for well decommissioning:

1. Removal of well casing and filling the borehole with sealant,
2. Decommissioning in place, or
3. Re-drilling the well.

4.1.1 Removal of Well Casing

Most wells currently installed at Base Kodiak are shallow, installed in unconsolidated sediments, and are constructed of materials amenable to perforation of the well casing with subsequent borehole sealing. This method is applicable for wells constructed of materials that cannot be perforated or when it is preferable to have no well materials remain in place. The procedure for borehole sealing described in this method is also applicable to dug wells, bedrock wells, or for any borehole which remains open to land surface. Decommissioning wells by this method will be accomplished as follows:

- Decommission monitoring wells and well points as soon as practicable.
- Knock out the bottom of the screen with a steel drill rod/pipe, allowing the well itself to be used as a tremie pipe.
- Remove the well casing and screen until the screened interval is above the groundwater interface, allowing the aquifer material to collapse into the borehole. As a general rule, if it is a 10-foot screen, pull the well out 10 feet, and so on for different screen lengths.
- Once the casing has been withdrawn to above the groundwater interface, add sealing grout or bentonite chips to the well until the materials are near ground surface. Chips will require hydration after completion. It is important to add more sealing material as the casing is withdrawn to ensure a steady amount is applied to the borehole. Allow the materials to completely vacate the well casing during removal may cause the borehole to slough and compromise the seal. Keeping the column close to full will help avoid this and also fill any borehole void space should the casing break while being pulled.
- For wells completed in a confined aquifer, begin placing grout or bentonite chips within the confining stratum to prevent migration through the confining layers.
- Ensure that sealing grouts, when used, are properly mixed and prepared in accordance with the manufacturer recommendations prior to placement.

- Continue to apply sealing materials as the well is removed to approximately 2 feet below ground surface. Complete by filling the remaining 2 feet with sand or gravel, and repair asphalt/cement as necessary.
- Record decommissioning procedures and report to ADEC (ADEC 2013).
- Characterize all casings, screens, caps, and other well materials removed from the decommissioned well for visual contamination and decontaminate or dispose of in compliance with applicable regulations.

4.1.2 Decommissioning in Place

Decommissioning wells in place is applicable for wells constructed of materials that can be perforated in place, are packed or located in formation of materials that would collapse when the casing is removed (such as gravel-packed wells), or for wells which cannot be readily removed from the subsurface. Most of the wells installed pre-1990 at Base Kodiak are amenable to decommissioning in place. Decommissioning wells in place will be accomplished using the following procedure:

- If the original construction of the well is known to have included a competent annular seal of grout or bentonite chips surrounding the well casing, the screen should be filled with sand and the casing should be completely sealed in-place up to the casing cut-off point located near the ground surface (ADEC 2013).

4.1.3 Re-Drilling the Well

Re-drilling should only be used when neither decommissioning method described above can be successfully employed. There is no way to ensure that the augers will follow the original borehole to the completed well depth.

Re-drilling can be an effective fallback option in circumstances where the well has been damaged, broken, filled, or plugged with soil or other extraneous media, preventing successful decommissioning using either of the prior two described methods (ADEC 2013).

4.1.4 Other Procedures

Currently there are no artesian wells at Base Kodiak. If an artesian well is ever installed, it will be decommissioned with a cement grout or concrete plug placed in the confining stratum overlying the artesian zone. The remainder of the well will be filled with cement grout or bentonite.

An alternative procedure will be submitted to ADEC for approval if a situation arises where a well cannot be decommissioned using one of the aforementioned methods. The alternative method will conform to ANSI/AWWA Standard A100-84 (Effective 6/14/91, Register 118).

4.2 Exceptions

The water table typically encountered at Base Kodiak is usually less than 20 feet below land surface. However, if a well is installed where the water table is not encountered for at least 50 feet, the well may be decommissioned using clean sand (rather than sealant material) in the interval from 10 feet above the seasonal high water table to 10 feet below land surface and sealed to land surface.

4.3 Documentation

The decommissioning procedure used for any monitoring well must be documented and submitted to ADEC.

ADEC currently does not have specified methods or documentation forms for submittal. At a minimum, the following information will be included: project name (if appropriate), date, location of well by quarter-quarter section or smallest legal subdivision, the latitude and longitude, the well identification number, the as-installed well log diagram, the former use of the well, the method of setting the plug, and the type and amount of sealant used during decommissioning.

This page intentionally blank

5.0 WELL DECOMMISSIONING SCHEDULE

Well integrity will be checked annually to determine if current uses are appropriate. Frost heave, changing Base Kodiak operations, new building construction, road regrading, completion of monitoring requirements, and other factors can result in reclassification of a well from operational to one which should be decommissioned. These wells will be decommissioned in a reasonable time frame in conjunction with other Base Kodiak activities.

This page intentionally blank

6.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2013. Monitoring Well Guidance. September.

United States Environmental Protection Agency (EPA). 1992. RCRA Ground-Water Monitoring: Draft Technical Guidance. Publication Number EPA/530-R-93-001.

This page intentionally blank

Draft
Attachment 10
Land Use Control Assurance Plan for Environmental Cleanup Activities

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 INTRODUCTION **1**
2.0 AUTHORITIES **3**
3.0 DEFINITIONS **5**
4.0 OBJECTIVES OF THE LUCAP **7**
5.0 ACTIVITIES COVERED UNDER THE PLAN **9**
6.0 LUCAP LOCATION AND RESPONSIBILITY FOR UPDATE AND DISTRIBUTION **11**
7.0 IMPLEMENTATION **13**
8.0 SITE INSPECTION, REVIEW, CERTIFICATION **15**
9.0 ANNUAL REPORTS AND FIVE-YEAR REVIEWS **17**
10.0 CHANGES IN LAND USE, AGENCY COORDINATION **19**
11.0 FUNDING COMMITMENT **21**
12.0 FUTURE PROPERTY CONVEYANCE **23**
13.0 CHANGE IN APPLICABLE STANDARDS **25**
14.0 REFERENCES **27**

TABLES

Table 1 LUCAP Distribution 11

APPENDICES

Appendix A List of Sites Requiring Land Use Control Measures
Appendix B General Services Administration Memo, October 16, 1998
Appendix C Agency Contacts
Appendix D Five-Year Review Criteria
Appendix E Land Use Control Implementation Plans

This page intentionally blank

ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
CASOB	Corrective Action Statement of Basis
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEU	Civil Engineering Unit
CFR	Code of Federal Regulations
EBST	Environmental Baseline Survey for Transfer
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
FOSL	Finding of Suitability for Lease
FOST	Finding of Suitability for Transfer
GSA	General Services Administration
LUC	land use control
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
RCRA	Resource Conservation and Recovery Act
SWMU	Solid Waste Management Unit
TSDF	Treatment, Storage, and Disposal Facility
USCG	U.S. Coast Guard

This page intentionally blank

1.0 INTRODUCTION

Environmental investigative activities being undertaken at Base Kodiak have revealed and may in the future reveal areas of environmental contamination ("sites"). These sites include those where hazardous substances and/or Resource Conservation and Recovery Act (RCRA) hazardous wastes or hazardous constituents were or may have been released into the environment as a result of activities conducted over the history of the facility. Sites may be regulated under RCRA, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Alaska State Cleanup or Underground Storage Tank regulations.

Such sites may generally be categorized as follows:

- Industrial sites, such as landfills, where waste remains in place when the site is closed
- Sites where soil and/or groundwater contamination remains in place because remediation activities take place over a long period (years)
- Sites where soil and/or groundwater contamination remain in place because removal is not practical (buildings or utilities prevent excavation, contamination is diffuse, no known successful remedial measures exist for the contaminants)

The sites for which land use controls (LUCs) are planned or have been implemented may be found in Appendix A. Additional sites may be added as final remedial decisions are made.

Because Base Kodiak is currently and will likely remain a multi-use facility with industrial, commercial, recreational and residential land uses, site remedy determinations must take land use into account to facilitate the use of risk-based cleanup criteria and/or to prevent unacceptable exposure to contaminants.

This page intentionally blank

2.0 AUTHORITIES

Base Kodiak operates a hazardous waste storage facility and manages three RCRA landfills in post-closure status under RCRA Permit No. AK9690330742. Section IX of the permit directs the U.S. Coast Guard (USCG) to undertake corrective action for Solid Waste Management Units (SWMUs), as required under Section 3004(u) of the RCRA statute and promulgated in regulation under 40 Code of Federal Regulations (CFR) 264.101.

RCRA requires that cleanup of releases of hazardous wastes and hazardous constituents to the environment be protective of human health and the environment. Part of the decision process for selecting a remedy involves assumptions concerning the current and future use of the land or water associated with a SWMU. In many cases, it is not possible or cost effective to clean up a site to contaminant levels that would allow residential development to occur. In such cases, future land uses, and activities must be controlled in some way to ensure that the remedy selected is protective. These LUCs become part of the remedy and are reviewed and enforced by the regulatory agencies. The U.S. Environmental Protection Agency (EPA) documents the remedy and associated LUC requirements in a Corrective Action Statement of Basis and modifies the RCRA Permit to include the provisions of the remedy. EPA Region 10 has developed guidance to ensure the consistent application of institutional controls or LUCs at federal facilities (EPA 1999). National EPA guidance is also available (EPA 2012a and 2012b).

In addition to RCRA and associated EPA guidance, the Alaska Department of Environmental Conservation (ADEC) cleanup regulations (18 Alaska Administrative Code [AAC] 75 allow for the development of institutional controls as part of a site remedy when required to be protective of human health and the environment (18 AAC 75.375). ADEC requires institutional controls at sites where contamination will remain onsite at levels higher than residential cleanup standards, or where constituents left in place do not allow groundwater to be used as a drinking water source. ADEC documents the decision in a "No Further Remedial Action Planned" Decision Document, which recognizes that wastes or contamination have, by necessity or mutual agreement with EPA or ADEC, been left in place, and requires the imposition of land use restrictions to protect human health and the environment. ADEC also has developed guidance for the development of institutional controls (ADEC 2017).

All real property interests controlled by the USCG are owned or held by the United States government. The USCG is the federal agency charged with administrative accountability, control, and custody over the real property at Base Kodiak. In the course of continuing operations, USCG has been required to perform certain environmental remedial actions. At some sites, the imposition of LUCs is part of the remedial action.

The USCG, as the landholding agency, has no authority to place deed restrictions on any land within its purview. This authority is held by the General Services Administration (GSA) as part of its authority to manage the utilization and disposal of real property. GSA has delineated this authority in an October 1998 memorandum (see Appendix B). This Land Use Control Assurance Plan (LUCAP) and the attached site-specific Land Use Control Implementation Plans (LUCIPs) provide a mechanism for instituting LUCs with continuing operations at Base Kodiak as required in the relevant remediation decision documents.

Should sites identified in this LUCAP be identified for excess, then, as required under CERCLA Section 120, environmental due diligence would identify whether additional remediation or changes to LUCs or control mechanisms were warranted as part of the disposal process. At that time, this LUCAP will be reviewed for its appropriateness.

This page intentionally blank

3.0 DEFINITIONS

"Land use control" means any restriction or control arising from the need to protect human health and the environment, that limits the use of and/or exposure to, environmentally contaminated media (e.g., soil, surface water, groundwater, etc.) at any site at Base Kodiak. The term includes controls on access (e.g., engineered and non-engineered mechanisms such as fences, caps, security guards). Additionally, the term encompasses both affirmative measures to achieve the desired control (e.g., night lighting of an area) and prohibitive directives (e.g., no drilling of drinking water wells). The term also includes "institutional controls," which are non-engineered mechanisms for ensuring compliance with necessary land use limitations (e.g., public advisories, legal restrictions on land or water usage, restrictions imposed, and information recorded pursuant to LUCIPs).

"Land Use Control Implementation Plan" or "LUCIP" means the plan through which LUCs are implemented at a site. The LUCIPs include both LUC objectives for the site being addressed as well as those LUCs which will be relied upon to achieve that objective. Each LUCIP will also specify what must be done in order to implement and maintain the specific LUCs required for the site. LUCIPs for each site will be appended to and be part of the Corrective Action Statement of Basis (CASOB) or other decision document for that site.

"Decision document" includes, but is not limited to, RCRA Statements of Basis/ Notices of Decision, RCRA Permit Modifications, and ADEC Decision Documents as identified in 18 AAC 75.

"Residential land use" (18 AAC 75) means the use of property for dwellings such as single family homes, multi-family apartments, children's homes, and nursing homes; because of the similarity of exposure potential and the sensitive nature of the potentially exposed population, "residential land use" includes uses of property for day care facilities, educational facilities, hospitals, playgrounds, and similar facilities; "residential land use" includes property restricted to residential use by legally enforceable zoning ordinance or specific deed restriction; vacant land that is not zoned or deed-restricted for commercial or industrial land use will be considered residential unless demonstrated otherwise.

This page intentionally blank

4.0 OBJECTIVES OF THE LUCAP

The Base Kodiak LUCAP has the following objectives:

- To establish and institutionalize a process to ensure appropriate long-term maintenance of those LUCs implemented as part of remedy selection for any contaminated site on the facility. This process is designed to accomplish the following:
  - Prevent unacceptable human or environmental exposures, where appropriate, through consideration of assumed future land use scenarios at those sites where LUCs will be necessary to make such assumptions reliable.
  - Integrate all site remedies that include LUCs into the facility's planning process.
  - Elevate the general level of awareness among Base Kodiak personnel as to the need to maintain LUCs in order to ensure long-term protection of human health and the environment.
  - Implement a process to add sites as it is determined that they require LUCs, or to delete sites as it is determined that they no longer require LUCs.
- To implement a process for Base Kodiak to periodically advise EPA and ADEC (as appropriate) of the continued maintenance of any LUCs implemented at Base Kodiak and of any planned changes in land use which might impact the site remedy.
- To provide reasonable assurances to EPA and ADEC (as appropriate) that those specific pathway and exposure assumptions relied upon in applying a risk-based cleanup standard to a given site will remain valid until such time as the Parties agree that either different site controls or unrestricted site usage would be appropriate.

This page intentionally blank

5.0 ACTIVITIES COVERED UNDER THE PLAN

The following activities are examples of work that would be covered under this LUCAP:

- Soil disturbance
- Dewatering/groundwater withdrawals
- Routine and non-routine aboveground and belowground utility work
- Well placement and drilling
- Drilling for other purposes
- Paving activities
- Construction and renovation of aboveground and belowground structures
- Outdoor recreational activities
- Training activities

This page intentionally blank

6.0 LUCAP LOCATION AND RESPONSIBILITY FOR UPDATE AND DISTRIBUTION

When LUCs are necessary to assure the reliability of land use assumptions, it is essential that appropriate procedures be put in place to ensure that such controls will be maintained for as long as necessary to keep the chosen remedy fully protective of human health and the environment.

Updated copies of the LUCAP (with all appendices) will be maintained by the following entities within the USCG and its contractors.

Table 1 LUCAP Distribution

DISTRIBUTION	COPY NUMBER
UNIT COPIES	
Administrative Record Room	
Master, Reproducible: Original Issue	Doc #
Master, Maintained Copy	Doc #
Record of Changes	Doc #
CEU Juneau	01
EPA Region 10 (2 copies)	02 / 03
PERSONAL COPIES	
Base Kodiak, Environmental Division Chief	04
Base Kodiak, TSDF Operator	05

Notes:
CEU = Civil Engineering Unit
EPA = U.S. Environmental Protection Agency
TSDF = Treatment, Storage, and Disposal Facility

The Base Kodiak Supervisory Environmental Protection Specialist has the responsibility for ensuring that updates are performed in a timely manner and that distribution of copies is made to all Plan holders.

A control document will be added to the Base Kodiak Environmental Management System documenting how updates to the LUCIP for each site will be handled by Base Kodiak.

This page intentionally blank

7.0 IMPLEMENTATION

This LUCAP contains five appendices:

- **Appendix A**: Land Use Control Site Listing for all sites covered under the LUCAP. The list includes, for each site, the site name, site description and site location as specified in the decision document, and the name and date of the decision document itself.
- **Appendix B**: A General Services Administration policy memo regarding property disposals.
- **Appendix C**: Agency Points of Contact
- **Appendix D**: Land Use Controls Five-Year Review Criteria
- **Appendix E**: LUCIPs for sites for which they have been developed.

Within 6 months after publication and final approval of a decision document containing LUCs, Base Kodiak will incorporate the LUCs into Base Kodiak's Environmental Management System (EMS) and will provide written notification to EPA and ADEC when the LUCs have been so incorporated. As future decisions involving LUCs are made at sites on Base Kodiak, these sites will become covered under this LUCAP and listed in Appendix A, and a new LUCIP appropriate to each such newly covered site will be added to Appendix C upon final approval of the decision document for that site. Every 5 years, a review of each site will occur using the criteria listed in Appendix E.

This LUCAP and its appendices will be legally binding on the USCG, regulatory agencies, and contractors working at Base Kodiak.

This page intentionally blank

8.0 SITE INSPECTION, REVIEW, CERTIFICATION

Unless otherwise agreed to in a site-specific LUCIP, Base Kodiak will conduct annual visual inspections of all sites identified in Appendix A to this Plan and annual reviews of the Environmental Management System. These inspections and reviews will be for the purposes of verifying that all necessary LUCs are properly documented and maintained. The Base Kodiak Supervisory Environmental Protection Specialist will be responsible for ensuring that all required inspections and reviews are performed, that EPA and ADEC are notified of any deficiencies noted, and that all appropriate measures are taken in a timely manner to correct any deficiencies with timely notification to EPA and ADEC detailing such measures.

Base Kodiak will notify EPA and ADEC within 30 days upon discovery of any activity inconsistent with the LUCAP objectives. Base Kodiak will work together with EPA and ADEC to rectify the situation. Base Kodiak will also identify what went wrong with the LUC process, evaluate how to correct the process in an effort to prevent future problems, and implement these changes after consultation with EPA and ADEC.

This page intentionally blank

9.0 ANNUAL REPORTS AND FIVE-YEAR REVIEWS

An annual monitoring report will be provided to EPA and ADEC. The annual report for all sites with LUCs at Base Kodiak will consist of a cover letter that will state that all sites are being monitored and maintained in accordance with the LUCAP and the specific LUCIPs that apply for the individual sites. An attachment to the letter will list the sites inspected with the dates of inspection and any discrepancies and corrective actions implemented.

Five-year review of the appropriateness of continuing LUCs will be performed using the criteria set forth in Appendix E. Five-year review reports will be submitted on the 5-year anniversary of the first annual report.

This page intentionally blank

10.0 CHANGES IN LAND USE, AGENCY COORDINATION

At least 60 days (except in emergency situations) prior to implementation of any proposed major change in land usage (defined below) at any site subject to LUCs, Base Kodiak will submit a request for agency concurrence of any such proposed change to EPA and ADEC. This notification will be provided to EPA and/or ADEC to obtain concurrence regarding the potential impact of the land use change on the site.

Each request for concurrence will include:

- An evaluation of whether the anticipated land use change will pose unacceptable risks to human health and the environment or negatively impact the effectiveness of the selected site remedy;
- An evaluation of the need for any additional remedial action or LUCs resulting from implementation of the anticipated major land use change; and,
- A proposal for any necessary changes in the selected site remedy.

No major land use change will be implemented until EPA and ADEC concurrence is obtained, so long as EPA and ADEC respond in a timely fashion (normally 30 days).

The following will constitute a major change in land use:

- Any change in land use (e.g., from industrial or recreational to residential) that would be inconsistent with those specific exposure assumptions in the human health and/or ecological risk assessments that served as the basis for the LUCs that were implemented at the site;
- Any activity intended to alter or negate the need for the specific LUCs implemented at the site.

Base Kodiak will immediately notify EPA and ADEC if, despite its best efforts to ensure compliance, a major change in land use at any site with an implemented LUC is discovered that has not been previously agreed to by EPA and ADEC. Such notifications will describe the nature and extent of the change and describe any measures implemented or proposed (including a timetable for completion), to reduce or prevent human health or ecological impacts.

This page intentionally blank

11.0 FUNDING COMMITMENT

Base Kodiak agrees to use its best efforts to obtain all necessary funding through the appropriate authorities or source(s) to ensure the continued maintenance of all LUCs covered under this Plan and, where necessary, the timely re-implementation of any LUCs and/or completion of site restoration activities necessitated by any violation of or unauthorized change to an implemented LUC. All requirements of this document requiring the expenditure of USCG funds are expressly subject to the availability of appropriations and the requirements of the Anti-Deficiency Act (31 United States Code Section 1341). No obligation undertaken by the USCG under the terms of this document will require or be interpreted to require a commitment to expend funds not obligated for a particular purpose. If the USCG cannot perform its obligations set forth in this document due to the unavailability of funds, the USCG will apply its best efforts to renegotiate the provisions of the LUCs.

This page intentionally blank

12.0 FUTURE PROPERTY CONVEYANCE

Should areas identified in this LUCAP be identified for excess, then Base Kodiak will ensure that:

- EPA and ADEC are provided with written notice at least 6 months prior to any such intended conveyance. If it is not possible to provide 6 months' notice, then at least 60 days' notice will be provided. Such notice will provide the regulatory agencies with the opportunity to discuss the appropriateness of the existing LUCs in light of the planned excess, and
- Consideration of each LUC is incorporated into those property disposal procedures (e.g., preparation of the Environmental Baseline Survey for Transfer (EBST), Finding of Suitability for Lease (FOSL), and Finding of Suitability for Transfer (FOST) to be utilized to meet CERCLA Section 120 and 40 CFR 373 notice requirements so that the transferee(s) is given adequate notice of site condition(s). It is understood that the planned excess of property of any site with LUCs may prompt the USCG, EPA, or ADEC to re-evaluate the appropriateness of the selected remedy, including any existing LUCs.

This page intentionally blank

13.0 CHANGE IN APPLICABLE STANDARDS

Nothing herein should be construed to preclude Base Kodiak from proposing at any time or the Parties from agreeing to the deletion of any site from coverage under this document based on either: (i) a change to applicable Federal or State risk-based cleanup standards, or (ii) a change in contaminant concentration levels allowing for unrestricted use as a result of the effects of man- induced or naturally-occurring bioremediation / attenuation. Deletion of a site from coverage under the LUCAP will be accomplished by one of the following methods:

- For sites under the RCRA Permit, a request for a Class 3 permit modification will be submitted requesting approval of No Further Action for the site
- For sites under other state or Federal authorities, a written request will be submitted documenting the request for deletion, reasons for such request, and a timeline for agency review and approval.

This page intentionally blank

14.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2011 (February). *Guidance on Using Institutional Controls in Oil and Other Hazardous Substance Cleanups.*

ADEC. October 2018. 18 Alaska Administrative Code 75. *Oil and Other Hazardous Substances Pollution Control.*

U.S. Environmental Protection Agency (EPA) Region 10. 1999 (May). *Region 10 Final Policy on the Use of Institutional Controls at Federal Facilities.*

EPA Office of Solid Waste and Response. December 2012a (December). *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites.*

EPA Office of Solid Waste and Response. 2012b (December). *Institutional Controls: A Guide to Preparing Institutional Control Implementation and Assurance Plans at Contaminated Sites.*

General Services Administration (GSA). 1998 (October). *Memorandum for Regional Directors: Restrictive Covenants on Non-Excess Property.* Martin, J.Q., Director, Redeployment Services Division.

This page intentionally blank

Draft
Appendix A
List of Sites Requiring Land Use Control Measures

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

Table 1 List of Sites Requiring Land Use Control Measures

SITE NO., NAME	LOCATION AND DESCRIPTION	NAME AND DATE OF DECISION DOCUMENT	OBJECTIVES OF RESTRICTION AND CONTROL	TOOLS TO IMPLEMENT AND EVALUATE	TIME FRAME IN WHICH LAND USE CONTROLS APPLY
Site 1, Coast Guard Landfill, RCRA Solid Waste Management Unit	Located north of Tom Stiles Road. Ten-acre landfill	Post-closure Plan, 1999 EPA RCRA Permit Corrective Action Statement of Basis Summary (2011)	To prevent waste exposure; to protect human health and environment	Covered landfill, locked gates, dig permit requirement, annual inspection, five-year review	In perpetuity
Site 2, Navy Landfill, RCRA Solid Waste Management Unit	Located north of Tom Stiles Road and west of Coast Guard Landfill. 7.5-acre landfill	ADEC Decision Document, 2004 EPA RCRA Permit Modification for Remedy, not yet signed	To prevent waste exposure; to protect human health and environment	Fencing and locked gates, storm water management, leachate collection, passive gas vent system, covered landfill, dig permit requirement, annual inspection	In perpetuity
Site 3, Laundry, RCRA Hazardous Waste Management Unit	Located at north end of Nyman Peninsula. Soil and groundwater contaminated with VOCs from former dry cleaning facility	RCRA Post-closure Permit, January 1998	To prevent waste exposure; to protect human health and environment	Locks on monitoring wells, fencing around SVE system, asphalt cap, dig permit requirement, annual inspection	Until soil and groundwater contamination is below applicable standards
Site 6A, MOGAS, RCRA Hazardous Waste Management Unit	Located at south end of Nyman Peninsula. Soil contaminated with petroleum hydrocarbons and VOCs from former USTs.	RCRA Post-closure Permit, January 1998	To prevent waste exposure; to protect human health and environment	RCRA permit Attachment 5 post-closure plan, EMS, annual inspections, five-year review	Until soil and groundwater contamination are below applicable standards
Site 6B, Nyman Peninsula Fuel Farm	Located on the southeast side of the base, spanning the central elevated portion of the Nyman Peninsula. Soil contaminated with petroleum hydrocarbons from former fuel storage tanks and conveyance facilities.	ADEC Decision Document, not yet signed EPA RCRA Permit Modification for Remedy, not yet signed	To prevent waste exposure; to protect human health and environment	EMS, annual inspections, five-year review	Until soil and groundwater contamination is below applicable standards

Table 1 List of Sites Requiring Land Use Control Measures

SITE NO., NAME	LOCATION AND DESCRIPTION	NAME AND DATE OF DECISION DOCUMENT	OBJECTIVES OF RESTRICTION AND CONTROL	TOOLS TO IMPLEMENT AND EVALUATE	TIME FRAME IN WHICH LAND USE CONTROLS APPLY
Site 7A, Barrel Storage Area No. 2, RCRA Hazardous Waste Management Unit	Located on Nyman Peninsula, within the fuel farm. Soil and groundwater contaminated with VOCs and petroleum hydrocarbons from former barrel storage area	RCRA Post-closure Permit, January 1998	To prevent waste exposure; to protect human health and environment	RCRA permit Attachment 5 post-closure plan, EMS, annual inspections, five-year review	Until soil and groundwater contamination are below applicable standards
Site 9, Kodiak AVGAS Hill	Located on a ridge crest on the northeast side of the Nyman Peninsula	EPA RCRA permit modification for Remedy, not yet signed	To remain protective of human health and the environment	Property is restricted to industrial use, engineering controls, dig permit, annual inspections, five-year review	In perpetuity
Site 10/11, Air Station	Located within the industrial southern portion of Base Kodiak. Groundwater contamination with petroleum products.	ADEC Decision Document, July 2003 EPA RCRA Permit Modification for Remedy, not yet signed	To prevent waste exposure; to protect human health and environment	Property restricted to industrial use, dig permit annual inspections, five-year review	Until soil and groundwater contamination is below applicable standards
Site 12, Buskin Lake Drum Disposal Area	Located approximately seven miles southwest of the city of Kodiak. Soil and ground water contamination with POL and DRO petroleum products.	ADEC Decision Document, 2006 EPA RCRA Permit Modification for Remedy, not yet signed	To prevent waste exposure; to protect human health and environment	EMS, annual inspections, five-year review	In perpetuity
Site 18, Drury Gulch, RCRA Solid Waste Management Unit	Located north of Rezanof Highway, across from the base main gate. Former metal debris landfill; soil contaminated with PCBs.	ADEC Decision Document, September 2003 EPA RCRA Permit Modification for Remedy, February 2011	To prevent debris and contaminated soil exposure; to protect human health and the environment	Soil cap, fencing, locked gate, dig permit requirement, annual inspections, five-year review	In perpetuity

Table 1 List of Sites Requiring Land Use Control Measures

SITE NO., NAME	LOCATION AND DESCRIPTION	NAME AND DATE OF DECISION DOCUMENT	OBJECTIVES OF RESTRICTION AND CONTROL	TOOLS TO IMPLEMENT AND EVALUATE	TIME FRAME IN WHICH LAND USE CONTROLS APPLY
Site 22, AK DOT Maintenance Area	Located north of the intersection of Anton Larson Bay Road and Tom Stiles Road.	EPA RCRA permit modification for Remedy, not yet signed	To remain protective of human health and the environment	Property is restricted to industrial use, engineering controls, dig permit, annual inspections	In perpetuity
Site 23, Old Power Plant, RCRA Solid Waste Management Unit	Located on north end of Nyman Peninsula, south of Site 3, Laundry. Soil and groundwater contamination by FS-6 fuel oil, soil, contaminated with PCBs.	EPA RCRA Permit Modification for Remedy, not signed February 2006	To protect human health and the environment	EMS, annual inspections, five-year review	Until soil and groundwater contamination are below applicable standards
Site 28, Former Building 17 Public Works Garage, RCRA Solid Waste Management Unit	Located south of the main gate, along the west fence-line. PCB contamination in soils from former transformer leakage.	EPA RCRA permit Modification for Remedy, 2011 ADEC Site Closure Approval Letter, July 2001	To protect human health and the environment	Asphalt cap, signage to restrict access, dig permit requirement, waste characterization for PCBs, annual inspections, five-year review	Until soil and groundwater contamination are below applicable standards
Site 33, Empty Container Storage Area, Subarea 33A	Located on the north side of Nyman Peninsula within the fuel farm. Petroleum contamination in soils.	EPA RCRA Permit Modification for Remedy, not yet signed	To protect human health and the environment	Signage to restrict access, dig permit requirement, waste characterization for petroleum, annual inspections, five-year review	Until soil contamination is below applicable standards
Site 34, Building A711, RCRA Solid Waste Management Unit	Located at corner of Tom Stiles Road and Anton Larsen Bay Road. Soil contaminated with FS-6 fuel oil; groundwater contaminated with low levels of petroleum hydrocarbons.	ADEC Decision Document, not yet signed EPA RCRA Permit Modification for Remedy, not yet signed	To protect human health and the environment from contaminated soils and groundwater	Annual inspections; EMS; five-year review	Until soil and groundwater contamination are below applicable standards
Site 35, Fire Training Area, RCRA solid waste management unit	Located on north side of airport. Soil and groundwater contaminated with fuel oils from fire training activity.	EPA RCRA permit modification for remedy not yet signed	To protect human health and the environment from contaminated soils and groundwater	EMS, annual inspections, five-year review	Until soil and groundwater contamination are below applicable standards.

Table 1 List of Sites Requiring Land Use Control Measures

SITE NO., NAME	LOCATION AND DESCRIPTION	NAME AND DATE OF DECISION DOCUMENT	OBJECTIVES OF RESTRICTION AND CONTROL	TOOLS TO IMPLEMENT AND EVALUATE	TIME FRAME IN WHICH LAND USE CONTROLS APPLY
Asbestos Monofill, Tank 167	Located on Nyman Peninsula within the fuel farm. Closed asbestos monofill disposal site.	EPA RCRA post-closure ADEC Decision Document not yet signed	To prevent waste exposure	EMS; five-year review	In perpetuity

Notes:
ADEC = Alaska Department of Environmental Conservation
AVGAS = aviation gasoline
DRO = diesel-range organics
EMS = Environmental Management System
EPA = U.S. Environmental Protection Agency
PCB = polychlorinated biphenyl
POL = petroleum, oil, and lubricants
RCRA = Resource Conservation and Recovery Act
VOC = volatile organic compound

Draft
Appendix B
General Services Administration Memorandum

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

OCT 1 5 1998

MEMORANDUM FOR REGIONAL DIRECTOS – 1PR, 4PR, 7PR, 9PR

FROM: JOHN Q. MARTIN s/JOHN Q. MARTIN
DIRECTOR
REDEPLOYMENT SERVICES DIVISION

SUBJECT: Restrictive Covenants on Non-excess Property

This memorandum clarifies the General Services Administration's (GSA) policy regarding restrictive covenants on real property by landholding agencies.

This issue has caused confusion and has created obstacles to the efficient and effective disposal of excess and surplus real property. Therefore it is essential that this issue be clarified and a consistent approach taken to these actions. This letter applies to GSA regional officials involved in the disposal of Federal real property and to all landholding executive agencies. This memorandum is effective immediately.

Recently, GSA has been approached by several military services requesting assistance with State environmental regulators. In the course of continuing military operations at specific installations, the Department of Defense (DOD) has been required to perform certain environmental remediation. These remediation actions require the final approval of the State regulators. In some states, the State regulators have demanded that DOD place use restrictions or other covenants on the property. These restrictions are intended to run with the land and restrict future owners of the property to specific uses. At this time, the installations in question are in continual use and are not being evaluated as potentially excess property.

At the same time, GSA is aware that other agencies have agreed to restrictive covenants on property in their inventory. These include historic preservation restrictions which have been agreed to by the landholding agency during negotiation of the National Environmental Policy Act (NEPA) or National Historic Preservation Act (NHPA) as these acts apply to the decision to excess the property.

GSA does not believe landholding agencies have the authority to place such restrictions on property in their inventory. GSA views such restrictive covenants as disposals of real property. Under the Federal Property and Administrative Services Act of 1949, as amended (Property Act) GSA was given the exclusive authority to manage the utilization and disposal of real property (40 U.S.C. §§ 471, et seq). The Property Act defines "property" to include "any interest in

property" (40 U.S.C. § 472(d)). GSA's regulations (41 C.F.R. §101-47.103-12(a)) define "real property" to include "any interest in land". Therefore, unless the landholding agency has specific authority to dispose of such property rights, the landholding agency must request GSA to dispose of these real property rights or request a delegation of disposal authority from GSA.

Generally, covenants restricting the future use of property are evaluated during the disposal process carried out by GSA. Therefore, where property is expected to be reported excess, GSA will usually deny the request from the landholding agency and evaluate any necessary restrictions during the disposal process. If there are special circumstances that demand agreement on use restrictions prior to being evaluated in the disposal process, GSA will review the request on a case-by-case basis. GSA's evaluation will consider the impact any restrictions may have on the future disposition of the property, the ability to use the property for its highest and best use (as determined by GSA), the economic impact of the requested restrictions, the legal requirement to place such a restriction on the property, and/or the enforceability of the requested restriction.

GSA is particularly concerned about requests to restrict the future use of property when the landholding agency does not contemplate declaring the property excess in the near future. GSA is doubtful as to the necessity, desirability or legal enforceability of placing restrictions on property that will remain in the Government's inventory. Questions as to how such restrictions will be enforced, and by whom, while the property is still an active Government facility are raised by these requests. Further, it would be difficult, if not impossible, for GSA to accurately determine the impact such restrictions may have on the future disposal of the property when immediate disposal of the property is not being contemplated. Therefore, GSA will deny all requests for land use restrictions on fully utilized property unless the requesting landholding agency can demonstrate the unique and extreme circumstances which would overcome GSA's objections to the placing of such restrictions on the property.

Official File – PRD
Readers – PR, PRD, PRP, PRA, Brooks, Chase, Flowers, Kelly, Mandell, Martin, Shouts, Butterworth LR

H:\RestCove.doc

PRD:JohnQ.Martin:10/16/1998:AW

Draft
Appendix C
Facility Contacts for Land Use Control Assurance Plan

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

Table 1 Facility Contacts for Land Use Control Assurance Plan

CONTACT INFORMATION
U.S. Coast Guard, Base Kodiak
Supervisory Environmental Protection Specialist U.S. Coast Guard Base Kodiak Building N-38 Kodiak, Alaska 99619 907-487-5320
Chief, Environmental and Fire Protection Branch U.S. Coast Guard Base Kodiak Building N-38 Kodiak, Alaska 99619 907-487-5320
Chief, Facilities Maintenance Branch U.S. Coast Guard Base Kodiak Building N-38 Kodiak, Alaska 99619 907-487-5320
Planning Technician U.S. Coast Guard Base Kodiak Building N-38 Kodiak, Alaska 99619 907-487-5320
U.S. Coast Guard
U.S. Coast Guard Civil Engineering Unit Juneau P.O. Box 21747 Juneau, Alaska 99802-174 907-463-2407
U.S. Environmental Protection Agency
RCRA Permits U.S. Environmental Protection Agency 1200 Sixth Avenue Seattle, Washington 98101 206-553-6702
Alaska Department of Environmental Conservation
Chief, Division of Spill Prevention and Response Alaska Department of Environmental Conservation 555 Cordova Street Anchorage, Alaska 99501 907-269-7545

This page intentionally blank

Draft
Appendix D
Five-Year Review Criteria

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

LAND USE CONTROLS
FIVE-YEAR REVIEW CRITERIA

Date: _____ Date of Previous Five-Year Review: _____

Name: _____ Date of Next Five-Year Review: _____

Every 5 years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site-specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for Five-Year Review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next 5 years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors change to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should land use controls be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items.

This page intentionally blank

Draft
Appendix E
Land Use Control Implementation Plans

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS VII

1.0 SITE 1 – COAST GUARD LANDFILL 1

1.1 Site Location 1
1.2 Site Description 1
1.3 Site Remedy 2
1.4 Land Use Control Objective 2
1.5 Specific Land Use Implementation Measures 2
1.6 Annual Reports and Five-Year Reviews 3
1.7 References 3

2.0 SITE 2 – NAVY LANDFILL 15

2.1 Site Location 15
2.2 Site Description 15
2.3 Site Remedy 16
2.4 Land Use Control Objective 16
2.5 Specific Land Use Implementation Measures 16
2.6 Annual Reports and Five-Year Reviews 17
2.7 References 17

3.0 SITE 3 – LAUNDRY 27

3.1 Site Location 27
3.2 Site Description 27
3.3 Site Remedy 29
3.4 Land Use Control Objective 31
3.5 Specific Land Use Implementation Measures 31
3.6 Annual Reports and Five-Year Reviews 31
3.7 References 32

4.0 SITE 6A – MOGAS 37

4.1 Site Location 37
4.2 Site Description 37
4.3 Site Remedy 38
4.4 Land Use Control Objective 38
4.5 Specific Land Use Implementation Measures 38
4.6 Annual Reports and Five-Year Reviews 38
4.7 References 39

5.0 SITE 6B – NYMAN PENINSULA FUEL FARM 45

5.1 Site Location 45
5.2 Site Description 45
5.3 Site Remedy 46
5.4 Land Use Control Objective 46
5.5 Specific Land Use Implementation Measures 46
5.6 Annual Reports and Five-Year Reviews 47

TABLE OF CONTENTS (CONTINUED)

5.7 References 47

6.0 SITE 7A – BARREL STORAGE AREA NO. 1 53

6.1 Site Location 53
6.2 Site Description 53
6.3 Site Remedy 53
6.4 Land Use Control Objective 54
6.5 Specific Land Use Implementation Measures 54
6.6 Annual Reports and Five-Year Reviews 55
6.7 References 55

7.0 SITE 9 – KODIAK AVGAS HILL 61

7.1 Site Location 61
7.2 Site Description 61
7.3 Site Remedy 62
7.4 Land Use Control Objective 62
7.5 Specific Land Use Implementation Measures 62
7.6 Annual Reports and Five-Year Reviews 62
7.7 References 62

8.0 SITE 10/11 – AIR STATION AND PAINT STORAGE BUILDING 67

8.1 Site Location 67
8.2 Site Description 67
8.3 Site Remedy 68
8.4 Land Use Control Objective 69
8.5 Specific Land Use Implementation Measures 69
8.6 Annual Reports and Five-Year Reviews 69
8.7 References 69

9.0 SITE 12 – BUSKIN LAKE DRUM DISPOSAL AREA 75

9.1 Site Location 75
9.2 Site Description 75
9.3 Site Remedy 76
9.4 Land Use Control Objective 76
9.5 Specific Land Use Implementation Measures 76
9.6 Annual Reports and Five-Year Reviews 76
9.7 References 77

10.0 SITE 18 – FORMER METAL DUMP AT DRURY GULCH 83

10.1 Site Location 83
10.2 Site Description 83
10.3 Site Remedy 84
10.4 Land Use Control Objective 84
10.5 Specific Land Use Implementation Measures 84
10.6 Annual Reports and Five-Year Reviews 85
10.7 References 85

TABLE OF CONTENTS (CONTINUED)

11.0 SITE 22 – AK DOT MAINTENANCE AREA 91

11.1 Site Location 91
11.2 Site Description 91
11.3 Site Remedy 92
11.4 Land Use Control Objectives 92
11.5 Specific Land Use Implementation Measures 92
11.6 Annual Reports and Five-Year Reviews 92
11.7 References 92

12.0 SITE 23 – OLD POWER PLANT 95

12.1 Site Location 95
12.2 Site Description 95
12.3 Site Remedy 96
12.4 Land Use Control Objective 96
12.5 Specific Land Use Implementation Measures 96
12.6 Annual Reports and Five-Year Reviews 96
12.7 References 97

13.0 SITE 28 – FORMER ENGINE TEST CELL BUILDING 103

13.1 Site Location 103
13.2 Site Description 103
13.3 Site Remedy 104
13.4 Land Use Control Objective 104
13.5 Specific Land Use Implementation Measures 104
13.6 Annual Reports and Five-Year Reviews 104
13.7 References 104

14.0 SITE 33A – EMPTY CONTAINER STORAGE AREA 109

14.1 Site Location 109
14.2 Site Description 109
14.3 Site Remedy 110
14.4 Land Use Control Objective 110
14.5 Specific Land Use Implementation Measures 110
14.6 Annual Reports and Five-Year Reviews 110
14.7 References 110

15.0 SITE 34 – BUILDING A-711 117

15.1 Site Location 117
15.2 Site Description 117
15.3 Site Remedy 118
15.4 Land Use Control Objective 118
15.5 Specific Land Use Implementation Measures 118
15.6 Annual Reports and Five-Year Reviews 118
15.7 References 118

16.0 SITE 35 – FORMER DOD FIRE TRAINING PIT 125

16.1 Site Location 125

TABLE OF CONTENTS (CONTINUED)

16.2 Site Description 125
16.3 Site Remedy 126
16.4 Land Use Control Objective 126
16.5 Specific Land Use Implementation Measures 126
16.6 Annual Reports and Five-Year Reviews 126
16.7 References 126

FIGURES

Figure 1 LUCAP Inspection Sites
Figure 2 Site 1
Figure 3 Site 2
Figure 4 Site 3
Figure 5 Site 6A
Figure 6 Site 6B – North
Figure 7 Site 6B – South
Figure 8 Site 7A
Figure 9 Site 9
Figure 10 Site 10/11
Figure 11 Site 12
Figure 12 Site 18
Figure 13 Site 22
Figure 14 Site 23
Figure 15 Site 28
Figure 16 Site 33A
Figure 17 Site 34
Figure 18 Site 35

TABLE OF CONTENTS (CONTINUED)

EXHIBITS

Exhibit 1(a) Site 1 – Coast Guard Landfill Land Use Controls Annual Inspection List 5
Exhibit 1(b) Site 1 – Coast Guard Landfill Land Use Controls Five-Year Review Criteria 7
Exhibit 1(c) Site 1 – Coast Guard Landfill Land Use Controls Inspection Plan 9
Exhibit 2(a) Site 2 – Navy Landfill Land Use Controls Annual Inspection List 19
Exhibit 2(b) Site 2 – Navy Landfill Land Use Controls Five-Year Review Criteria 21
Exhibit 2(c) Site 2 – Navy Landfill Land Use Controls Inspection Plan 23
Exhibit 3(a) Site 3 – Laundry Land Use Controls Annual Inspection List 33
Exhibit 3(b) Site 3 – Laundry Land Use Controls Five-Year Review Criteria 35
Exhibit 4(a) Site 6A – MOGAS Land Use Controls Annual Inspection List 41
Exhibit 4(b) Site 6A – MOGAS Land Use Controls Five-Year Review Criteria 43
Exhibit 5(a) Site 6B – Nyman Peninsula Fuel Farm Land Use Controls Annual Inspection List 49
Exhibit 5(b) Site 6B – Nyman Peninsula Fuel Farm Land Use Controls Five-Year Review Criteria 51
Exhibit 6(a) Site 7A – Barrel Storage Area No. 1 Land Use Controls Annual Inspection List 57
Exhibit 6(b) Site 7A – Barrel Storage Area No. 1 Land Use Controls Five-Year Review Criteria 59
Exhibit 7(a) Site 9 – AVGAS Hill Land Use Controls Annual Inspection List 63
Exhibit 7(b) Site 9 – AVGAS Hill Land Use Controls Five-Year Review Criteria 65
Exhibit 8(a) Site 10/11 – Air Station Land Use Controls Annual Inspection List 71
Exhibit 8(b) Site 10/11 – Air Station Land Use Controls Five-Year Review Criteria 73
Exhibit 9(a) Site 12 – Buskin Lake Drum Disposal Area Land Use Controls Annual Inspection List 79
Exhibit 9(b) Site 12 – Buskin Lake Drum Disposal Area Land Use Controls Five-Year Review Criteria 81
Exhibit 10(a) Site 18 – Former Metal Dump at Drury Gulch Land Use Controls Annual Inspection List 87
Exhibit 10(b) Site 18 – Former Metal Dump at Drury Gulch Land Use Controls Five-Year Review Criteria 89
Exhibit 11(a) Site 22 – AK DOT Maintenance Area Land Use Controls Annual Inspection List 93
Exhibit 12(a) Site 23 – Old Power Plant Land Use Controls Annual Inspection List 99
Exhibit 12(b) Site 23 – Old Power Plant Land Use Controls Five-Year Review Criteria 101
Exhibit 13(a) Site 28 – Former Engine Test Cell Building Land Use Controls Annual Inspection List 105
Exhibit 13(b) Site 28 – Former Engine Test Cell Building Land Use Controls Five-Year Review Criteria 107
Exhibit 14(a) Site 33A – Empty Container Storage Area Land Use Control Annual Inspection List 113
Exhibit 14(b) Site 33A – Empty Container Storage Area Land Use Control Five-Year Review Criteria 115
Exhibit 15(a) Site 34 – Building A-711 Land Use Controls Annual Inspection List 121
Exhibit 15(b) Site 34 – Building A-711 Land Use Controls Five-Year Review Criteria 123
Exhibit 16(a) Site 35 – Former DoD Fire Training Pit Land Use Controls Annual Inspection List 129
Exhibit 16(b) Site 35 – Former DoD Fire Training Pit Land Use Controls Five-Year Review Criteria 131

This page intentionally blank

ACRONYMS AND ABBREVIATIONS

%	percent
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADOT&PF	Alaska Department of Transportation and Public Facilities
Ahtna	Ahtna Environmental, Inc.
AK DOT	Alaska Department of Transportation
AS	air sparge
AST	aboveground storage tank
AVGAS	Aviation Gasoline
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene and xylenes
CA	corrective action
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
DNAPL	dense non-aqueous phase liquid
DoD	U.S. Department of Defense
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
FUDS	Formerly Used Defense Sites
FS-6	fuel oil, burner grade number 6
GAC	granular activated carbon
HMWU	Hazardous Waste Management Unit
Jacobs	Jacobs Engineering Group Inc.
JP-5	jet propellant number 5
KEA	Kodiak Electric Association
KMnO4	potassium permanganate
LOWS	Liquid Oily Waste System
LTM	long-term monitoring
LUC	land use control
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
mg/kg	milligrams per kilogram
mL	milligrams per liter
MNA	monitored natural attenuation
MOGAS	motor gasoline
MWR	Morale, Welfare, and Recreation
NAPL	non-aqueous phase liquid
NDAI	No DoD Action Indicated
No.	number

ACRONYMS AND ABBREVIATIONS (CONTINUED)

PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PFAS	per- and polyfluoroalkyl substances
POL	petroleum, oil, and lubricants
ppbv	parts per billion by volume
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
S&W	Shannon & Wilson
SAA	satellite accumulation area
SAIC	Science Applications International Corporation
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TCE	trichloroethene
TPH	total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
UST	underground storage tank
VOC	volatile organic compound
Windward	Windward Environmental LLC
WWII	World War Two

1.0 SITE 1 – COAST GUARD LANDFILL

This Land Use Control Implementation Plan (LUCIP) for Site 1 – Coast Guard Landfill is the document that implements the specific requirements for this site under the Land Use Control Assurance Plan (LUCAP) for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the land use control (LUC) objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

1.1 Site Location

U.S. Coast Guard (USCG) Base Kodiak is located approximately 5 miles south of the town of Kodiak, Alaska, on Kodiak Island. In 1990, Site 1, the Coast Guard Landfill, was identified as a Solid Waste Management Unit (SWMU). The landfill is located north of Tom Stiles Road, across from the Lake Louise Housing area (Figure 1).

1.2 Site Description

From the early 1970s to 1987, the Coast Guard Landfill was used for the disposal of municipal solid waste. While the exact composition of the waste is not known, the USCG has estimated the composition to be 60 percent (%) domestic refuse, 20% commercial refuse, 10% industrial waste, 5% construction waste, and 5% demolition waste.

The landfill occupies a small valley surrounded by three hills composed of bedrock. Three surface drainages exit the areas between the hills. The landfill is fenced with a 6-foot-high chain link fence, gated, and locked. The entrance road from Tom Stiles Road to the landfill also has a vehicle gate, preventing unauthorized vehicular traffic. The gate is hung with signs stating, “Government Property – No Trespassing” and “No Vehicles – Foot Traffic Welcome.” Pedestrians can access this road to walk from Lake Louise Housing to the Buskin River fishing access on the north side of the landfill.

As early as 1983, sanitary sewage sludge from the Base wastewater treatment plant was deposited at the landfill. In 1987, the USCG ceased the disposal of municipal solid waste at the landfill and implemented partial closure activities. Until 1993, the USCG continued to use the landfill for the disposal of digested sewage sludge and temporary storage of asbestos waste. In 1994, the asbestos waste was removed and taken to the Kodiak Borough Landfill (Shannon & Wilson [S&W] 1999). In 1996, the USCG conducted a leachate engineering evaluation to determine the amount and quality of leachate from the landfill that was contributing flow to the wastewater treatment plant (S&W 1997a). In 1997, the USCG performed maintenance measures at the landfill to intercept and divert groundwater entering the landfill, improve cover conditions, and reconstruct surface water perimeter diversion ditches (S&W 1997b). From 1997 to 2000, the USCG undertook landfill monitoring activities, including sampling five wells, three surface water points, and leachate from Manhole 2. In 1999, the USCG submitted a closure plan to Alaska Department of Environmental Conservation (ADEC), and closed the landfill in late Summer 2000, with a cover consisting of a geosynthetic clay liner, overlain by topsoil and seeded (S&W 1999, 2000). Since 1999 to present, the landfill has undergone periodic inspection and semi-annual sampling of groundwater and surface water around the landfill. In 2006, a request was submitted to ADEC to discontinue post-closure groundwater and surface water monitoring at the site (Hart Crowser 2006).

In July 2016, an investigation to determine background concentrations for manganese and iron in groundwater and surface water was conducted at Site 1 (Ahtna Environmental, Inc. [Ahtna] 2016a). In August 2016, a petition was submitted to ADEC to compare water sampled from the USCG Landfill – Site 1 to surface water monitoring standards under ADEC Title 18, Alaska Administrative Code (AAC), Chapter 60 (18 AAC 60), Solid Waste Management regulations, due to the evidence of the hydraulic connectivity between surface water and groundwater at the site (Ahtna 2016b). The ADEC concurred with USCG petition to place Site 1 in surface water detection monitoring (ADEC 2016). Semi-annual LUC inspections and groundwater and surface water monitoring has continued with analytical groundwater and surface water results compared to surface water regulations.

1.3 Site Remedy

The following remedy from the Resource Conservation and Recovery Act (RCRA) Corrective Action Statement of Basis (U.S. Environmental Protection Agency [EPA] 2009) has been selected for Site 1:

> *The proposed remedy for the Coast Guard Landfill is to complete final closure and capping of the landfill under ADEC Solid Waste regulations (18 AAC 60), and to conduct groundwater and surface water monitoring twice a year for five years. Final closure was completed in 2000 as an interim action by the Coast Guard, and monitoring activities have been underway since that time. Landfill inspections also take place semi-annually to ascertain the condition of the cover and the fence.*

1.4 Land Use Control Objective

Land use in the area remains industrial. Kodiak Island residents may use the road near the landfill for foot access to the Buskin River, located north and west of the landfill, but do not cross the landfill itself. A residential housing area (Lake Louise Housing) is located approximately 300 yards south of the landfill.

To maintain the integrity of the selected remedy, the property is restricted to industrial uses, with engineering controls in place to limit access to solid wastes. The area affected by restrictions is shown on Figure 2. Specific boundary survey information is available at Base Kodiak Environmental Branch.

1.5 Specific Land Use Implementation Measures

For Site 1, Coast Guard Landfill, the LUCs consist of the following:

- The final landfill cover, passive methane venting systems, and surface water and groundwater diversion systems will remain in place, and will be inspected semi-annually in accordance with the Inspection Plan in Exhibit 1(c) to ensure that no erosion or other acts of nature or man-caused activities disturb or remove the cover material, or disturb the methane vents or diversion systems.
- Access to the site is restricted by a locked gate at the south end, fencing, and signs indicating that unauthorized access is prohibited. Access is inspected by routine security patrols.
- Any intrusive activity at this site will require review and approval by the Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present, and appropriate worker health and safety measures must be taken.

1.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9, using the results of the inspection items identified in Exhibits 1(a) and 1(c) of this LUCIP.

Five-year reviews of LUCs will be performed in accordance with the criteria set forth in the LUCAP, Appendix D.

1.7 References

The reader is referred to the following documents for additional information and background on this site:

ADEC. 2016 (September). USCG Site 1 Petition to Move to Surface Water Monitoring Review, Letter from Kaylie Holland, ADEC, to Robert Gray, USCG.

Ahtna. 2016a (July). *Site 1 Background Concentrations, Kodiak, Alaska,* Prepared for USCG.

Ahtna. 2016b (July). Petition to Place Coast Guard Landfill (Site 1) in Surface Water Monitoring, Prepared for USCG.

EPA. 2009 (July). *Statement of Basis for Remedy Selections and Determinations of Corrective Action Complete without Controls, USCG Kodiak Proposed In Draft Permit*. Prepared for USCG.

EPA. 2011. *Corrective Action Statement of Basis Summary, RCRA Permit, Attachment 11.*

Hart Crowser. 2006 (June). *Request to Discontinue Post-Closure Water Monitoring, Site 1 – Landfill, ISC Kodiak, Alaska.* Prepared for USCG.

SAIC. 1995. *Final Corrective Measures Study, Site 1 - Coast Guard Landfill.* Prepared for USCG, FD&CC-Pacific, Seattle, Washington.

S&W. 1997a (January). *Draft Leachate Engineering Evaluation, Site 1- US Coast Guard Landfill, Kodiak, Alaska.* Prepared for USCG, FD&CC-Pacific, Seattle, Washington.

S&W. 1997b (December). A*fter-Action Report, Landfill Maintenance Measures, Site 1. USCG, Base Kodiak, Kodiak, Alaska.* Prepared for USCG, FD&CC-Pacific, Seattle, Washington.

S&W. 1999 (March). *Draft Alternative Landfill Closure Plan, US Coast Guard Landfill, ISC Kodiak, Kodiak, Alaska.* Prepared for USCG, FD&CC-Pacific, Seattle, Washington.

S&W. 2000 (November). *Closure Report, US Coast Guard Landfill, ISC Kodiak, Kodiak, Alaska.* Prepared for USCG, FD&CC-Pacific, Seattle, Washington.

This page intentionally blank

Exhibit 1(a) Site 1 – Coast Guard Landfill Land Use Controls
Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Cover and other physical improvements are maintained in accordance with the Inspection Plan (latest edition).	Are documented inspection records available for the site? Yes No Do they show that the Inspection Plan is being followed? Yes No
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to protect the integrity of the cover.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 1(b) Site 1 – Coast Guard Landfill Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

Exhibit 1(c) Site 1 – Coast Guard Landfill Land Use Controls Inspection Plan

(Note to Reader: This document is adopted from Shannon & Wilson, Inc., 1999, Alternative Landfill Closure Plan, Appendix, Post-closure Plan).

The USCG Chief of Environmental Branch will supervise the inspection of the landfill facilities and environmental control systems, and provide routine preventive maintenance, as needed. The inspections will be conducted on a semi-annual basis. Semi-annual inspections will typically occur in the spring (April) and in late fall (October), coinciding with the onset of warmer weather after extended winter storms and prior to the beginning of winter. The spring inspection will assess possible damage caused by winter storm events. The fall inspection will verify that drainage systems are clear of debris and operational, anticipating the higher precipitation and runoff associated with the wettest months of the year in Kodiak.

The inspection will be documented by the inclusion of data collected during the inspection on forms provided for that purpose. The inspector will complete the forms at the time of the inspection and place file copies in the permanent file for the landfill.

1.0 Inspection Activities

Inspections will focus on the major elements of the landfill, including fencing and gates, stormwater management infrastructure, leachate collection infrastructure, and the vegetation covering the landfill cap. Inspection of these elements is briefly discussed below. An example of a typical inspection form follows this section.

1.1 Inspection of the Fencing and Gates

Fencing and gates provide some control over access to the closed landfill, preventing the illegal disposal of waste onto the closed landfill and discouraging individuals from accessing the landfill area. Inspection of the fences and gates will require the inspector to traverse the perimeter of the landfill in order to observe the fence and fence posts. Inspectors will note where weather, soil stability failures, or vandalism has damaged the fence. Field notes will describe the nature of the damage, including estimates of the effort required to repair the damage. At the location of gates in the fence, the inspector will check the condition of hinges, latches, and locks, verifying that the gate is operational and secure.

1.2 Inspection of the Stormwater Management Infrastructure

The stormwater management infrastructure includes the groundwater interception piping installed on most of the landfill perimeter, the perimeter drainage swales, and ditches that convey the storm- and groundwater from the landfill to adjacent streams, rivers, or lakes. These infrastructure components are important because they convey water away from the landfilled wastes, thereby minimizing the potential for leachate generation. Additionally, effective stormwater management infrastructure will prevent the run-on of stormwater to the landfill and minimize the potential for runoff to erode or otherwise damage the final cover. Inspection of these components will require the inspector to traverse the perimeter of the landfill in order to observe the drainage swales, and the groundwater interceptor piping and manholes. Inspectors will note the condition of the swales and perimeter ditches, identifying areas where water tends to pond or where bank erosion may threaten to compromise the stability of adjacent slopes or the landfill cap.

Inspections will also include the opening of manholes and the inspection of piping connected to those manholes. The inspector will note whether the piping is conveying intercepted groundwater, if turbidity

in the water may imply the failure of a segment of the piping, and if weather-related events have caused damage to the pipe or manholes. Field notes will accurately describe the condition of the components and provide an estimate of the effort that may be required to repair the observed damage.

After inspection of the infrastructure at the perimeter of the landfill, the inspector will observe the condition of ditches or drainageways that convey storm- and groundwater from the landfill to adjacent streams, rivers, or bodies of water. The inspector will note the condition of the conveyances, noting where erosion or other damage to the conveyance has occurred that may adversely affect the landfill stormwater infrastructure.

1.3 Inspection of the Leachate Collection Infrastructure

The leachate collection infrastructure is confined principally to the sewer line extension beginning at a structure designated as "Manhole 2" and extending into the landfill, including interim manholes, gas venting stacks, and perforated piping. These infrastructure components are important because they collect and convey leachate from the landfill to the Base wastewater treatment plant, thereby minimizing the potential for leachate impacts to local groundwater. Inspection of these components will require the inspector to traverse the alignment of the sewer system from Manhole 2 to the terminus of the perforated line within the confines of the landfill. Inspections will include the opening of manholes and the inspection of piping connected to those manholes. The inspector will note whether the piping is conveying leachate, if turbidity in the leachate may imply the failure of a segment of the piping, and if weather-related events have caused damage to the pipe or manholes. Field notes will accurately describe the condition of the components and provide an estimate of the effort that may be required to repair the observed damage.

1.4 Inspection of the Passive Gas Vent System

The passive gas vent system is a series of perforated polyvinyl chloride pipes buried in trenches backfilled with clean gravel beneath the low-permeability geosynthetic clay liner that forms the bottom layer of the soil cover system. These perforated pipes are connected to vertical risers that are housed in protective boxes set flush with the ground surface. As landfill gases are generated within the landfill, the perforated pipes provide a high-permeability route through which the gases can be vented to the atmosphere. No operational requirements are associated with the gas vent system. Maintenance of the perforated pipes is not necessary. Inspection of the gas vent system will principally involve an inspection of the protective boxes to verify that the lid remains in place over the box so that the riser pipe is protected. Each riser is fitted with a screen to prevent animals from entering the buried wastes through these openings. Inspection will also verify that the screens remain in place, and corrosion of the screen has not occurred.

1.5 Inspection of the Landfill Cover

The landfill cover vegetation protects the cover soil so that erosion due to surface water runoff does not occur. Additionally, the vegetation serves a valuable function by absorbing some of the moisture that infiltrates into the soil and by transpiring the moisture into the atmosphere. A healthy stand of grasses and shallow-rooted plants is critical to the long-term stability of the landfill and minimum maintenance costs. Inspection of the cover vegetation will require the inspector to traverse the landfill, typically on several transects, so that the entire surface of the landfill can be observed. The inspector will note whether damage due to any of the following has occurred:

- Settlement or subsidence in any area
- An absence or loss of vegetation
- Erosion or ponding of water

- Leakage of leachate at the perimeter of the landfill or an exposure of the waste anywhere within the boundary of the landfill
- Thermal instability, frost action, combustion, or fire
- Damage to any part of the cover due to a failure of cover soils or perimeter anchor trenches
- Tree saplings that have taken root
- Animals that have burrowed into the cap.

Damage caused by weather-related factors, trespassing, and unauthorized disposal of waste on the landfill must also be documented. Field notes will accurately describe the condition of the cover vegetation and provide an estimate of the effort that may be required to repair or restore the vegetation.

1.6 Documentation of Repair or Restoration

Upon receipt of an inspection report documenting damage to or a failure of landfill cover components, the USCG Environmental Branch Chief will develop a work schedule that will result in the timely replacement, repair, or restoration of the damaged or failed component. The work may require supplemental inspections, engineering investigations, development of construction plans, or similar efforts prior to the initiation of actual construction work. In most cases, however, repair or restoration will require only minor additional investigation followed by a field effort to correct the deficiency noted by the inspection. The environmental manager will document in a written memorandum all activities required to complete a repair or restoration. These memoranda will be placed in the operating record for the landfill, maintained by the USCG Environmental Branch Chief or other approved location.

Monitors of the landfill components will pay attention to the recurrence of damage or other deficiency in the landfill components. Recurring problems are symptomatic of more significant problems that may require a more extensive investigation to derive an appropriate solution that minimizes long-term maintenance.

This page intentionally blank

Site 1 – U.S. Coast Guard Landfill
Landfill Cover Checklist

ITEM	FINDINGS	COMMENT
Soil Cover: • Signs of settling or heave • Signs of environmental damage due to wind, water, freezing/thaw cycle, or intrusion by plants or animals • Signs of improper surface water drainage such as ponding.		
Leachate Collection System: • Piping conveying leachate • Manholes in good condition		
Gas Vent System • Protective bores remain in place • Screens in good condition		
Drainage System: • Drains clear of sediment and other debris • Manholes and piping in good condition		
Run-on/Runoff Control: • Erosion problems • Signs of environmental damage or intrusion by plants (other than grasses) or animals • Swales in good condition • Perimeter ditches in good condition		
Protective Fences and Gates: • Hinges, latches, lock, and gate in good condition • Posts secure in ground • Fence in good condition • Gate operational and secure		
Inspector's Signature:		Date of Inspection:

This page intentionally blank

2.0 SITE 2 – NAVY LANDFILL

This LUCIP for Site 2 – Navy Landfill is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

2.1 Site Location

In 1990, Site 2, the Navy Landfill, was identified as an SWMU. The landfill is located north of Tom Stiles Road, and west of Anton Larsen Bay Road, to the northeast of the A-711 Building (Figure 1).

2.2 Site Description

The Navy Landfill is a 7.6-acre site that was used for the disposal of solid wastes from the early 1940s to 1972. In 1972, when the Base was turned over to the USCG, the landfill was closed, covered with soil, and incompletely graded. No engineering controls or access controls were put in place at the time the landfill was closed. The total volume and depth of the wastes are unknown; however, historical maps and current site topography suggest that the landfill may be 10 to 40 feet thick. Historical maps suggest that an unnamed lake was drained and used as the landfill. Although the exact types and composition of wastes placed in the landfill are unknown, they probably included base-generated domestic refuse and industrial wastes, such as spent solvents, used oils, scrap metal, batteries, and contaminated fuels.

In 1983, the Kodiak Electric Association (KEA) erected a substation over the southeastern portion of the landfill. In the early 1990s, debris from home demolition on-Base was temporarily stored at the landfill site. Currently the site is inactive and surrounded by a 6-foot-high chain link fence, placed in 1997 by the USCG to restrict access.

The Navy landfill occupies a relatively flat area 40 to 55 feet above mean sea level adjacent to a northwest-southeast trending ridge situated to the northeast of the site. The site is bounded to the west by a large pond known as Red Lake (Figure 3). The alluvial plain of the Buskin River occupies the relatively flat area located to the west of the landfill. Depth to bedrock is approximately 4 to 30 feet below original land surface. Soils consist primarily of low permeability silty/clayey gravels that probably originated from the surrounding hills and were reworked and redeposited by the Buskin River as it meandered in this relatively narrow portion of the floodplain. Depth to groundwater ranges from 1 to 11 feet below ground surface (bgs) at the site. Groundwater flows west-southwest toward the Buskin River.

Investigations at the Navy Landfill site took place in 1987-1989, 1992-1994, 1999-2000, 2010, 2017, 2018, and 2019. Based on the results of the 2019 investigation/monitoring, additional investigation is still needed at the site (U.S. Army Corps of Engineers [USACE] 2019). The earliest studies were carried out by the U.S. Geological Survey (USGS) for the USCG. From 1992-1994, the USCG undertook RCRA Facility Investigation (RFI)/Corrective Measures Study (CMS) investigations. From 1999 to 2000, additional environmental sampling was carried out by USACE under the Formerly Used Defense Sites (FUDS) Program. In 1999, USACE also re-graded, seeded, and revegetated the landfill to improve the cover material and upgraded surface water diversion ditches, and run-off controls (Jacobs Engineering Group Inc. [Jacobs] 2000).

In 2004, the FUDS program developed a No Further Remedial Action Planned with institutional controls Decision Document (Jacobs 2004). The EPA and ADEC did not sign this document and additional field investigation was completed.

In 2010, the USCG completed an additional site investigation to further characterize metals and establish background concentrations. As indicated in the Permit's Attachment 7 SWMU Schedule of Compliance, the Site 2 milestone for compliance was to complete the final site investigation report and risk assessment by June 30, 2011. A draft *Multi-media Site Investigation Report and Focused Risk Assessment, Site 2 – Navy Landfill/Red Lake, USCG Base Support Unit Kodiak, Kodiak, Alaska* was prepared on February 4, 2011, by Windward Environmental LLC (Windward 2011). At EPA's request in 2015, Battelle reviewed Site 2 documents and developed an updated conceptual site model. The Battelle report included recommendations for obtaining additional sediment and surface water background information and identifying trends in metals in groundwater over time. The report also recommended a focused investigation of contaminant flux as well as direct toxicity and bio-accumulation tests (Battelle 2015). Between 2017 and 2019, an investigation was conducted to determine background concentrations of metals, and to complete an ecological risk evaluation. This report concluded that Navy Landfill appears to pose a potential risk to human health and the environment and included recommendations for additional investigation to be completed in the area (USACE 2019).

2.3 Site Remedy

The selected remedy for the Navy Landfill is to continue to maintain the cover and drainage controls, and to restrict access. Land use controls are required to ensure that the land use remains industrial (Jacobs 2004).

2.4 Land Use Control Objective

Land use in the area has been and continues to be industrial. A KEA substation is located to the southeast, and the Alaska Department of Transportation and Public Facilities (ADOT&PF) maintenance facility is located to the southwest. There is no recreational use of the immediate area surrounding the landfill.

To maintain the integrity of the selected remedy, the property is restricted to industrial uses, with engineering controls in place to prevent access to contaminated media. The area affected by restrictions is shown on Figure 3.

2.5 Specific Land Use Implementation Measures

For Site 2, Navy Landfill, the LUCs consist of the following:

- The final landfill cover and surface water run-on diversion systems will remain in place and will be inspected annually to ensure that no erosion or other acts of nature or man-caused activities are disturbing or removing the cover material or disturbing the diversion systems. Inspections will be in accordance with the Inspection Plan in Exhibit 2(c).
- Access to the site is restricted by a locked gate at the southeast corner, fencing, and signs indicating that unauthorized access is prohibited.
- Any intrusive activity at this site will require review and approval by the Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that

contaminated media may be present, and that appropriate worker health and safety measures must be taken.

2.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9, using the results of the inspection items identified in Exhibits 2(a) and 2(c) of this LUCIP. Five-year reviews of LUCs will be performed in accordance with the criteria set forth in the LUCAP, Appendix D.

2.7 References

The reader is referred to the following documents for additional information and background on this site:

ADEC. 2018 (Accessed on February 26, 2018.). Contaminated Site Database, File Number 2601.38.072. Available online at: http://dec.alaska.gov/spar/csp/db_search.htm.

Battelle. 2015. *Final Technical Memorandum Updated Conceptual Site Models and Evaluation of Potential Data Gaps Sites 2, 3, 16 and 34 USCG Integrated Support Command Base Kodiak, Kodiak Alaska.* Prepared for the EPA Site Characterization and Monitoring Technical Support Center. August.

EPA. (not yet completed). *Corrective Action Statement of Statement of Basis, SWMU 2 Navy Landfill.*

Jacobs. 2000 (March). *Navy Landfill Re-grading Report. Final. Prepared U.S. Army Corps of Engineers, Anchorage, Alaska.*

Jacobs. 2004 (April). *Clean-up Decision Document, Navy LF, Kodiak, Alaska.* Prepared for U.S. Army Corps of Engineers, Anchorage, *Alaska*.

SAIC. 1995. *Final Corrective Measures Study, Site 2 - Navy Landfill.* Prepared for USCG, FD&CC-Pacific, Seattle, Washington.

USACE, Alaska District. 1999 (August). *Statement of Work. Civil Construction Services for the Navy Landfill Cover Regrading, Kodiak, Alaska.* Prepared by Jacobs.

USACE, Alaska District. 2000 (March). *Technical Memorandum 1999 Supplemental Data Collection, Navy Landfill (Site 2). Kodiak Alaska.* Prepared by Jacobs.

USACE, Alaska District. 2019 (December). *Draft Site Monitoring Report, Groundwater, Stream, and Background Sampling and EcoScoping, Navy Landfill, Kodiak Island, Alaska, Revision 1,* Prepared by Bristol Environmental Remediation Services, LLC.

Windward. 2011 (February). *Draft EPA Multi-Media Site Investigation Report and Focused Risk Assessment, Site 2 Navy Landfill/Red Lake.* USCG Base Support Unit Kodiak, Kodiak, Alaska.

This page intentionally blank

Exhibit 2(a) Site 2 – Navy Landfill Land Use Controls
Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Cover and other physical improvements are maintained in accordance with the Inspection Plan (latest edition).	Are documented inspection records available for the site? Yes No Do they show that the Inspection Plan is being followed? Yes No
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to protect the integrity of the cover.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 2(b) Site 2 – Navy Landfill Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

The USCG Chief of Environmental Branch will supervise the inspection of the landfill facilities and environmental control systems, and provide routine preventive maintenance as needed. The inspections will be conducted on an annual basis.

The inspection will be documented by the completion of forms provided for that purpose. The inspector will complete the forms at the time of the inspection and place file copies in the permanent file for the landfill.

1.0 Inspection Activities

Inspections will focus on the major elements of the landfill, including fencing and gates, surface water management infrastructure and the vegetation covering the landfill cap. Inspection of these elements is briefly discussed below. An example of a typical inspection form follows this section.

1.1 Inspection of the Fencing and Gates

Fencing and gates provide control over access to the closed landfill, preventing the illegal disposal of waste onto the closed landfill and discouraging individuals from accessing the landfill area. Inspection of the fences and gates will require the inspector to traverse the perimeter of the landfill in order to observe the fence and fence posts. Inspectors will note where weather, soil stability failures, or vandalism has damaged the fence. Field notes will describe the nature of the damage. At the location of the gate, the inspector will check the condition of hinges, latches, and locks, verifying that the gate is operational and secure.

1.2 Inspection of the Surface Water Management Infrastructure

The surface water management infrastructure includes the perimeter drainage swales and ditches that convey stormwater from the landfill to Red Lake and the Buskin River. Inspection of these components will require the inspector to traverse the perimeter of the landfill in order to observe the drainage swales. Inspectors will note the condition of the swales, identifying areas where water tends to pond or where bank erosion may threaten to compromise the stability of adjacent slopes or the landfill cap.

After inspection of the infrastructure at the perimeter of the landfill, the inspector will observe the condition of ditches or drainageways that convey stormwater from the landfill. The inspector will note the condition of the conveyances, noting where erosion or other damage to the conveyance has occurred that may adversely affect the landfill surface water management infrastructure.

1.3 Inspection of the Landfill Cover

The landfill cover vegetation protects the cover soil so that erosion due to surface water runoff does not occur. Additionally, the vegetation serves a valuable function by absorbing some of the moisture that infiltrates into the soil and by transpiring the moisture into the atmosphere. Inspection of the cover vegetation will require the inspector to traverse the landfill, typically on several transects, so that the entire surface of the landfill can be observed. The inspector will note whether damage due to any of the following has occurred:

- Settlement or subsidence in any area

- An absence or loss of vegetation
- Erosion or ponding of water
- Thermal instability, frost action, combustion, or fire
- Damage to any part of the cover due to a failure of cover soils or perimeter trenches.

Damage caused by weather-related factors, trespassing, and unauthorized disposal of waste on the landfill must also be documented. Field notes will accurately describe the condition of the cover vegetation and provide an estimate of the effort that may be required to repair or restore the vegetation.

2.0 Documentation of Repair or Restoration

Upon receipt of an inspection report documenting damage to or a failure of landfill cover components, the USCG Environmental Branch Chief will develop a work schedule that will result in the timely replacement, repair, or restoration of the damaged or failed component. The work may require supplemental inspections, engineering investigations, development of construction plans, or similar efforts prior to the initiation of actual construction work. In most cases, however, repair or restoration will require only minor additional investigation followed by a field effort to correct the deficiency noted by the inspection. The Environmental Branch Chief will document in a written memorandum all activities required to complete a repair or restoration. These memoranda will be placed in a permanent record for the landfill, maintained by the Environmental Branch Chief at Base Kodiak or other approved location.

Site 2 – Navy Landfill
Landfill Cover Checklist

ITEM	FINDINGS	COMMENT
Soil Cover: • Signs of settling or heave • Signs of environmental damage due to wind, water, freezing/thaw cycle, or intrusion by plants or animals • Signs of improper surface water drainage such as ponding. • Loss of vegetation from cover		
Surface Water Management System: • Ditches clear of sediment and other debris • Swales in good condition • Perimeter ditches in good condition		
Protective Fence and Gates: • Hinges, latches, lock, and gate in good condition • Posts secure in ground • Fence in good condition • Gate operational and secure		
Inspector's Signature:		Date of Inspection:

This page intentionally blank

3.0 SITE 3 – LAUNDRY

This LUCIP for Site 3 – Laundry is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

3.1 Site Location

In 1994, Site 3, the Coast Guard Laundry, was closed as a Hazardous Waste Management Unit (HWMU). The Laundry site is located east of Seafarer Drive and just east of the Billiken Theatre (Figure 1).

3.2 Site Description

Site 3 is the former base laundry facility; it is now the Morale, Welfare, and Recreation (MWR) Boathouse and small boat maintenance facility. The site is approximately 500 feet southeast of Inner Womens Bay, the nearest surface water. Soils in the area generally are shallow fill, consisting of silty gravels; and gravelly sands with layers of ash and peat, 1 to 3 feet thick, were encountered in several locations. Bedrock is encountered at 3 to 28 feet bgs across the site. A bedrock high is located to the west of the site, and a bedrock trough is located on the east side of the Laundry Building. The bedrock trough slopes to the north and ends approximately 600 feet to the north at the south side of the recreation building. Groundwater is located 5 to 15 feet bgs and generally flows northward following the contours of the bedrock surface.

From 1941 to 1972, laundry and dry-cleaning operations were conducted in the former Coast Guard Laundry facility as part of the U.S. Naval Air Station. In 1972, the station was transferred to the USCG. In 1999, the building was renovated and became the MWR Boathouse (Hart Crowser 2005). From the late 1940s or early 1950s through 1987, laundry personnel reportedly disposed of dry-cleaning solvent still bottoms on the ground surface on the south side of the building; approximately 5 gallons per week in tetrachloroethene (PCE) still bottoms were disposed of in the same way. Carbon tetrachloride may have also been disposed of on the south side of the building, as it was used as a dry-cleaning agent until the 1950s. A hazardous waste satellite accumulation area (SAA) on the south side of the former Coast Guard Laundry facility was used following discontinuation of direct disposal to the ground in 1987. Hazardous waste, including approximately one 55-gallon drum of waste solvent and sludge generated every 3 months, and new solvent for the facility were stored in the SAA (Science Applications International Corporation [SAIC] 1997). 1n 1994, Site 3 was closed as an HWMU (EPA 2019).

In 1985, USCG notified EPA that Base Kodiak generated, transported, and stored hazardous waste. The information provided to EPA was not a timely notification of hazardous waste activity; however, instead of taking enforcement action, EPA allowed the facility to continue operating hazardous waste storage under certain conditions, which included submitting a RCRA permit application. The EPA issued a Consent Order and a Federal Facilities Compliance Agreement to Base Kodiak in 1990 and 1991, respectively, requiring submittal of groundwater monitoring plans for hazardous waste sites and submittal of closure plans for hazardous materials treatment, storage, and disposal sites not included in the permit application. Both conditions applied to Site 3 (EPA 1997). In 1990, the USCG submitted a draft closure plan for Site 3 with a final revision submitted in 1994. Interim actions included closure as a disposal unit and groundwater monitoring. Because contaminated soils would remain in place and groundwater was found to be contaminated with PCE and its degradation products, the unit was required to be closed as a landfill.

During closure activities, the engineered asphalt cap over contaminated soil, runon and runoff controls with a catch basin, and an air sparge (AS)/soil vapor extraction (SVE) system were installed (SAIC 1997).

The primary contamination at Site 3 is PCE identified in soil, soil vapor, and in groundwater. PCE degradation products, including trichloroethene (TCE), 1,2-dichloroethene isomers, and vinyl chloride are also present. Other volatile organic compounds (VOCs) (e.g., chloroform, xylenes, and 1,2-dichloroethane), and total petroleum hydrocarbons (TPH) have also been detected. In 1998, soil contamination was initially identified and further characterized during monitoring well installation and trenching activities conducted from 1992 to 1994.

In 1988 and 1989, the USGS advanced soil borings and installed wells around the former Coast Guard Laundry facility; vinyl chloride and TPH were identified in the known disposal area south of the facility. Chloroethylene, PCE, and TPH were detected in soil immediately east of the building. In 1992, the existing monitoring network at Site 3 was established with the installation of wells MW-03-001 and MW-03-003 through MW-03-006 (SAIC 1997b). The network was expanded in 1994 with the installation of 11 more wells, all of which were installed in the unconsolidated overburden (Hart Crowser 2005). PCE at a concentration of 5.6 milligrams per kilogram (mg/kg) and TCE at 0.380 mg/kg were detected in soil at well MW-03-001 in the source area, and PCE, 1,2-DCE, and TCE were detected downgradient. The highest concentration of PCE was detected during installation of well MW-03-011 at depths ranging from 22.5 to 24.5 feet bgs near the bedrock interface; the concentration was 1,700 mg/kg. A 1992 soil vapor survey identified PCE, TCE, and 1,2-DCE across the site, with the highest soil vapor concentrations south of the former Coast Guard Laundry facility in the source area. Trichloroethane and its degradation products were detected occasionally (SAIC 1997b). Beginning in 1992, the small monitoring well network at Site 3 was sampled quarterly. The number of wells sampled each quarter increased with the installation of the 11 more wells in 1994; the plume was detected downgradient as far as well MW-03-013, by the Base Kodiak galley.

During 2005 groundwater monitoring, soil investigations, and additional well installations, a second source area on the east side of the MWR Boathouse was identified (Hart Crowser 2005). The release at this source may have been caused by spills or leaks of solvents into drains of the boathouse, which would have then leaked out the sewer pipe. This area, in the vicinity of well MW-03-011, contains PCE-impacted soil with concentrations indicative of dense non-aqueous phase liquid (DNAPL). A groundwater plume extends away from the area of PCE-impacted soil to the north toward the galley and barracks. The 2005 investigation identifying the second source area was initiated to determine the cause of contaminant levels remaining elevated in well MW-03-011, while concentrations in wells closer to the original source (i.e., south of the former Coast Guard Laundry facility) declined slightly. A total of 14 wells, unconfined and bedrock aquifer pairs, were installed. During soil boring advancement and well installation, the highest concentration of PCE was detected in soil at well MW-03-103S with a concentration of 6,400 mg/kg; the highest concentrations were detected in soil below the water, approximately 13 feet bgs. The second and third highest concentrations were detected in soil at wells MW-03-102S and MW-03-106S, respectively. Chlorinated solvents were also detected in soil upgradient of both source areas at well MW-03-107S. The unconfined aquifer in the second source area was found to be significantly impacted. Groundwater samples collected contained concentrations of PCE and TCE at multiple orders of magnitude above their groundwater protection standards. At well MW-03-103M, the PCE concentration was at the saturation limit, indicative of the presence of potential DNAPL free product. The bedrock aquifer was found to be slightly impacted with most contaminants below their respective protection standards. Additional corrective actions (CAs) were employed following identification of the second source area. Before initiating further actions, four additional wells, wells MW-03-201 through

MW-03-204, were installed. The newly installed wells and other existing wells were sampled to identify baseline contamination concentrations before initiating further CAs (Hart Crowser 2006).

In in 2007 and 2008, additional investigations were conducted (Windward 2009). Groundwater, water from catch basins near storm drains, seeps, soil, and air quality in buildings were assessed. Investigation results further refined understanding of the bedrock surface contour and identified an additional area within the groundwater plume where VOC concentrations indicated the potential presence of DNAPL. The previously identified area is adjacent to the east side of the MWR Boathouse and occurs between approximately 13 and 21 feet bgs. The other area is approximately 75 feet downgradient (north) of the east release area at a depth of approximately 27 feet bgs (Ahtna 2019). Vapor sampling initiated during these events indicated that vapor intrusion was occurring in the galley/pizza parlor, barracks, and MWR Boathouse.

3.3 Site Remedy

In 1997, the post-closure plan for Site 3 was finalized and outlined the path forward, which included inspections of the asphalt cap and support structures, groundwater wells, and remediation system, and a compliance and CA monitoring program. Post-closure activities include monitoring the effectiveness of CAs through groundwater, monitoring trend analysis and taking vapor removal measurements. In 1992, initial quarterly groundwater monitoring began and the groundwater monitoring plan was updated as part of post-closure. In 1995, the post-closure period began; quarterly CA groundwater monitoring has been conducted since 1998 and will be required for at least 30 years. Land use control also applies at the site (Windward 2009).

The goal of CA at Site 3 is to remediate groundwater contaminated with PCE and its breakdown products to background concentrations. Because groundwater contamination above action levels was present, the post-closure plan was required to include groundwater CAs. In 1995, active corrective measures were implemented during closure activities; an AS/SVE system was installed to remediate soil and groundwater beneath the asphalt cap. Corrective measures consisted of installing 17 AS points below the groundwater table and installing SVE wells in the unsaturated zone. Sparge points were installed down to bedrock because the contamination included DNAPL. The system began operation in 1997. AS systems remove VOCs in the saturated zone through injection of contaminant-free air. Dissolved contaminants transfer to air bubbles and are carried to the unsaturated zone for collection by SVE. The vapors extracted are treated granular activated carbon (GAC) filters. Corrective actions at Site 3 also included installation and management of an asphalt cap. The asphalt cap was engineered with fill added to create grade for runon and runoff control (SAIC 1997b). Further CAs implemented at the site are discussed below.

From 1997 until 2001, the AS/SVE system was operated on a pulse cycle of 2 hours on and 4 hours off for a total of 8 hours of operation per day. A new schedule began in Fall 2001 when it was determined that continuous operation would be more effective at this site. The system was operated continuously from September 2001 until May 2008, when it was returned to pulse mode until Fall 2008. In 2005, a decline in removal rates had been noted. The system was operated in pulse mode until October 2013 when the system was turned off completely and only run to collect samples; however, seasonally since July 2014, the SVE system has been operated from July to October in pulse mode without the AS system (Ahtna 2019). Since 2012, less than 2 pounds of total contaminants per year were removed by the system. Beginning in 2020, the AS/SVE system is not operated but maintained in a readiness state for resumed operation should increasing concentration trends be observed in groundwater.

In 2005, after the second source area on the east side of the MWR Boathouse was identified, additional CA has taken place. In situ chemical oxidation using potassium permanganate (KMnO4) was implemented

in the second source area to attempt remediation of the DNAPL plume. The initial attempt at this remediation involved injecting a 3.5% solution of KMnO4 into the subsurface; however, a preferential flow pathway was identified in a storm drain that allowed the solution to discharge to Inner Womens Bay. The solution was able to enter a storm drain and migrate downgradient. Efforts including blocking the end of the pipe and moving the injection sites away from the storm drain were unsuccessful in preventing migration. To continue the CA and prevent KMnO4 from migrating offsite, approximately 12,000 pounds of KMnO4 solid powder was poured into boreholes in the source area. The boreholes were filled from bedrock up to approximately 10 feet bgs, all within the saturated zone to allow the powder to dissolve in groundwater. Two rounds of groundwater sampling were conducted following the injections to track conditions. The revised remedy did not sufficiently reduce concentrations of chlorinated compounds in soil and groundwater (Hart Crowser 2006).

In 2008, following identification of a complete vapor intrusion pathway (Windward 2009), further CAs were employed to mitigate concentrations of VOCs exceeding risk standards. Ducts and fans were installed in Barracks Building 1, the galley/pizza parlor, and the MWR Boathouse to create negative pressure in subbasements and crawlspaces; vapor barriers were installed in these buildings as well. The air extracted through the duct and fan system was/is passed through a GAC treatment system. Indoor air quality has since been monitored.

In 2009, a groundwater interceptor trench was installed immediately upgradient of the AS/SVE system equipment shed at Site 3 to significantly reduce groundwater flow through the original source area located south of the former Coast Guard Laundry facility. The trench was lined vertically with plastic sheeting and a sump pump was installed to intercept shallow groundwater flow and convey it to a surface ditch across Storis Drive (Ahtna 2019).

The most recent CAs include 2016 excavations, removing a preferential pathway, and soil amendment injections. The remediation pilot treatment study (i.e., Phase III) followed the removal and reconfiguration of sub-grade utilities and removal of preferential flow pathways during Phase II. An old wood-stave drainpipe was removed from the east side of the MWR Boathouse, and sanitary and stormwater systems on the east side of the building were reconfigured to avoid the areas of greatest contamination. Phase III consisted of excavating localized contaminated soil down to bedrock with large-diameter augers. The excavation area is bounded by well MW-03-202 to the south and well MW-03-402D to the north. Approximately 357 tons of contaminated soil was removed for offsite disposal. Most boreholes were backfilled with amended sand, which contained Daramend, a product that has a blend of zero valent iron and organic carbon. Daramend enhances biological growth, resulting in depleted oxygen in groundwater, promoting reducing conditions, and degrading chloroethenes in groundwater (Ahtna 2020).

In 2020, a Pilot Treatment Study Addendum (Ahtna 2020) was finalized, which assesses the effectiveness of the 2016 pilot treatment, removal action, and amendment installation. The Pilot Study Addendum's monitoring results, including sampling results from select monitoring wells for VOCs, geochemical parameters, and bacteria, revealed that Daramend has locally treated chloroethene contamination; however, it did not have a strong effect on downgradient groundwater (e.g., MW-03-403). Further, full delineation of the eastern source area has not been completed. Contamination remains, most likely below the eastern wall of the MWR Boathouse. The Pilot Treatment Study Addendum recommends applying a liquid carbon amendment in the source area to maintain geochemical and microbial conditions that are conducive to reductive dechlorination.

Ongoing corrective measures at Site 3 include maintenance of an asphalt cap placed over the source area to reduce contaminant leaching by infiltration of surface water as well as long-term monitoring (LTM) of groundwater. Groundwater sampling, groundwater elevation, monitoring well and asphalt cap

inspections are currently conducted quarterly. As described above, the remedy formerly included operation of an AS/SVE system, but the AS/SVE system is now maintained in a readiness state for resumed operation should increasing concentration trends be observed in groundwater.

A Supplemental RFI/CMS will be conducted in 2021 to evaluate the existing conditions at the site and determine a new CA to replace the AS/SVE system. The forthcoming Supplemental RFI/CMS will address the remaining data gaps for Site 3 so that a final remedy can be selected and implemented to address source area impacts, dissolved phase impacts in groundwater, and downgradient/ downstream impacts at Inner Womens Bay.

3.4 Land Use Control Objective

Land use in the area has been and continues to remain a mix of residential, commercial and industrial, with barracks and pizza parlor to the northeast of the site, the Billiken Theatre to the west, and the hazardous waste storage building to the southwest. Due east of the building is an open field.

To remain protective of human health and the environment, the property is restricted to commercial/industrial use, with engineering controls in place to limit access to contaminated soils and groundwater. The area affected by these restrictions is shown on Figure 4.

Engineering controls include:

- Locks on monitoring wells
- Fence around the SVE system (original source area)

Asphalt cap administrative controls include:

- Dig permit process

3.5 Specific Land Use Implementation Measures

For Site 3, Coast Guard Laundry, the LUCs consist of the following:

- The asphalt cap over the contaminated area on the south side of the building will remain in place and is inspected at least annually to ensure that it is in good condition.
- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that chlorinated solvent compounds may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of chlorinated VOCs prior to offsite disposal. If soils do not contain chlorinated solvent compounds, they may be able to be replaced in the excavation. Excavated soils will be handled as specified in an approved Soil Management Plan, to be developed on a case-by- case basis.
- Any groundwater removed for utility or other work will be managed as hazardous material.

3.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 3(a) of this LUCIP.

3.7 References

The reader is referred to the following documents for additional information and background on this site:

Ahtna and AMEC Foster Wheeler Environment & Infrastructure, Inc. 2017 (September). *Site Compliance Report- Site 3 Former Coast Guard Laundry Kodiak, Alaska.*

Ahtna. 2018 (May). *Pilot Treatment Study Report. Site 3, Laundry, USCG Base Kodiak, Alaska.*

Ahtna. 2019 (August). *Resource Conservation and Recovery Act Quarterly Groundwater Monitoring Report, Second Quarter 2019, Sites 3 and 7A, USCG Base Kodiak, Kodiak, Alaska.*

Ahtna. 2020 (April). *Pilot Treatment Study Report Addendum. Site 3, Laundry, USCG Base Kodiak, Alaska.*

EPA. 1997 (March). *Comprehensive Groundwater Monitoring Evaluation, Sites 3, 6A, 7A, USCG Integrated Support Command, Kodiak, Alaska.*

EPA. 2019 (October) (revised). *Resource Conservation and Recovery Act Hazardous Waste Facility Management Permit, Permit No. AK9 69033 0742*. Issued by the EPA Region 10 in April 2011 to USCG Base Kodiak, Alaska.

Hart Crowser. 2005 (October). *Investigation Report Site 3 – Laundry, USCG ISC Kodiak, Kodiak, Alaska.* Prepared by Hart Crowser, Anchorage, Alaska.

Hart Crowser. 2006. *Site Investigation and Interim Corrective Action Report: Site 3 – Laundry, USCG Integrated Support Command, Kodiak, Alaska.*

SAIC. 1997. *Revised Final Post-Closure Plan, Site 3 – Laundry, USCG Integrated Support Command Kodiak, Alaska.* Prepared by SAIC, Olympia, Washington.

USCG. Base Kodiak. 2021 (March). *Base Kodiak RCRA Permit No AK9690330742* and attachments, as of March 2021 renewal.

Windward. 2009 (July). *Final Current Conditions Report Site 3 – Former Laundry, USCG Integrated Support Command Kodiak, Alaska.*

Exhibit 3(a) Site 3 – Laundry Land Use Controls
Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Cap and other physical improvements are maintained in accordance with the RCRA permit requirements (latest edition).	Are documented inspection records available for the site? Yes No Do they show that the inspection requirements are being followed? Yes No
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that solid waste may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminants, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be tested prior to offsite disposal or onsite replacement.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 3(b) Site 3 – Laundry Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

4.0 SITE 6A – MOGAS

This LUCIP for Site 6A – MOGAS (motor gasoline) is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility wide LUCAP.

4.1 Site Location

In 1995, Site 6A, the MOGAS site, was closed as a HWMU. The site is located near the southwest end of Nyman Peninsula (Figure 1).

4.2 Site Description

At one time, Site 6-A, MOGAS, consisted of 18 25,000-gallon underground storage tanks (USTs) that were arranged in two parallel rows of nine tanks each surrounding a central utilidor. The tanks originally contained both aviation fuel and MOGAS. In the 1970s through the early 1980s, the tanks were used exclusively to store MOGAS. From the early 1980s to 1991, the tanks were used to store a variety of petroleum products including off-specification fuels, waste oil, and solvents. The tanks and associated piping were removed in 1995. The contaminated soils at the site have been capped with asphalt and the site was closed under RCRA. Additional investigations were conducted in 2003 to further assess soil and groundwater contamination to determine if a clean closure could be attained. Soil sampling results showed no contaminants above the ADEC Method Two cleanup levels in use at the time (Method Two, Tables B1 and B2, Human Health Over 40-Inch Zone inhalation or direct contact cleanup levels [2003]) with the exception of arsenic, which was above regulatory cleanup levels but within the range of background conditions (Hart Crowser 2004). The 2004 report includes a vapor intrusion evaluation and an ecological screening level evaluation as well as a summary of the 1994 to 1997 samples. There is documentation that the report was submitted to EPA but there is no documentation of comments, acceptance, or any submission to ADEC for review and approval.

Situated on the southeast side of the Base, Nyman Peninsula consists of a northeast-southwest trending bedrock ridge mantled by a thin layer of glacial till, peat, and volcanic ash deposits with areas of artificial fill. Site 6A is located on the southeastern portion of the peninsula, near the crest of the bedrock ridge. The site slopes steeply down to Womens Bay to the east and Inner Womens Bay to the west. The site is approximately 1,500 feet from Inner Womens Bay, the nearest surface water. Soils in the area generally are shallow fill, consisting of silty gravels and gravelly sands with one to 3-foot-thick layers of ash and peat were encountered in several locations. Bedrock is encountered at 3 to 23 feet across the site. Groundwater is located 13 to 17 feet bgs and generally flows southwestward following the contours of the valley to the west of the site. Some component of flow also flows toward the north-northeast, reflecting the position of the site near the crest of the bedrock ridge.

Petroleum hydrocarbons and solvent-related compounds remain in soil and groundwater under the cap. No evidence has been found to suggest these contaminants are moving. From 1997 to present, an array of monitoring wells is in place and monitored semi-annually. Petroleum compounds in soil and groundwater are currently above ADEC cleanup standards.

4.3 Site Remedy

Corrective measures at Site 6A consist of an asphalt cap placed over the source area to reduce contaminant leaching by infiltration of surface water, a groundwater monitoring program, and inspections/maintenance of the permanent cap over the contaminated soil. The cap must be maintained in perpetuity unless the soil either meets the cleanup levels or soil is excavated and only clean material remains No additional corrective measures are being considered at this time.

The Revised Final Post-Closure Plan (SAIC 1997) outlined a semi-annual compliance detection monitoring plan for nine monitoring wells, including a tri-annual Appendix IX analyte suite at well MW-6A-107, and gauging (SAIC 1997). Two monitoring wells have been moved from the sampling program to water level elevations only, in 2006 the Appendix IX sampling was discontinued , and detection monitoring sampling is now conducted annually in October.

4.4 Land Use Control Objective

Land use in the area has been and continues to remain industrial, with the active and closed fuel farms to the northeast of the site, open storage areas to the south, and vacant land to the east and west.

To remain protective of human health and the environment, the property is restricted to commercial/industrial use, with engineering controls in place to limit access to contaminated soils and groundwater. The area affected by these restrictions is shown on Figure 5.

4.5 Specific Land Use Implementation Measures

For Site 6A, MOGAS, the LUCs consist of the following:

- The asphalt cap over the contaminated area will remain in place and is inspected at least annually to ensure that it is in good condition.
- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum and chlorinated solvent compounds may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum and VOCs prior to offsite disposal. If soils do not contain chlorinated solvent compounds, they may be able to be replaced in the excavation.

4.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 4(a) of this LUCIP.

4.7 References

The reader is referred to the following documents for additional information and background on this site:

Clarus Technologies, LLC. 2006 (July). *RCRA Quarterly /Semi-Annual Report – Second Quarter 2006, USCG Sites 3, 6A, 7A - Kodiak, Alaska.*

Hart Crowser. 2004 (September). *Supplemental Investigation Report, Site 6A, MOGAS, USCG Integrated Support Command Kodiak, Kodiak, Alaska.*

SAIC. 1997 (July). *Revised Final Post-Closure Plan, MOGAS, USCG Integrated Support Command Kodiak, Kodiak, Alaska.*

USCG. Base Kodiak. 2021 (March). *Base Kodiak RCRA Permit No AK9690330742* and attachments, as of March 2021 renewal.

This page intentionally blank

Exhibit 4(a) Site 6A – MOGAS Land Use Controls
Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Cap and other physical improvements are maintained in accordance with the RCRA permit requirements (latest edition).	Are documented inspection records available for the site? Yes No Do they show that the inspection requirements are being followed? Yes No
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be tested prior to offsite disposal or onsite replacement.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 4(b) Site 6A – MOGAS Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the administrative record files.

This page intentionally blank

5.0 SITE 6B – NYMAN PENINSULA FUEL FARM

This LUCIP for Site 6B – Nyman Peninsula Fuel Farm is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

5.1 Site Location

Site 6B, the Nyman Peninsula Fuel Farm (Fuel Farm), is located on the southeast side of the Base and spans the central, elevated portion of Nyman Peninsula (Figure 1).

5.2 Site Description

During World War Two (WWII), the U.S. Navy established a base on Kodiak Island to protect the Gulf of Alaska and serve as an intermediate point between installations at Cold Bay and Sitka. The Fuel Farm has been the major bulk storage facility at the Base since the original construction of the Naval Station. The Fuel Farm consists of several areas (Figures 6 and 7):

The FS-6 (fuel oil, burner grade number 6) area was primarily used to store FS-6 "heavy" naval fuel. In 2001, aboveground storage (AST) Tank 172 was demolished. Between 1998 and 2001, USTs 166, 167, 169, 170, 171 were decommissioned, and the piping, heater pits, and valve stations associated with these tanks were cleaned and decommissioned. Aboveground and belowground pipelines associated with operation of the decommissioned tanks were abandoned in place or removed. The FS-6 area is no longer being actively used for fuel storage; however, on the opposite side of access road west of Tank 2, two fuel lines with a cathodic protection continue to be actively used. Tank 168 has been refurbished and recommissioned for spill response additional storage.

The JP-5 (jet propellant number 5) area consists of decommissioned fuel storage facilities and some that are still in use. Between 1943 and 1959, JP-5 and diesel Tanks 194 through 197 were removed. In 1999, reinforced concrete UST Tanks 191 through 193 were cleaned and decommissioned. Pipelines to/from the decommissioned tanks were drained and capped or removed. Three steel AST tanks (N10, N12, and N60) are still in active use of storage of JP-5 fuel. Former Tanks 195 and 196 were located where current tanks N10/N12 and associated infrastructure are currently located.

The 6B Site slopes steeply down to Womens Bay on the east and Inner Womens Bay on the west. To the south, the site is bounded by Tillamook Rock Cutoff and is located adjacent to Peninsula Lake.

Site soils consist of variable thicknesses of artificial fill, peat deposits, compact glacial till, and weathered bedrock, over bedrock. The elevation of the bedrock at the site and the depth to bedrock are both variable throughout the site. Site groundwater, when present, is generally encountered in perched layers on either bedrock or the lower permeability till, with depths ranging from 2 to 20 feet. In July 2002, the ADEC issued a determination that groundwater on the Nyman Peninsula, and on Site 6B, is not a suitable current or future water source. Surface water generally follows land topography and flows east or west off the ridge line thorough drainages into Peninsula Lake, Womens Bay, or Inner Womens Bay.

Since 1995, soil contamination by petroleum products has been identified at the site, which reportedly resulted from leakage from the tanks or spills during fuel transfer. Between 1995 and 2003, the

contamination range and characteristics were assessed. As noted above, decommissioning and cleaning/removal of tanks and associated equipment also took place prior to and during this period. In 2004 an interim action plan was developed to remove, properly treat, and dispose of petroleum contaminated soils from Site 6B, and restore the site to surrounding grade for possible future development.

In 2004, soil was excavated near Tanks 169, 170, 171, 172, 191, and 192 and thermally treated. Post-excavation confirmation samples indicated that ADEC Method Two Soil cleanup levels for soil were met for all source areas, with the exception of Tanks 172 and 192 (Hart Crowser 2005).

In 2005, soil was excavated near the former Tank 172 and N-11 pump house/oil-water separator areas and thermally treated. Approximately 4,900 tons of soil was excavated near the former Tank 172 location and approximately 1,500 tons near the N-11 pump house/OWS. Post-excavation confirmation samples collected at both locations indicate that neither ADEC Method Two cleanup levels nor less stringent site alternative cleanup levels were met. As a result, further action was recommended for both locations (Hart Crowser 2006).

In 2006, additional soil was excavated near the N-11 pump house/OWS area. Soil samples were also collected near the previously remediated area surrounding Tank 172. Post excavation samples collected from the N-11 pump house area and the Tank exceeded ADEC Method Two cleanup levels and site alternative cleanup level. As a result, further action was recommended (Clarus 2007).

In 2004, free product recovery for Site 6B began with the installation of a passive skimmer in monitoring well MW-6B-105. Between 2004 and 2008, absorbent socks and bailing were used in addition to the passive skimmer to collect free product. The total amount of free product collected by the end of 2008 was 23.120 liters. In 2009, additional wells were installed for free product recovery. As of January 2012, a total of 26.26 liters of product had been recovered through this effort (Windward 2012a).

A Supplemental RFI is planned at Site 6B for 2021. As a precursor to the Supplemental RFI, a Current Conditions Report (USCG 2019) is being prepared and will be finalized by Fall 2020. The Current Conditions Report was developed to provide summary of the existing impacts to the environment at Site 6B.

5.3 Site Remedy

In 2013, a Final Interim Measure Report (Windward 2012b) was submitted to the EPA but no comments have been received. The proposed remedy for 6B is continued periodic product removal at monitoring well MW-6B-105 and implementation of institutional controls, although no remedy has been selected for the site.

5.4 Land Use Control Objective

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils. The areas affected by these restrictions are shown on Figures 6 and 7.

5.5 Specific Land Use Implementation Measures

For Site 6B, Nyman Peninsula Fuel Farm, the LUCs consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of

intrusive activity. Dig permit issuance will require notification of the contractor that petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.

- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels prior to offsite disposal.

5.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 5(a) of this LUCIP.

5.7 References

The reader is referred to the following documents for additional information and background on this site:

Chugach Management Services, Inc. 2001 (December). *Final After-Action Report for Nyman Fuel Farm Decommissioning Phase III.* Prepared for Pacific Facilities Design and Construction Center, USCG.

Clarus. 2007. *2006 Interim Action Report: Site 6B – FS-6 and JP-5 Tanks Area, Site 9– Former AVGAS Tanks Area, USCG ISC Kodiak, Kodiak, Alaska.* Prepared for USCG.

Hart Crowser. 2004 (June). *Interim Action Plan Site 6B - FS-6 and JP-5 Tanks USCG Integrated Command Kodiak, Kodiak, Alaska.* Prepared for USCG.

Hart Crowser. 2005 (January). *2004 Interim Action Report Site 6B - FS-6 and JP-5 Tanks, USCG Integrated Support Command Kodiak, Kodiak Island, Alaska.* Prepared for USCG.

Hart Crowser. 2006 (January). *2005 Interim Action report Site 6B - FS-6 and JP-5 Tanks USCG Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared for USCG.

USCG. 2019 (October). *Current Conditions Report, Solid Waste Management Unit Site 6B.*

Windward. 2012a. *Free Product Monitoring and Recovery Quarterly Report – Sites 6B and 10/11, October 2011 through December 2011, USCG Base Kodiak, Kodiak, Alaska.* Prepared for USCG.

Windward. 2012b (October). *Site 6B Final Interim Measures Report USCG Base Kodiak, Kodiak, Alaska.* Prepared for USCG.

This page intentionally blank

Exhibit 5(a) Site 6B – Nyman Peninsula Fuel Farm Land Use Controls Annual Inspection List

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated medias, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 5(b) Site 6B – Nyman Peninsula Fuel Farm Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors change to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

6.0 SITE 7A – BARREL STORAGE AREA NO. 1

This LUCIP for Site 7A – Barrel Storage Area No. 1 is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

6.1 Site Location

In 1995, Site 7A, Barrel Storage Area No. 1, was closed as an HMWU. Site 7A is located in the center of Nyman Peninsula within the Fuel Farm (Figure 1).

6.2 Site Description

Site 7A, Barrel Storage Area No. 1, was historically used for storing barrels of waste petroleum products, solvents, and other hazardous wastes. In 1991, the barrels were removed. The site is contaminated with petroleum hydrocarbons, chlorinated solvents, and chlorinated pesticides as a result of spills and leaking barrels. In 1996, an asphalt cap was placed over the contaminated soils and the site was closed under RCRA. An AS/SVE system was constructed and is operated to remove solvents and hydrocarbons from the subsurface.

The subsurface at Site 7A is composed of 2 to 3 feet of gravel fill underlain by a thin ash layer and variable thicknesses of peat. Beneath the peat is silty, sandy gravel that transitions to glacial till. Bedrock is 6 to 20 feet bgs at this site. Depth to groundwater ranges from 4 to 15 feet. Groundwater flows to the south and west.

Petroleum hydrocarbons, chlorinated solvents, and chlorinated pesticides remain in soil and groundwater under the cap. No evidence has been found to suggest these contaminants are moving. An array of monitoring wells is in place and wells are monitored quarterly.

6.3 Site Remedy

The goal of CA at Site 7A is to remediate groundwater to background levels for organic compounds. Non-organic compounds, and specifically metals, are not targeted in the CA plan at Site 7A. Since 1995, quarterly groundwater monitoring has been conducted at the site (Ahtna 2019). Active corrective measures were implemented during closure activities; in 1996, an AS/SVE system was installed to remediate soil and groundwater beneath the asphalt cap. The system, which consisted of 55 AS points below the groundwater table and SVE wells in the unsaturated zone, began operation in January 1997. AS systems remove VOCs in the saturated zone through injection of contaminant-free air. Dissolved contaminants transfer to air bubbles and are carried to the unsaturated zone for collection via SVE (SAIC 1997). The vapors extracted are treated by two GAC filters (Ahtna 2019). Air sparging also promotes biological degradation of petroleum-related contamination through oxygenation and bacteria growth. Corrective actions at Site 7A also included installing and managing an asphalt cap. AS/SVE systems function at a better capacity when the unsaturated zone is at least 5 feet thick. With groundwater present originally as shallow as 2.5 feet bgs on the north end of Site 7A, the asphalt cap was engineered with fill added to create a sufficient unsaturated zone and create grade for runon and runoff control (SAIC 1997a).

In 1997, the post-closure plan for Site 7A was revised and finalized and outlined the path forward including installing the asphalt cap, a groundwater monitoring system, CA system inspections, and a compliance and CA monitoring program. Generally, post-closure includes monitoring the effectiveness of CAs through groundwater monitoring trend analysis and vapor removal measurements (SAIC 1997).

Beginning in 1997 with system startup though to 2003, the AS/SVE system was operated on a pulse cycle of 2 hours on and 4 hours off for a total of 8 hours of operation per day. A new schedule began in Fall 2003; the system was operated for 2 hours followed by 3 months turned off. However, from July to October, the remediation system would be run for 8 hours per day. This was continued until October 2013 when the system was turned off completely and only run to collect samples. Since July 2014, the SVE system has been operated seasonally from July to October in pulse mode without the AS system (Ahtna 2019).

A 2020 evaluation of historical data revealed asymptotic mass removal rates/diminishing returns, indicating that the AS/SVE system had exhausted its remedial efficacy. In 2020, the system was shut off and is maintained in a readiness state for resumed operation should increasing concentration trends be observed.

Ongoing corrective measures at Site 7A include maintenance of the asphalt cap placed over the source area to reduce contaminant leaching by infiltration of surface water as well as LTM. Groundwater sampling, groundwater elevation, monitoring well, and asphalt cap inspections are currently conducted quarterly.

6.4 Land Use Control Objective

Land use in the area has been and continues to remain industrial, because the site is within the active and closed fuel farm.

To remain protective of human health and the environment, the property is restricted to commercial/industrial use, with engineering controls in place to limit access to contaminated soils and groundwater. The area affected by these restrictions is shown on Figure 8.

6.5 Specific Land Use Implementation Measures

For Site 7A, Barrel Storage Area No. 1, the LUCs consist of the following:

- The asphalt cap over the contaminated area will remain in place and is inspected at least annually to ensure that it is in good condition.
- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum and chlorinated solvent compounds may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum and VOCs prior to offsite disposal. If soils do not contain chlorinated solvent compounds, they may be able to be replaced in the excavation.

6.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 6(a) of this LUCIP.

6.7 References

The reader is referred to the following documents for additional information and background on this site:

Ahtna. 2019 (August). *Resource Conservation and Recovery Act Quarterly Groundwater Monitoring Report, Second Quarter 2019, Sites 3 and 7A, USCG Base Kodiak, Kodiak, Alaska.*

Clarus Technologies, LLC. 2006 (July). *RCRA Quarterly /Semi-Annual Report - Second Quarter 2006, USCG Sites 3, 6A, 7A – Kodiak, Alaska.*

Hart Crowser. 2001 (October). *Memorandum, Engineering Evaluation for Sites 3 and 7A, 7500-20.*

Hart Crowser. 2002a (December). *Work Plan, Pulsing Plan and Rebound Analysis for Site 7a, Integrated Support Command Kodiak, Kodiak Alaska.*

Hart Crowser. 2002b (October). *Site 7A Remediation System Operation and Maintenance Manual, USCG Support Center, Kodiak Alaska.*

Hart Crowser. 2004 (February). *Pulsing Plan and Rebound Analysis, Site 7A, ISC Kodiak, Alaska.*

Hart Crowser. 2006 (March). *Hazardous Waste Investigation Report, Site 7A - Barrel Storage Area, USCG ISC Kodiak, Kodiak, Alaska.*

HDR. 2012 (April). *RCRA Quarterly Report, First Quarter 2012, USCG Base Support Unit Kodiak, Sites 3 and 7A, Kodiak, Alaska.* Prepared for the USCG.

SAIC. 1994 (September). *Data Presentation Report, Groundwater Monitoring Well Installations and Site Characterization Results, Site 6A – MOGAS.* USCG Support Center Kodiak, Kodiak, Alaska.

SAIC. 1995 (September). *Final Post-Closure Plan, Site 7A, USCG Support Center Kodiak. Kodiak, Alaska.*

SAIC. 1997. *Revised Final Post-Closure Permit Application, Site 7A – Barrel Storage Area No. 1.* USCG Integrated Support Command Kodiak, Kodiak, Alaska.

USCG. Base Kodiak. 2021 (March). *Base Kodiak RCRA Permit No AK9690330742* and attachments, as of March 2021 renewal.

This page intentionally blank

Exhibit 6(a) Site 7A – Barrel Storage Area No. 1 Land Use Controls Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Cap and other physical improvements are maintained in accordance with the RCRA permit requirements (latest edition).	Are documented inspection records available for the site? Yes No Do they show that the inspection requirements are being followed? Yes No
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminants, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be tested prior to offsite disposal or onsite replacement.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 6(b) Site 7A – Barrel Storage Area No. 1 Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors change to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

7.0 SITE 9 – KODIAK AVGAS HILL

This LUCIP for Site 9 - Kodiak Aviation Gasoline (AVGAS) Hill is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

7.1 Site Location

Site 9, Kodiak AVGAS Hill, FUDS ADEC Hazard Identification No.: 23438, File No. 2601.26.048, is located on a ridge crest on the northeast side of the Nyman Peninsula. This site is identified as SWMU 9 as shown on Figure 1.

7.2 Site Description

The site slopes steeply downward to Womens Bay on the south and east, and more gradually downward to the west and north toward Storis Drive and Windrider Drive. The main historical uses at Site 9 are associated with 64 USTs in four arrays of 16 tanks each (Tank Groups A, B, C, and D). The USTs were installed between 1941 and 1944 for AVGAS storage. Each welded-steel tank had an approximate capacity of 25,000 gallons. The tanks were 8 to 10 feet in diameter and approximately 300 feet long, each approximately 4 feet bgs. In 1972, the Navy utilized the tank farm until the Naval Air Station was turned over to the USCG. The USCG has no record of using the tanks. In 1978, most of the tanks and associated piping were removed by the U.S. Department of Defense (DoD).

Since 1987, multiple soil and groundwater investigations have been performed at Site 9, confirming the presence of petroleum contamination related to AVGAS leaks and releases. Multiple remedial actions have been conducted including product recovery, in situ remediation, and removal of petroleum-contaminated soils. Chlorinated solvent contamination also is present at Site 9 and is believed to be associated with the disposal of dry-cleaning solvent from a former Navy-operated laundry facility located adjacent to Site 9. The laundry facility currently is used by the USCG as the MWR Boathouse (AECOM 2017).

In 2011, Site 9 was added to the FUDS program (ADEC 2018) when the responsible party/lead agency for Site 9 was revised from the USCG to the USACE, with USCG remaining the landowner. The regulatory lead agency for Site 9 is the EPA, but the site is also regulated by ADEC. The FUDS program published a Final Phase II Remedial Investigation (RI) report for Site 9, which recommended a Phase III RI to further characterize portions of the site and develop enough information for a human health risk assessment (AECOM 2017). In 2019, a Phase III RI was performed at Site 9 and the report as of September 2020 was still draft (USACE 2020). In the Phase III RI, soil, groundwater, soil gas, sediment, and surface water samples were collected to further characterize environmental conditions, define the nature and extent of contamination, and support a baseline human health risk assessment for the site. Additionally, data were collected to confirm that historical detections of contaminants are indicative of present site conditions and confirm that contaminant migration has reached the marine environment via soil deposition and groundwater seeps. Topographical constraints, as well as the steep southern cliff's slope to Womens Bay for all tank group sites, are prohibitive for further delineation activities (USACE 2020).

7.3 Site Remedy

Site 9 is currently in the RFI phase, and a final remedy has not been determined for this site. The interim action is to implement institutional controls.

7.4 Land Use Control Objective

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils and groundwater. The area affected by these restrictions is shown on Figure 9.

7.5 Specific Land Use Implementation Measures

For Site 9, AVGAS Hill, the LUCs consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels prior to offsite disposal. This may be superseded by an approved Soil Management Plan on a case-by-case basis.

7.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 7(a) of this LUCIP.

7.7 References

ADEC. 2018 (January). Contaminated Site Database, File Number 2601.26.048. Available online at: http://dec.alaska.gov/spar/csp/db_search.htm. Accessed on January 12, 2018.

AECOM. 2017. *Final Phase II Remedial Investigation Avgas Hill- Kodiak Navy Army Formerly Used Defense Site (F10AK100712) Kodiak, Alaska.* Prepared for U.S. Army Corps of Engineers, Anchorage, Alaska. February 2017.

USACE, Alaska District. 2020 (July). *Draft AVGAS Hill Phase III Remedial Investigation Report FUDS No. F10AK1007-12 Kodiak, Alaska.*

Exhibit 7(a) Site 9 – AVGAS Hill Land Use Controls
Annual Inspection List

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 7(b) Site 9 – AVGAS Hill Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

8.0 SITE 10/11 – AIR STATION AND PAINT STORAGE BUILDING

This LUCIP for Site 10/11 – Air Station and Paint Storage Building is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

8.1 Site Location

Site 10/11, Air Station and Paint Storage Building, is located within the industrial area in the southern portion of Base Kodiak (Figure 1).

8.2 Site Description

Site 10, Air Station, includes three hangars, several aircraft fueling stations, an oil-water separator, the Air Station fuel farm, and a large tarmac area where helicopters and C-130 aircraft are serviced and fueled. Site 11, the Paint Storage Building, includes a small building currently used for storing and dispensing paint and paint-related solvents. Because the sites are adjacent to each other, they are addressed as one site and are referred to Site 10/11. Two major releases are known to have occurred at the site, both located east of Hangar 1. The first release was a leak of an estimated 220,000 gallons of jet fuel, specifically JP-5 from a pipeline associated with the Air Station fuel farm. In May 1987, the USCG discovered the leak and repaired it. Between 1989 and 1992, approximately 118,000 gallons of spilled product were recovered. In April 1992, the second release occurred and consisted of 41,000 gallons of JP-5. Between 1992 and 1995, approximately 27,000 gallons were recovered.

Site 10/11 is bounded to the southwest by Inner Womens Bay. The ground slopes steeply upward to the northwest and southeast, and more gradually to the northeast toward the Base residential areas. The subsurface geology consists of sand and gravel deposits and has a relatively high hydraulic conductivity. Groundwater gradients are typically flat in the area of the Site 10/11 tarmac, but they are influenced by a sheet pile wall located between the bay and the tarmac. This wall is located at depth within the dike between the edge of the tarmac and Inner Womens Bay. The wall was originally installed to allow filling of the site for the tarmac. It is thought that discontinuities in the sheet pile wall were caused by shifting of the wall during the 1964 earthquake that struck Alaska.

In 2004, it was estimated that free product was potentially present on the groundwater table over approximately 9 acres across this site. During more recent analyses (2002 through 2019), detection of free product in wells installed to recover product has been intermittent, indicating that little floating product remains in the subsurface at the site. The sheet pile wall likely provides a barrier between the floating product on the groundwater interface and the bay, despite the wall's discontinuities. The relatively flat gradient of the site groundwater would also further slow any migration of the free product and associated contaminants.

A 2001, CMS proposed implementation of a system to recover residual free product floating on the groundwater table under the tarmac area by pumping groundwater from wells. The CA also included monitoring groundwater in 10 wells to track changes in petroleum product contamination beneath the tarmac (S&W 2001). The Site 10/11 Interim Action Work Plan recommended a phased action plan to monitor free product at the site and to recover it to the extent possible (Hart Crowser 2002). Between

September and November 2002, surface seeps, stormwater, groundwater, and sediments were sampled and analyzed. In April 2003, an additional 10 groundwater monitoring wells were installed, and groundwater was sampled and analyzed in May and November 2003. Sampling events continued through September 2004.

At the conclusion of the 2004 monitoring period, it was determined that stormwater from the A1-1 outfall and the groundwater from the seeps along the beach complied with ADEC surface water levels (18 AAC 70). Concentrations of groundwater from seeps were also below the ADEC groundwater levels. Analytical results for surface water, outfall, seep, and tarmac runoff samples were below relevant levels. As of 2004, groundwater in the vicinity of the historical spills continued to exceed ADEC surface water levels. With the exception of benzene, state groundwater levels were not exceeded in the groundwater monitoring rounds performed in 2003. Between May 2003 and September 2004, the amount of free product removed from site wells was 4,361 milliliters. At the end of 2004, the monitoring network and deployed recovery devises appeared sufficient in addressing the issue (Hart Crowser 2005b).

In October 2005, a biological reconnaissance was conducted along the shoreline adjacent to Site 10/11. Surveys conducted to identify signs of hydrocarbon seeps or sheens and effects of major habitat alternations revealed a small area at the southeast end of the site where sediment contained iron precipitates sometimes indicative of hydrocarbon contamination in a marine environment. No sheen, odor, or other direct evidence of hydrocarbons was observed, and no evidence indicated that the possible chemical contaminants were influencing species' distribution or health (Hart Crowser 2005b).

From 2003 to 2011, passive recovery efforts, including a passive skimmer and absorbent socks, were completed. In 2012, passive free product removal was terminated due to the low recovery of product during monitoring events; from 2009 to January 2012, the maximum volume of free product recovered per well per monthly service period remained less than 375 milligrams per liter per well (Windward 2012). No free product monitoring/removal activities have been performed at the site since January 2012.

In 2013, the EPA requested the preparation of the Corrective Measures Implementation (CMI) Plan. In 2019, the USCG submitted a CMI Work Plan (USCG 2019a), completed a groundwater and seep monitoring event in June, and documented the results of the monitoring event in a CMI Report (USCG 2019b). During the 2019 monitoring event, a total of 25 groundwater monitoring wells were sampled; 12 wells contained petroleum hydrocarbon-related analytes present at concentrations above project screening levels, and 6 wells contained chlorinated VOCs above project screening levels. Four seep samples were collected along the intertidal zone of Inner Womens Bay; one seep exceeded the ADEC surface water quality levels for total aqueous hydrocarbons, though the exceedance was driven by non-detect values. The 2019 investigation results were consistent with previous investigations.

8.3 Site Remedy

The selected remedy for Site 10/11 includes LUCs, stormwater monitoring and management, groundwater monitoring in sentry wells, seep sampling in the intertidal zone, and the determination of presence or absence of free product. Specifically, the remedy is as follows:

- Intrusive activities must be reviewed and approved by the Base Kodiak Facilities Engineer, and notification will be made to any contractors working at the site that petroleum-contaminated soil may be present, and appropriate health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for petroleum hydrocarbons prior to offsite disposal.

- Stormwater monitoring and management in accordance with EPA's Multi-Sector General Permit.
- Groundwater monitoring in sentry wells and seep sampling in the intertidal zone to ensure that there is no release of contaminants above Alaska ambient water quality standards to Inner Womens Bay.
- Product monitoring in all wells. The presence or absence of product will be documented.

8.4 Land Use Control Objective

Land use on Site 10/11 will continue to be industrial indefinitely, consistent with ongoing support services to aircraft using Base Kodiak.

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils and groundwater. The area affected by these restrictions is shown on Figure 10.

8.5 Specific Land Use Implementation Measures

For Site 10/11, Air Station, the LUCs consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels prior to offsite disposal. This may be superseded by an approved Soil Management Plan on a case-by-case basis.

8.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 8(a) of this LUCIP.

8.7 References

The reader is referred to the following documents for additional information and background on this site:

Hart Crowser. 2002 (October). *Draft Work Plan for Flow Monitoring and Environmental Sampling to Support Stormwater Management USCG /SC Kodiak, Site 10/11 Kodiak, Alaska.* Prepared for the USCG.

Hart Crowser. 2005a (February). 2004 *Summary Report for Environmental Sampling and Analysis and Product Recovery Results, USCG ISC Kodiak, Site 10/11 Kodiak, Alaska.* Prepared for the USCG.

Hart Crowser. 2005b (October). *Biological Reconnaissance of the Shoreline Adjacent to Site 10/11 USCG Base Kodiak, Alaska.*

S&W. 2001 (September). *Corrective Measures Study (CMS) for Sites 10 and 11, the Air Station and the Paint Storage Area, at the Integrated Support Command Kodiak, Alaska.* Prepared for the USCG. September.

USCG. 2005a (February). *2004 Summary Report for Environmental Sampling and Analysis and Product Recovery Results, USCG ISC Kodiak, Site 10I11, Kodiak, Alaska.* Prepared by Hart Crowser.

USCG. 2005b (October). *Biological Reconnaissance of the Shoreline Adjacent to Site 10/11, USCG Base Kodiak, Alaska.* Prepared by Hart Crowser.

USCG. 2019a (August). *Corrective Measures Implementation Work Plan, Site 10/11, USCG Base Kodiak, Alaska.* Prepared by AECOM.

USCG. 2019b (December). *DRAFT Corrective Measures Implementation Report, Site 10/11, USCG Base Kodiak, Alaska.* Prepared by AECOM.

Windward. 2012 (February). *Free Product Monitoring and Recovery Phase 2 Quarterly Report – Sites 6B and 10/11 October 2011 Through December 2011 USCG Base Kodiak, Kodiak, Alaska.*

Exhibit 8(a) Site 10/11 – Air Station Land Use Controls
Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated medias, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 8(b) Site 10/11 – Air Station Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors change to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

9.0 SITE 12 – BUSKIN LAKE DRUM DISPOSAL AREA

This LUCIP for Site 12 – Buskin Lake Drum Disposal Area is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

9.1 Site Location

Site 12, Buskin Lake Drum Disposal Area, is located approximately 7 miles southwest of the city of Kodiak (Figure 1). The Buskin Lake Drum Disposal Area (Site 12) includes two subareas of concern: Buskin Lake Drum Disposal Subarea and Buskin Lake Drum Cache Subarea (Figure 11). Both subareas of this site lie within the Upper Buskin Watershed. The 6-acre Buskin Lake Drum Disposal Subarea is located in a remote area approximately 3,000 feet west of Buskin Lake and lies on a gently sloping floodplain near the southern bank of the lake's main tributary. The 14-acre Buskin Lake Drum Cache Subarea is located approximately 2,000 feet north of the Buskin Lake Drum Disposal Subarea and is situated on a floodplain approximately 1,000 feet west of the lake.

9.2 Site Description

During WWII, the U.S. Navy established a base on Kodiak Island to protect the Gulf of Alaska and serve as an intermediate point between installations at Cold Bay and Sitka. During the ownership of the U.S. Navy, approximately 3,000 steel 55-gallon drums were disposed of at the Buskin Lake Disposal Area. Between 1947 and 1969, Navy activities on Kodiak Island were phased out. In 1972, the USCG assumed operational responsibility of the property. In 2002, another cache of drums was discovered in a wooded area west of Buskin Lake and north of the Buskin Lake Drum Disposal Area. The Buskin Lake Drum Disposal Area is known by its FUDS property number, F10AK1007-06, and its ADEC contaminated sites record key number, 198825X115066.

From 1987 to 1989 and 1993 to 2004, restoration/investigation activities were conducted for the Buskin Lake Drum Disposal Subarea. From July 2002 to May 2003, groundwater monitoring was conducted. In 2009, members of the Sun'aq tribe described the possible location of transformer disposal in the Buskin Lake area; however, research and a site visit conducted in 2012 revealed no evidence of transformer disposal.

Buskin Lake Drum Disposal Subarea: In 1994, approximately 3,000 abandoned 55-gallon steel drums containing approximately 6,000 gallons of petroleum product were removed. In 1998, approximately 5,200 cubic yards of petroleum, oil, and lubricants (POL)-contaminated soil were excavated and thermally treated at the USCG Base in Kodiak. The primary contaminant sources were removed, except for eight discrete locations containing diesel-range organic (DRO) contamination above ADEC Method Two cleanup levels. Because groundwater had been encountered during soil excavation, groundwater monitoring wells were installed to determine whether the groundwater quality had been impacted by fuel. During 2002 and 2003, monitoring results suggest that even though residual contamination occurs mainly in areas below the seasonal high groundwater elevation, contamination in the groundwater is not above the established cleanup levels.

Buskin Lake Drum Cache Subarea: During 2003 and 2004, a total of 167 steel 55-gallon drums were removed from the Cache Subarea, and approximately 4 cubic yards of POL-contaminated soil was excavated and transported offsite for disposal. Groundwater samples were not collected because groundwater was not encountered during soil excavation.

9.3 Site Remedy

During 2006, the site underwent an analysis to determine future remedial action. Three alternatives were analyzed: (1) No action; (2) Conditional closure and No DoD Action Indicated (NDAI) determination; and (3) Excavation of soil to Method Two Cleanup Levels and thermal testing of the soils on-island. The selected remedy was Conditional Closure and NDAI determination. This remedy met the threshold criteria of overall protection of human health and the environment and incurred least cost to do so. The eight discrete areas of subsurface POL contamination are being left in place on the basis that human health and ecological risks are minimal due to incomplete exposure pathways. ADEC groundwater cleanup levels (18 AAC 75) and water quality standards for fresh water (18 AAC 70) have been met. The analysis concluded that contamination of the site has been cleaned up to the extent practicable.

9.4 Land Use Control Objective

The Buskin Lake Drum Disposal Area is currently owned by the USCG. There are no residential units in this area, and future use of the areas is expected to be similar. The property is located within a protected watershed and is used primarily for recreation and subsistence hunting and fishing. Buskin Lake is used by USCG as a drinking water source; however, no producing drinking wells exist on the Buskin Lake Drum Disposal Area.

Land use in the Buskin Lake Disposal Area will remain consistent with current uses, including recreational and subsistence hunting and fishing.

9.5 Specific Land Use Implementation Measures

For Site 12, Former Buskin Lake Drum Disposal Area, the LUCs consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels prior to offsite disposal. This direction may be superseded by an ADEC-approved Soil Management Plan on a case-by-case basis.

9.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 9(a) of this LUCIP.

9.7 References

The reader is referred to the following documents for additional information and background on this site:

SAIC. 1995. *Final RFIICMS Report, Volume I, Introduction and Facility-Wide Information, USCG Support Center Kodiak, Kodiak, Alaska.*

USACE. 2006a. *USACE FUDS Decision Document, Buskin Lake Drum Disposal Area, Kodiak, Alaska (FUDS Property No. F10AK1007-06).* Prepared by Jacobs.

USACE. 2006b (July). *Proposed Plan for Site Closure, Buskin Lake Drum Disposal Area (Site 12), Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2005a (January). *2002-2003 Comprehensive Groundwater Monitoring Report, Buskin Lake Drum Disposal Area (Site 12), Kodiak, Island, Alaska.* Final. Prepared by Jacobs.

USACE. 2005b (June). *Technical Memorandum, 2004 Drum Cache Investigation, Buskin Lake Drum Disposal Area (Site 12), Kodiak Island, Alaska.* Prepared by Jacobs.

USACE. 1999 (November). *Summary Report 1998 Interim Removal Action, Site 12, Buskin Lake Drum Disposal Area #1, Kodiak Island, Alaska.* Final. Revision 1. Prepared by Jacobs.

USCG. 2012 (July). *Site 12 – PCB Transformer Site Investigation USCG, Base Support Unit Kodiak, Kodiak, Alaska.* Final. Prepared by Windward Environmental LLC and HDR Engineering Inc.

This page intentionally blank

Exhibit 9(a) Site 12 – Buskin Lake Drum Disposal Area Land Use Controls Annual Inspection List

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 9(b) Site 12 – Buskin Lake Drum Disposal Area Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors change to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

10.0 SITE 18 – FORMER METAL DUMP AT DRURY GULCH

This LUCIP for Site 18 – Former Metal Dump at Drury Gulch is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

10.1 Site Location

In 1990, Site 18, the Former Metal Dump at Drury Gulch, was identified as an SWMU. Drury Gulch is located across from the Base Kodiak Main Gate and southwest of the Kodiak Airport (Figure 1).

Drury Gulch is oriented from the southwest to the northeast. A small drainage (1 to 10 gallons per minute) flows along the gulch toward the northeast, under Rezanof Highway and through a man-made storm drainage ditch to where it reaches a culvert that takes the water under the Kodiak Airport to drain to Outer Womens Bay. Flows may be substantially higher during heavy rains. The gulch is bounded by steep sided bedrock hillsides, with slopes of 30 to 60 degrees. Groundwater in the gulch is shallow and intermittent, flowing at or near the surface following precipitation events.

10.2 Site Description

Drury Gulch is approximately 6 acres in size. The area is a natural drainage that was used by the U.S. Navy as part of the Kodiak Naval Station Reserve. For an unknown period between 1939 and 1975, the upper and lower portions of the gulch were used for the storage and disposal of metal and wood debris. During the re-routing of the Rezanof Highway in the mid-1970s and mid-1980s, the metal and wood debris was removed from the site or buried onsite and the surface re-graded. Site investigations in 1993, 1999, and 2000 showed that elevated levels of polychlorinated biphenyls (PCBs) remained in the gulch from past military activities. The presence of PCBs in the area is believed to result from storage or disposal of metal debris such as electrical components, or the use of soil cover/backfill material containing PCBs.

Between 2003 and 2008, approximately 20,306 tons of PCB-contaminated soil and 450 tons of TCE-contaminated soil were removed from the site. Excavated areas within the gulch were backfilled and contoured to maintain the hydraulic capacity of the gulch, promote drainage, minimize erosion, eliminate downstream transport of PCB-contaminated sediment, and accommodate settling and subsidence.

In 2010, the first five-year review was conducted and indicated the importance of maintaining the integrity of the cover to preserve the hydraulic capacity of the gulch while preventing PCB exposure to human and ecological receptors. Quarterly inspections were scheduled for 3 years, followed by 3 years of semi-annual inspection. More frequent inspections were planned during the first year to ensure cover performance and to make sure that vegetation was established on the cover (Jacobs 2011). In May 2010, according to available records, the first stormwater inspection was conducted (Fairbanks Environmental Services 2010).

The second five-year review inspection report (AECOM 2016), revealed the cap remedy is functioning as intended; however, sediment affected by PCB concentrations greater than the remedial action objective presented in the Decision Document warranted further evaluation to determine if ecological protectiveness is being met. Recommendations were made that included a focused ecological risk assessment to determine the concentration of PCBs in sediment that will be protective of ecological

receptors. Additionally, an offsite drainage, identified as the Rezanof roadside ditch, continues be the primary source of sediment accumulating onto the Drury Gulch cap remedy. During large storm events, significant amounts of sediment are brought down the ditch and accumulate on the site perimeter fence. The possibility that sediment accumulation may compromise the site perimeter fence and block the 18-inch culvert leading from the site to the upper Stilling Basin may occur if a permanent solution to control sediment accumulation is not found. The report also identified three additional drainages leading into Drury Gulch and the cap remedy including Upper Gulch Creek, Deer Bone Drainage, and the Dog Leg Drainage. There is some concern that during large storm events water entering the gulch through these drainages could cause additional sediment accumulation. Therefore, continued coordination with all stakeholders was recommended to ensure that potential impacts are minimized.

10.3 Site Remedy

The RCRA Corrective Action Statement of Basis and the ADEC Decision Document (September 2003) selected the following remedy for Site 18:

> *The chosen remedy for the PCB contamination in Drury Gulch is to excavate all areas with PCBs greater than 10 mg/kg. After excavation of the contaminated soil, all disturbed or reworked areas of the gulch will be covered with a minimum of 2 feet of clean fill material and re-vegetated. Segments of the Drury Gulch channel will be lined with geotextile membrane and riprap. Beginning just north of Rezanof Highway and ending where the channel goes beneath the airport runway, a new drainage channel will be installed adjacent to the existing channel, and the excess soil will be used to fill the existing channel. Land use controls would then be put in place to prevent human or environmental exposure to PCBs.*

10.4 Land Use Control Objective

Land use in the area has been and continues to remain industrial. However, Kodiak Island residents also cross this area on their way to recreational opportunities on Old Womens Mountain. It is also used as an access by USCG personnel and contractors to fire water storage tanks, a potable water tank, electrical utilities, and fiber optic cable vaults. A residential housing area is located west of the site on Aviation Hill, positioned approximately 100 vertical feet above Drury Gulch and approximately 350 feet west of the drainage.

To maintain the integrity of the selected remedy, the property is restricted to industrial uses, with engineering controls in place to limit access to PCB-contaminated soils. The area affected by restrictions is shown on Figure 12.

10.5 Specific Land Use Implementation Measures

For Site 18, Former Metal Dump at Drury Gulch, the LUCs consist of the following:

- Soil cover over the disturbed areas of the gulch will remain in place, and will be inspected in accordance with the Final LTM and Maintenance Plan, Drury Gulch, Formerly Used Defense Site: F10AK1007-01, Kodiak, Alaska (USACE 2016) to ensure that no erosion or other acts of nature or man- caused activities are disturbing or removing the cover material.
- Access to the site is restricted by a locked vehicle gate at the south end, fencing, and signs indicating that unauthorized access is prohibited. Access is inspected by routine security patrols.

- Any intrusive activity at this site will require review and approval by the Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that PCBs may be present, and appropriate worker health and safety measures must be taken.
- Any work conducted by ADOT&PF on the culvert under Rezanof Highway will be coordinated with the USCG prior to project start to ensure that the cover and drainage are not disturbed.

10.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9, using the results of the inspection items identified in Exhibit 10(a) of this LUCIP.

Five-year reviews of LUCs will be performed in accordance with the criteria set forth in the LUCAP, Appendix D.

10.7 References

The reader is referred to the following documents for additional information and background on this site:

AECOM. 2016 (June). *Draft Second CERCLA Five-Year Review Report, Drury Gulch Formerly Used Defense Site (F10AK100701) Kodiak, Alaska.* Prepared for U.S. Army Corps of Engineers, Anchorage, Alaska.

EPA. 2011 (February). *Site 18 - Former Metal Dump at Drury Gulch, Corrective Action Statement of Basis.*

Fairbanks Environmental Services. 2010 (May). *May 2010 Inspection Report (#1 Quarterly), Drury Gulch.* Prepared for U.S. Army Corps of Engineers, Anchorage, Alaska.

Jacobs. 2008 (September). *Final Remedial Action Report, Drury Gulch, Kodiak, Alaska.* Prepared for USACE, Alaska District.

Jacobs. 2011 (March). *First CERCAL Five-Year Review Report, Drury Gulch, Kodiak Island, Alaska*. Draft Final. Prepared for U.S. Army Corps of Engineers, Anchorage, Alaska.

USACE. 2002 (October). *2000 Remedial Investigation/ Feasibility Study, Drury Gulch, Kodiak, Alaska.* Final.

USACE. 2003 (September). *Cleanup Decision Document, Drury Gulch, Kodiak, Alaska.* Final.

USACE. 2003 (July). *Work Plan, 2003, Remedial Action, Drury Gulch, Kodiak, Alaska.* Final.

USACE. 2003 (August). *Drury Gulch, Kodiak, Island, Alaska, Environmental Remediation and Restoration, Inspection and Corrective Action Memorandum of Understanding.* Prepared for USACE, Alaska District and USCG Base Kodiak.

USACE. 2016 (July). *Final Long-Term Monitoring and Maintenance Plan, Drury Gulch, Formerly Used Defense Site: F10AK1007-01, Kodiak, Alaska.*

This page intentionally blank

Exhibit 10(a) Site 18 – Former Metal Dump at Drury Gulch Land Use Controls Annual Inspection List

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Cover and other physical improvements are maintained in accordance with the Inspection Plan (latest edition).	Are documented inspection records available for the site? Yes No Do they show that the Inspection Plan is being followed? Yes No
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to protect the integrity of the cover.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 10(b) Site 18 – Former Metal Dump at Drury Gulch Land Use Controls Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

11.0 SITE 22 – AK DOT MAINTENANCE AREA

This LUCIP for Site 22 – Alaska Department of Transportation (AK DOT) Maintenance Area is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

11.1 Site Location

Site 22 – AK DOT Maintenance Area was identified as an SWMU in 1990. Site 22 consists of a large maintenance building and the surrounding area located north of the intersection of Anton Larson Bay Road and Tom Stiles Road (Figure 13).

11.2 Site Description

AK DOT leases and operates the maintenance and storage area within USCG Base Kodiak (SAIC 1995). Site 22 is located in the Buskin River Valley, approximately 600 feet east of the river, on a relatively flat area that slopes gently (less than 2%) to the south. The elevation of the site is approximately 40 to 50 feet mean sea level and is less than 20 feet above the elevation of the Buskin River. There are no obvious drainage pathways running through the site, and all runoff apparently flows overland or infiltrates the ground. Small hills stand to the west-northwest and to the east of the site.

In 1992, a soil gas survey and surface soil sampling were conducted to identify potential soil and groundwater contamination. Subsurface conditions encountered during soil gas survey activities included unconsolidated alluvial deposits, bedrock, and groundwater at depths less than 3 feet bgs. Soil gas samples were collected from 37 locations and analyzed for benzene, toluene, ethylbenzene and xylenes (BTEX) and chlorinated VOCs. Soil gas survey results indicated organic compounds are present over an extensive portion of the site and the presence of volatile compounds in the shallow subsurface likely represented subsurface soil or groundwater contamination. BTEX compounds comprised most of the detections in the northern, southwestern, and east central portions of the site. Toluene was the highest detected concentration, ranging between 11 parts per billion by volume (ppbv) and 17,000 ppbv. Detected chlorinated VOCs included PCE, TCE, 1,2-dichloroethane, carbon tetrachloride, and chloroform, ranging between 14 ppbv and 430 ppbv.

Using the results of the soil gas survey and the identified source areas, surface soil samples were collected from six locations and analyzed for metals (arsenic, cadmium, chromium, lead, nickel, zinc), VOCs, and semi-volatile organic compounds (SVOCs). Subsurface soil samples were not collected at that time due to soil gas survey results indicating possible widespread subsurface contamination, in which a much larger subsurface sampling program would have been needed. Surface soil sample results indicated that no VOCs or SVOCs were detected. Chromium, lead, and nickel were detected at all six sample locations at concentrations above the background levels. Soil metals concentrations were compared to RCRA action levels to determine whether Site 22 would be carried forward as a CMS; however, none of the site metals concentrations exceeded the respective action levels, and Site 22 was not carried forward to a CMS.

11.3 Site Remedy

Site 22 is currently in the RFI phase and a final remedy has not been determined for this site. The interim action is to implement institutional controls.

11.4 Land Use Control Objectives

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils and groundwater. The area affected by these restrictions is shown on Figure 13.

11.5 Specific Land Use Implementation Measures

For Site 22 – AK DOT Maintenance Area, the LUCs consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels prior to offsite disposal. This may be superseded by an approved Soil Management Plan on a case-by-case basis.

11.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 11(a) of this LUCIP.

11.7 References

SAIC. 1995 *Final RFI/CMS Report Volume 10 Site 22 – Alaska Department of Transportation Maintenance Area, U.S. Coast Guard Support Center Kodiak, Kodiak, Alaska RFI Data Report.* Prepared for U.S. Coast Guard Facilities Design and Construction Center (Pacific). Coast Guard Contract No. DTCG50-94-R-643V44. SAIC Project No. 01-1099-04-3086. February.

Exhibit 11(a) Site 22 – AK DOT Maintenance Area Land Use Controls Annual Inspection List

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for PCBs and petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The asphalt pavement west of Building 518 must be maintained in good condition.	Is the asphalt cover west of Building 518 in good condition? Have needed repairs been completed? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

12.0 SITE 23 – OLD POWER PLANT

This LUCIP for Site 23 – Old Power Plant is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

12.1 Site Location

In 1992, Site 23, Old Power Plant, was identified as an SWMU. The site is located on the west side of Nyman Peninsula along both sides of Seafarer Drive (Figure 1).

Building 12 is approximately 300 feet east of Inner Womens Bay, the nearest surface water. Soils in the area generally are shallow fill, consisting of slightly silty gravelly sands, interspersed with concrete, rebar, brick, and wood. Gravelly sands with zones of coarse gravel underlie the fill. Bedrock plunges steeply from the hillside to the east. Groundwater is encountered 6 to 10 feet bgs.

12.2 Site Description

Site 23 is located west of the active steam plant and consists of the area around the Old Power Plant (Building 12); the hill slope directly east of the Old Power Plant; the area downgradient of the Old Power Plant to the west, including the old stormwater management system with former and current stormwater outfalls; the beach; and the area west of Building 518, the former electric substation (Figure 14). Navy Special Fuel Oil (known as FS-6) and jet fuel were formerly burned at the Old Power Plant to provide power and steam heating for the Base. A number of USTs and fuel distribution lines were associated with this facility, and several aboveground tanks located next to the plant have been removed. At the Old Power Plant, several fuel spill events have occurred, and FS-6 remains in the subsurface. PCBs have been identified in soils on the west side of Building 12 and Building 518, as well as in the stormwater system.

Investigations and interim actions have occurred at this site since 1992. USTs on the east side of Building 12 have been closed in place, leaving FS-6 contaminated soil on the east and north sides of the building. In 2001, a CMS for Site 23 was developed and finalized with EPA (S&W 2001). From 2001 to 2009, the USCG completed interim actions (removal actions) and while the EPA was notified, the Work Plans were not approved by the EPA (USCG 2010). In 2003, an interim removal action was performed and approximately 330 tons of PCB-contaminated soil was removed from the site (Hart Crowser 2003). In 2005, 73.5 tons of PCB-contaminated soil was identified and removed from Site 23. Several grid locations within the excavation had associated PCB concentrations that exceeded cleanup levels but were not removed. The excavation was backfilled with these areas left in place (Hart Crowser 2003, 2006). In 2005, a Supplemental CMS was completed (Hart Crowser 2005c). Approximately 303.7 tons of PCB-contaminated soils were removed from Site 23 in 2007. Due to the presence of utilities, PCB-contaminated soil was left in place in the vicinity of Building 518. An additional 67 cubic yards of PCB-contaminated soil was removed from the vicinity of Building 518 in 2009. The excavated soil was spread in the unpaved area north of Building 518 (Figure 13) and capped with 3 inches of gravel and a 3-inch-thick asphalt cap. The cap was extended to cover all of the unexcavated areas that contained historically documented PCB-contaminated soil above the 1 part per million (ppm) action level. A fence was installed around the cap to prevent unauthorized access (Northwind 2009). In 2011, an additional Supplemental CMS Risk Consideration Memorandum was submitted (Windward 2011).

From 2004 to 2014, groundwater monitoring was performed to monitor migration of petroleum hydrocarbons and PCB contamination. Over the course of 6 years, PCBs were detected in five wells at concentrations between 0.0015 to 0.52 micrograms per liter (Hart Crowser 2004d; Clarus 2010). According to the ADEC Contaminated Site database, three polycyclic aromatic hydrocarbon (PAH) compounds (benzo[a]pyrene, benzo[b]fluoranthene, and dibenzo[a,h]anthracene) were also detected above ADEC cleanup levels in June 2009 (ADEC 2015).

In 2021, the USCG is planning a Supplemental RFI to be performed in order to address ongoing EPA concerns regarding potential ecological risk posed by the migration of PCBs to surface water and sediment; as of August 2020, a Draft Work Plan (USCG 2019) has been prepared for the effort and will be finalized by Fall 2020.

12.3 Site Remedy

Site 23 is currently in RFI phase and a final remedy has not been determined for this site. As described above, numerous interim removal actions were performed between 2001 and 2009. The asphalt cover on the west side of Building 518 is expected to stay in place, with PCBs slightly above 1 ppm. Some PCB-contaminated soil will remain in place on the west side of Building 12 because it is not easily accessible or is below the groundwater table.

12.4 Land Use Control Objective

Land use in the area has been and continues to remain industrial, with a hazardous materials distribution center located in Building 518, and the active steam plant and the Liquid Oily Waste System (LOWS) facility to the east. The Billiken Theatre is located to the north. To the south is an electrical substation.

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to PCB- and petroleum-contaminated soils. The area affected by these restrictions is shown on Figure 14.

12.5 Specific Land Use Implementation Measures

For Site 23, Old Power Plant, the LUCs consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that PCB and petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels and the presence of PCBs above ADEC Method Two cleanup levels and above Toxic Substances Control Act (TSCA) regulatory levels prior to offsite disposal.
- Asphalt pavement over the PCB-contaminated soils west of Building 518 will remain in place and will be inspected annually to ensure that pavement is in good condition.

12.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 12(a) of this LUCIP.

12.7 References

The reader is referred to the following documents for additional information and background on this site:

ADEC. 2015 (March). Contaminated Sites Database, http://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/1048. Accessed on March 17, 2015.

Anchor. 1999 (August). *Final RFI Report Marine Sediment RCRA Feasibility Investigation Womens Bay Near Integrated Support Command Kodiak.* Kodiak, Alaska.

Clarus. 2007. *PCB Characterization Report, Fall 2006, USCG ICS Kodiak, Site 23, Kodiak, Alaska.* Prepared for USCG.

Clarus. 2008. *2007 PCB-Contaminated Soil Removal Action Report, USCG ISC Kodiak, Kodiak, Alaska.* Prepared for USCG.

Clarus. 2010. *June 2010 Groundwater Sampling and Analysis Report, USCG BSU Kodiak, Alaska, Site 23 – Old Power Plant.* Prepared for USCG.

Hart Crowser. 2003 (September). *PCB-Contaminated Soil Characterization, Removal, and Disposal.* Site 23, USCG ISC Kodiak.

Hart Crowser. 2004a (January). *Groundwater Monitoring Work Plan, Site 23, Old Power Plant, USCG ISC, Kodiak, Alaska.*

Hart Crowser. 2004b (May). Memorandum from N. Muniz and T. Nichols to T. Stoh, USCG. *Site 9 - Former AVGAS Tanks, Site 23 - Old Power Plant: Well Installation, Development, Sampling, and Analysis.*

Hart Crowser. 2004c (June). *Final 2004 Sample and Analysis Plan Site 23, PCB Remediation USCG ISC, Kodiak, Kodiak, Alaska.*

Hart Crowser. 2004d (October). *Supplemental Corrective Measures Study Work Plan, Site 23 – Old Power Plant, USCG, ISC Kodiak, Kodiak, Alaska.*

Hart Crowser. 2005a (January). *Groundwater Sampling and Analysis, USCG ISC Kodiak Site 23, Old Power Plant.*

Hart Crowser. 2005b (August). *Groundwater Sampling and Analysis, USCG ISC Kodiak Site 23, Old Power Plant.*

Hart Crowser. 2005c. *Final Supplemental Corrective Measures Study, Site 23, Old Power Plant, ISC, Kodiak, Alaska.*

Hart Crowser. 2006. *PCB-Contaminated Soil Characterization, Removal, and Disposal, Site 23, USCG ISC Kodiak, Kodiak, Alaska*. Prepared for USCG.

Northwind. 2009. *Draft Final Environmental Work Plan and Sequence of Construction: Asphalt Cap, Underground Storage Tank Closure, and Oil/Water Separator Replacement, Site 23, Old Power Plant, USCG, ISC Kodiak, Kodiak, Alaska.* Prepared for USCG.

SAIC. 1991. *RCRA Facility Investigation Report, USCG Support Center Kodiak, Kodiak, Alaska.* Report prepared by Science Applications International Corporation, Olympia, Washington, for USCG, Maintenance and Logistics Command Pacific (Seattle, Washington).

SAIC. 1994 (September). *Results of Phase 1 Marine Sampling Along the Nyman Peninsula, USCG Support Center Kodiak, Kodiak, Alaska.*

SAIC. 1995 (February). *Final RFI/CMS Report, Volume 9, Site 17/23 USCG Support Center, Kodiak, Kodiak, Alaska.* Report prepared by Science Applications International Corporation, Olympia, Washington, for USCG Facilities Design and Construction Center Pacific, Seattle, Washington.

S&W. 1996 (August). *Work Plan, Corrective Measures Study, Site 23, Old Power Plant, Kodiak, Alaska.* Report prepared by Shannon & Wilson, Inc. Seattle, Washington, for USCG, Facilities Design and Construction Center Pacific. Seattle, Washington.

S&W. 1998 (January). *Draft Work Plan Tank Decommissioning FS-6 and JP-5 Storage Tanks ISC Kodiak, Kodiak, Alaska.* Report prepared by Shannon & Wilson, Inc. Seattle, Washington, for USCG, Facilities Design and Construction Center Pacific, Seattle, Washington.

S&W. 2001 (March). *Final Corrective Measures Study, Site 23 - Old Power Plant, USCG Integrated Support Command Kodiak, Kodiak Alaska.*

USCG. 2010 (September). Response to Comments, May 2009 Groundwater Monitoring Plan and November 2009 Monitoring Report, and February 2010 After-Action Report, Site 23, Old Power Plant. Correspondence, September 10.

USCG. 2019 (June). *DRAFT Supplemental RCRA Facility Investigation/Uniform Federal Policy for Quality Assurance Project Plan, Solid Waste Management Unit Site 23 - Former Power Plant.* Prepared by AECOM.

Windward. 2011 (March). *Draft Site 23 Supplemental Corrective Measures Study – Risk Considerations Memorandum, USCG Base Support Unit Kodiak, Kodiak, Alaska.*

Exhibit 12(a) Site 23 – Old Power Plant Land Use Controls
Annual Inspection List

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for PCBs and petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The asphalt pavement west of Building 518 must be maintained in good condition.	Is the asphalt cover west of Building 518 in good condition? Have needed repairs been completed? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 12(b) Site 23 – Old Power Plant Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

13.0 SITE 28 – FORMER ENGINE TEST CELL BUILDING

This LUCIP for Site 28 – Former Engine Test Cell Building is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

13.1 Site Location

In 1994, Site 28, the Former Engine Test Cell Building, was identified as an SWMU. The former Engine Test Cell Building (Building 17) site is located west of Building N-1, the USCG Vehicle Maintenance Facility, near the intersection of Cape Spencer Street and Rezanof Highway (Figure 1). The SWMU consists of the area surrounding former Building 17, including the slope below Cape Spencer Street and the former location of the petroleum storage and dispensing system.

13.2 Site Description

In 1940, the Engine Test Cell Building was constructed. The building was 9,000 square feet with two 1,000-square-foot engine test cells extending off its west site. The main portion of the building contained a motor rewind shop, general repair shop, refrigeration repair shop, and an electric repair shop. The building was served by four USTs, which were also installed in 1940. Three of the four USTs were reported to be 15,000-gallon AVGAS tanks located approximately 115 feet southwest of Building 17, near Hangar 3. In addition, a 1,000-gallon lube oil tank was co-located with the AVGAS USTs. Supply piping ran from the USTs to the building, from the east end of the tanks up a steep slope to a pump station located between the test cells. It is unknown when the facility closed; however, the building had been demolished by 1976. The date when the USTs were removed is also unknown. Supply piping, fill pipes, and possibly ballast materials for the USTs appear to remain in place. Piping is at least partially contained in concrete utilidors. There was no record of chemical releases from the USTs, piping, or any other potential source at Site 28 (S&W 2001).

The site is approximately 1,000 feet north of the head of Inner Womens Bay, the nearest surface water. Soils in the area generally are shallow fill, consisting of slightly silty gravelly sands, interspersed with concrete, rebar, brick, and wood. Gravelly sands with zones of coarse gravel underlie the fill. Layers of ash and peat, 1 to 3 feet thick, were encountered in several locations. Bedrock slopes generally to the south and was encountered between 7 and 40 feet bgs. In the vicinity of Hangar 3, bedrock plunges below 40 feet bgs. Groundwater was not encountered above bedrock surface in the vicinity of Building 17 and immediately downslope from the area. In the vicinity of Hangar 3, groundwater was encountered 10 to 15 feet bgs (S&W 2001).

The results of the CMS sampling indicate that there are no significant sources of chemicals in site soils or groundwater. Although soil borings were located adjacent to all known sources of potential releases at the site, all chemicals detected in site soils were below action levels. Fill soils associated with grading activities following demolition of the former Building 17 and construction of the Vehicle and Storage Building contain low concentrations of PCBs. The detected concentrations range from 0.23 mg/kg to 19 mg/kg with only one sample above 10 mg/kg. Greater than 50% of the samples were below 1 mg/kg (S&W 2001).

Health risk-based levels were developed for the site using a modified industrial scenario that takes into account an exposed skin surface (1,900 square centimeters) for cool climates. A surface soil cleanup level of 14 mg/kg was calculated. An exposure point concentration, used to represent the likely concentration to which a worker might be exposed was calculated and determined to be below both the ADEC surface soil cleanup level and the health risk-based calculated cleanup level (S&W 2001).

13.3 Site Remedy

The RCRA Corrective Action Statement of Basis recommended No Further Remedial Action with Institutional Controls for Site 28. The proposed remedy for this site is designed to control potential exposure to soils contaminated with PCBs. The area in which PCBs remain in soil has been paved with asphalt.

13.4 Land Use Control Objective

Land use in the area has been and continues to remain industrial, with Vehicle Maintenance Building N-1 and VAS Building east and north of the site, and Hangar 3 to the south.

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to PCB-contaminated soils. The area affected by these restrictions is shown on Figure 15.

13.5 Specific Land Use Implementation Measures

For Site 28, Former Jet Engine Test Cell Building, the LUCs consist of the following:

- Pavement over the contaminated area will remain in place and will be inspected annually to ensure that pavement is in good condition.
- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that PCBs may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be replaced under the paved area or tested for the presence of PCBs prior to offsite disposal.

13.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 13(a) of this LUCIP.

13.7 References

The reader is referred to the following documents for additional information and background on this site:

EPA. 2011. *Site 28 - Former Building 17, Public Works Garage. Corrective Action Statement of Basis Summary in RCRA Permit Attachment 11.*

S&W. 2001 (June). *Final Corrective Measures Study, Site 28, Building 17 Engine Test Building, Integrated Support Command Kodiak, Kodiak, Alaska.*

USCG. 2003. *Building 26 & 27 Parking Lot Site Plan N1, N94.* Project No. 33S01042, Drawing Number C1.

Exhibit 13(a) Site 28 – Former Engine Test Cell Building Land Use Controls Annual Inspection List

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to protect the integrity of the cover.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 13(b) Site 28 – Former Engine Test Cell Building Land Use Controls Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

14.0 SITE 33A – EMPTY CONTAINER STORAGE AREA

This LUCIP for Site 33A – Empty Container Storage Area is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

14.1 Site Location

Site 33A, the Empty Container Storage Area, Subarea 33A, is located a few feet downslope of a ridge crest that forms a topographic high along the axis of Nyman Peninsula (Figure 1).

14.2 Site Description

Site 33 is comprised of two discrete storage locations (Subareas 33A and 33B) separated by a wooded area of approximately 125 feet (Figure 15). Subarea 33B has no remaining concentrations of constituents in soils over ADEC cleanup levels and a request for Permit Modification for No Further Action is being submitted under separate cover. Subarea 33A is the subject of this request.

Subarea 33A is approximately 100 feet long by 45 feet wide. A Navy barracks occupied the subarea between 1942 and 1969. The two-story barracks were constructed on a concrete pad 80 feet by 29.5 feet. A portion of the barracks foundation remains at Subarea 33A. The barrack was heated with a furnace that operated on diesel fuel. The diesel fuel was stored in a 500-gallon UST located at the southwest corner of the building.

In the early 1980s, the two subareas making up Site 33 were used for storage of empty product containers pending re-issuance for use at the Base. The majority of the empty containers had contained POL products. Other empty product containers held soaps, solvents, alcohol, and corrosion inhibitors. Occasionally, empty containers formerly containing used oil or hazardous waste were stored at Site 33 pending re-issuance. Containers stored onsite ranged in size from 1 to 85 gallons. Product containers that were empty were stored horizontally and stacked. Containers that held any amount of residual material were stored in an upright position. In Spring 1994, at the direction of the Base Commanding Officer, the use of Site 33 for empty container storage was discontinued. Photographs taken in June 1994 indicate that the containers were in good to excellent condition. Drums at the site were segregated into empty containers, containers with known residual product and water, and containers with unknown contents. Drums were emptied, crushed, and disposed of at the Kodiak Borough Landfill. Contents were tested, consolidated where possible, and disposed either as a hazardous waste or as a non-hazardous waste to offsite disposal facilities. Oily water was processed through the Kodiak LOWS.

Subarea 33A is on relatively flat ground. Above and below the subarea are steep slopes with rock outcrops, seeps, and springs present. Soils are silty sands underlain by organic-rich peats with some gravel. Underlying the peaty deposits is peaty clay and clay interbedded with gravel.

Groundwater is shallow, typically encountered at 3 feet bgs or less. No current or future known use of groundwater exists within the industrial area of the Base, and drinking water is obtained from a surface water source more than 2 miles upgradient of this site. The nearest surface water is Inner Womens Bay, approximately 500 feet west of the site. Surface water does not drain directly to Womens Bay from this area, but sheet flows off the site into small drainages that disappear before reaching the bay.

In 1994, no excavation was performed in Subarea 33A during site activities. In 1996, an investigation was carried out in Subarea 33A to evaluate the nature and extent of contamination. The subarea was divided into a grid on approximately 20-foot centers. In 1997, an interim corrective measure was carried out at Site 33A. The primary purpose of the interim measure was to excavate soil containing lead and petroleum and remove the UST. Soils containing petroleum and PAH remain at the site. In 2000, two groundwater seeps were identified downgradient to the west of Subarea 33A. Samples were collected from each of the samples for petroleum, VOCs, and PAH. All detections were below ADEC groundwater cleanup levels at the time of the investigation. When compared to ADEC surface water quality levels and ecological screening levels, only one PAH exceeded any standard. Since the origin of the seeps was unknown, it was recommended that further evaluation of the seeps be conducted under Site 6B activities (S&W 2000).

14.3 Site Remedy

The selected site remedy is to implement institutional controls.

14.4 Land Use Control Objective

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils. The areas affected by these restrictions are shown on Figure 16.

14.5 Specific Land Use Implementation Measures

For Site 33A, the institutional controls include the following measures:

- Signage will be placed to restrict access to authorized personnel and requiring permission for any intrusive activity.
- Intrusive activities must be reviewed and approved by the Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and notification will be made to any contractors working at the site that petroleum-contaminated soil may be present and appropriate health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for petroleum prior to offsite disposal.

14.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 14(a) of this ILUCIP.

14.7 References

The reader is referred to the following documents for additional information and background on this site:

EPA. 1999 (May). Letter from M. Bussell to Captain J. Miller, USCG. Re: Comments on Draft Interim Measures Report, Site 33. Dated May 13, 1999.

SAIC. 1995 (October). *Work Plan for Site 33 – Empty Container Storage Area, USCG Support Center Kodiak Alaska.* Prepared by SAIC, Olympia, Washington. Prepared for USCG Facilities Design & Construction Center Pacific, Seattle, Washington.

S&W. 1996 (July). *Site Investigation Report Site 33 Empty Container Storage Area, Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared by Shannon & Wilson, Inc., Seattle, Washington. Prepared for USCG Facilities Design & Construction Center Pacific, Seattle, Washington.

S&W. 1997 (April). *Draft Interim Measures Work Plan, Site 33 – Empty Container Storage Area, Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared by Shannon & Wilson, Inc., Seattle, Washington. Prepared for USCG Facilities Design & Construction Center Pacific, Seattle, Washington.

S&W. 1998 (April). *Draft Interim Measures Report, Site 33 – Empty Container Storage Area, Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared by Shannon & Wilson, Inc., Seattle, Washington. Prepared for USCG Facilities Design & Construction Center Pacific, Seattle, Washington.

S&W. 2000 (October). *Groundwater Assessment Final Interim Measures Report, Site 33 – Empty Container Storage Area, Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared by Shannon & Wilson, Inc., Seattle, Washington. Prepared for USCG Facilities Design & Construction Center Pacific, Seattle, Washington.

This page intentionally blank

Exhibit 14(a) Site 33A – Empty Container Storage Area Land Use Control Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 14(b) Site 33A – Empty Container Storage Area Land Use Control Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors change to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

15.0 SITE 34 – BUILDING A-711

This LUCIP for Site 34 – Building A-711 is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

15.1 Site Location

In 1992, Site 34, Building A-711, was identified as an SWMU. The building is located at the intersection of Tom Stiles Road and Anton Larsen Bay Road in the Buskin River valley, approximately 400 feet northeast of the Buskin River (Figure 1).

15.2 Site Description

Building A-711 was originally constructed as an ordnance shop for the U.S. Army. In 1953, the building was transferred to the U.S. Navy for use as an auto hobby shop. In 1971, the Navy leased the building to the ADOT&PF. In 1972, ownership of the land was transferred to the USCG. The building remains under lease to the ADOT&PF and is used as a vehicle maintenance shop and office area. Tank MA-6, a 2,000-gallon heating oil tank previously located on the south side of the building, was installed in 1942 and removed in 1995. This tank held FS-6 fuel oil (USACE 2008a).

The A-711 area is located between 25 and 50 feet above sea level, approximately 400 feet northeast of the Buskin River. The geology is characterized by unconsolidated alluvial and glacial deposits, and volcanic ash, underlain by shallow bedrock of metamorphosed Kodiak Formation. Shallow groundwater is found in the unconsolidated deposits of fill, sand and gravel, and volcanic ash. Groundwater is typically found at 7 to 15 feet bgs (USACE 2008a).

The results of studies undertaken between 1995 and 2019 on this site have shown that an extensive plume of non-aqueous phase liquid (NAPL) petroleum contamination is present in a smear zone at the water table across much of the site (Figure 16). This plume is predominantly a mixture of diesel and heavy oil hydrocarbons. Product thickness ranges from 3.5 to 15 feet. Groundwater in the vicinity of this plume of NAPL is contaminated with gasoline-range organics, DRO, and residual-range organics, with PAH occurring in one well (USACE 2008a).

The total extent of contaminated soil is estimated at 114,000 square feet and approximately 16,000 cubic yards. Following the 2019 site investigation (USACE 2020), the defined extent of the groundwater plume extends approximately 550 south of Building A-711 near the intersection of Rezanof Drive and Anton Larson Bay Road, then turns and extends an additional 600 feet east. The rate at which the contamination is expanding is unresolved.

In 2004, surface water seep samples collected on the eastern bank of the Buskin River did not show any contamination. Surface soil and sediment samples at the same locations showed low levels of PAH; the source of these PAHs is not known.

15.3 Site Remedy

In 2008, a Feasibility Study was conducted to determine a remedial action. The interim action selected was Open Excavation with LTM and Institutional Controls (USACE 2008b). In 2007, a portion of this remedy was implemented with the excavation of 8,370 tons of contaminated soil from the areas exhibiting the highest levels of contamination. In 2008, LTM was implemented, and a Feasibility Study identified data gaps. As of August 2020, a Final Remedy has not been selected; a Final Remedy can be identified for this site when data gaps are filled, the RFI is complete, and a CMS Report has been approved.

15.4 Land Use Control Objective

Land use in the area has been and continues to remain industrial, with Vehicle Maintenance Building N-1 and outside vehicle storage activities. Similar industrial land use under the ADOT&PF lease is expected to continue for the foreseeable future.

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils. The area affected by these restrictions is shown on Figure 17.

15.5 Specific Land Use Implementation Measures

For Site 34, Building A-711, the LUCs consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels prior to offsite disposal.
- All activities involving the placement of fill, whether by USCG or its lessees, must be approved by Base Kodiak Facilities Engineer.

15.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 15(a) of this LUCIP.

15.7 References

The reader is referred to the following documents for additional information and background on this site:

ADOT&PF. 1996 (September). *Phase l Environmental Site Assessment, ADOT&PF Airport Maintenance Facility, Kodiak, Alaska.* Prepared by Shannon & Wilson, Inc.

Chugach Development Corporation. 1996 (March). *Final Interim Measures Report, Quartermasters Gas Station, Solid Waste Management Unit No. 14, USCG Support Center Kodiak.* Prepared by Chugach Development Corporation and Science Applications International Corporation Associates for USCG Facilities Design and Construction Center (Pacific).

Harding Lawson Associates. 1995 (March). *RCRA Facility Investigation, Site 14- Quartermaster Gas Station, USCG Support Center, Kodiak, Alaska.* Prepared by Harding Lawson Associates for USCG Facilities Design and Construction Center (Pacific).

SAIC. 1995 (February). *RFI/CMS Report. Volume 10. Site 22 - Alaska Department of Transportation Maintenance Area, USCG Support Center Kodiak, Kodiak, Alaska*. RFI Data Report. Final. Prepared by Science Applications International Corporation for USCG Facilities Design and Construction Center (Pacific).

SAIC. 1997 (September). *Draft, Groundwater Monitoring Report, Site 14 - Quartermaster Gas Station USCG Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared by Science Applications International Corporation for USCG Facilities Design and Construction Center (Pacific).

USACE. 2000 (May). *Final 1999 Interim Removal Action Report, Site 34 (Building A-711) Kodiak Island, Alaska.* Prepared by Jacobs.

USACE. 2001 (August). *Draft Report: Monitored Natural Attenuation Evaluation, Site 34, Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2002 (July). *Technical Memorandum. Well Installation and Groundwater Monitoring Report. Site 34, Building A-711, Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2004 (August). *Final Work Plan: 2004 Remedial Investigation Building A-711 (Site 34) Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2005 (July). *Pre-Final 2004 Remedial Investigation Report, Building A-711, Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2008a (April). *Final Feasibility Study, Building A-711, Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2008b (June). *Draft Proposed Plan for Building A-711, Kodiak Island, Alaska.* Prepared by Jacobs.

USACE. 2020 (May). *DRAFT Historical Data Compilation and Data Gap Investigation Report, Building A-711 Fuel Oil Leak, Formerly Used Defense Site F10AK1007-004, Kodiak, Alaska.*

USCG. 1995 (December). *Site Assessment & Decommissioning Report for Underground Storage Tank MA6 – ADOT&PF Building A711.* Prepared by Larry A. King, USCG Civil Engineering Unit (Juneau, Alaska).

This page intentionally blank

Exhibit 15(a) Site 34 – Building A-711 Land Use Controls
Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
Any activities involving the placement or removal of fill must be approved by the USCG Facilities Engineer.	Have any activities involving placement or removal of fill occurred in the last year? Yes No Was approval obtained from Base Kodiak Facilities Engineer? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 15(b) Site 34 – Building A-711 Land Use Controls
Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

16.0 SITE 35 – FORMER DOD FIRE TRAINING PIT

This LUCIP for Site 35 – Former DoD Fire Training Pit is the document that implements the specific requirements for this site under the LUCAP for Environmental Cleanup Activities for Base Kodiak. It describes the site, location, and remedial actions undertaken, and provides the LUC objectives and means by which the objectives will be achieved. Where necessary, references are made to required activities that apply to all sites under the facility-wide LUCAP.

16.1 Site Location

In 1997, Site 35, Former DoD Fire Training Pit, was identified as an SWMU. The site is located on the north side of the Kodiak Airport property, north of Runway 3, approximately 400 feet south of the Buskin River (Figure 1).

16.2 Site Description

The Fire Training Pit was a component of the operations of the Naval Operating Base at Kodiak. Little information is available regarding its construction or use. Based on available records, it was in use as early as 1951 and its use is thought to have ceased prior to 1979 when the current fire training area became active. The fire training pit was used to simulate aircraft fires to train firefighting crews. A variety of flammable liquids were placed in the pit, ignited, and extinguished as a training exercise. Over time, releases to the ground underneath the pit occurred, and petroleum has migrated horizontally into the vadose zone and vertically to the groundwater table.

The Fire Training Pit is located approximately 20 feet above sea level, approximately 400 feet south of the Buskin River. The geology is characterized by unconsolidated alluvial and glacial deposits, primarily gravelly sands and sandy gravels. The area was extensively filled and reworked during airfield construction in WWII. Groundwater is typically found at 2 to 17 feet bgs, with the shallower depths in the area close to the river. Net groundwater flow is to the north and northeast. The groundwater is under some tidal influence.

In 1999 to 2001, the fire training pit area underwent an interim action to remove the mass of contamination associated with the fire training pit itself. This excavation removed more than 23,000 tons of contaminated soil beneath and adjacent to the former fire training pit. The remaining contamination in soil and groundwater is residual contamination that has spread over time downgradient of the original source. Studies conducted between 1998 and 2017 show that DRO is distributed downgradient to the north and northeast of the site. Soil contamination is found in a smear zone 2 to 10 feet thick across the site. The plume is estimated to cover approximately 150,000 square feet and is covered by 0.5 to 16 feet of clean overburden. Free product has been found in two monitoring wells; the rate of accumulation is very slow.

In 2004, surface water seep samples collected on the eastern bank of the Buskin River did not show any contamination. Sediment samples in the Buskin River showed very low levels of PAH; the source of PAH has not been determined.

In 2019, USCG sampled and analyzed groundwater for per- and polyfluoroalkyl substances (PFAS). PFAS was detected above the screening level in multiple wells (USCG 2019).

16.3 Site Remedy

A Feasibility Study was conducted in 2006, 2007, and 2008 based on the 2004 Remedial Investigation (USACE 2006) and the 2005 Treatability Investigation and Design Treatability Study (USACE 2007). At this time, remedial alternatives that are being considered include monitored natural attenuation (MNA), open excavation and MNA, air sparging and in situ chemical oxidation. From 2006 to 2008, an in situ remediation system was installed as part of a treatability study and operated. Based on information available to date, it is anticipated that contaminated soil and groundwater will remain at this site for an undetermined time period. A remedy has not been selected for Site 35.

16.4 Land Use Control Objective

Land use in the area has been and continues to remain industrial; the area in which the pit is located is within the Federal Aviation Administration controlled area of the Kodiak Airport. The airport property is operated under a long-term lease to the ADOT&PF. Similar industrial land use under the ADOT&PF lease is expected to continue for the foreseeable future.

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils. The area affected by these restrictions is shown on Figure 18.

16.5 Specific Land Use Implementation Measures

For Site 35, Former DoD Fire Training Pit, the LUCs consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels prior to offsite disposal.
- Signage will be maintained along the fence line facing the river stating that there is contamination in the area, and that recreational use on the south side of the river is prohibited.

16.6 Annual Reports and Five-Year Reviews

The annual report for this site will be prepared in accordance with the LUCAP, Section 9.0, using the results of the inspection items identified in Exhibit 16(a) of this LUCIP.

16.7 References

The reader is referred to the following documents for additional information and background on this site:

USACE. 2002 (April). *Draft 2001 Interim Removal Action, Airport Staging Area, Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2005a (October). *Final 2005 Treatability Investigation Work Plan, Airport Staging Area Fire Training Pit, Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2005b (May). *Preliminary Draft 2005 Feasibility Study, Former Fire Training Pit, Airport Staging Area, Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2006. *Final 2004 Remedial Investigation, Former Fire Training Pit, Airport Staging Area, Kodiak, Alaska.* Prepared by Jacobs.

USACE. 2006 (March). *Draft Airport Staging Area, Former Fire Training Pit Site Feasibility Study.* Prepared by Jacobs.

USACE. 2008 (January). *Final Feasibility Study, Former Fire Training Pit, Airport Staging Area, Kodiak, Alaska.* Prepared by Jacobs.

USCG. 1999. *RCRA Facility Investigation, Site 35, Former Department of Defense Fire Training Pit, ISC Kodiak, Kodiak Island, Alaska.* Prepared by Shannon & Wilson.

USCG. 2019. *Draft Site 35 Fire Training Pit Per- and Polyfluoroalkyl Substances Groundwater Sampling Report, USCG Base Kodiak, Alaska.* Prepared by Ahtna Global, LLC.

This page intentionally blank

Exhibit 16(a) Site 35 – Former DoD Fire Training Pit Land Use Controls Annual Inspection List

Date: **Date of Previous Inspection:**

Name: **Date of Next Inspection:**

LAND USE CONTROL	INSPECTION ITEMS AND FINDINGS
Any intrusive activity at this site will require review and approval by Base Kodiak Environmental Division, on behalf of the Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? Yes No Have contractors been notified of presence of contaminated media, and have health and safety plans been prepared as appropriate? Yes No
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? Yes No
The USCG will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? Yes No On what date were the regulatory authorities notified?
Comments:	

This page intentionally blank

Exhibit 16(b) Site 35 – Former DoD Fire Training Pit Land Use Controls Five-Year Review Criteria

Date:	**Date of Previous Inspection:**
Name:	**Date of Next Inspection:**

Every five years, the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for five-year review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next five years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors changed to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

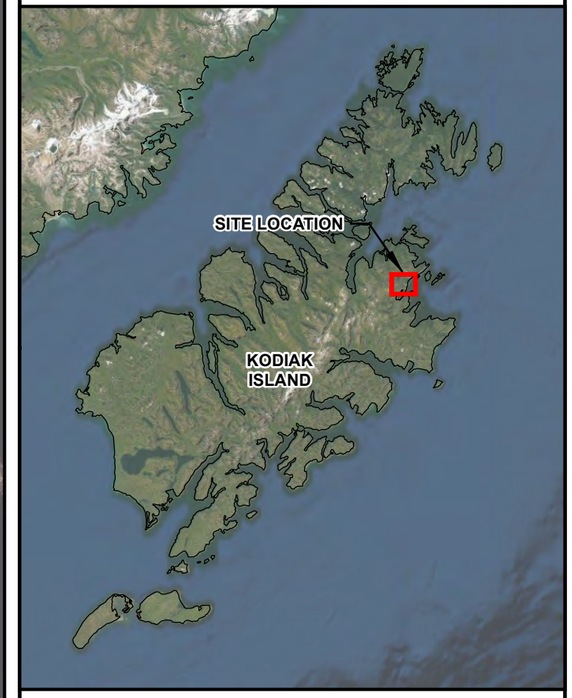
Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the LUC File.

This page intentionally blank

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN
USCG BASE KODIAK, KODIAK, ALASKA

LUCAP INSPECTION SITES



Legend

- Land Use Control
- River/Creek
- Roads
- Lake

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

0.5 0.25 0 0.5 1

SCALE IN MILES

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	1
P.M.: CS	DRAWN: CMH	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_F01.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 1

Legend

---------- Fence

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

200 100 0 200 400

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	2
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 2

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

200 100 0 200 400

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	3
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 3

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

80 40 0 80 160

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	4
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 6A

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

80 40 0 80 160

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	5
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCGBase_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 6B

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

150 75 0 150 300

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	9/15/2020	6
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 6B

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

150 75 0 150 300

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	9/15/2020	7
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 7A

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

40 20 0 40 80

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	8
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 9

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

200 100 0 200 400

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	9
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 10/11

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

150 75 0 150 300

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	10
P.M.: CS	DRAWN: JC	

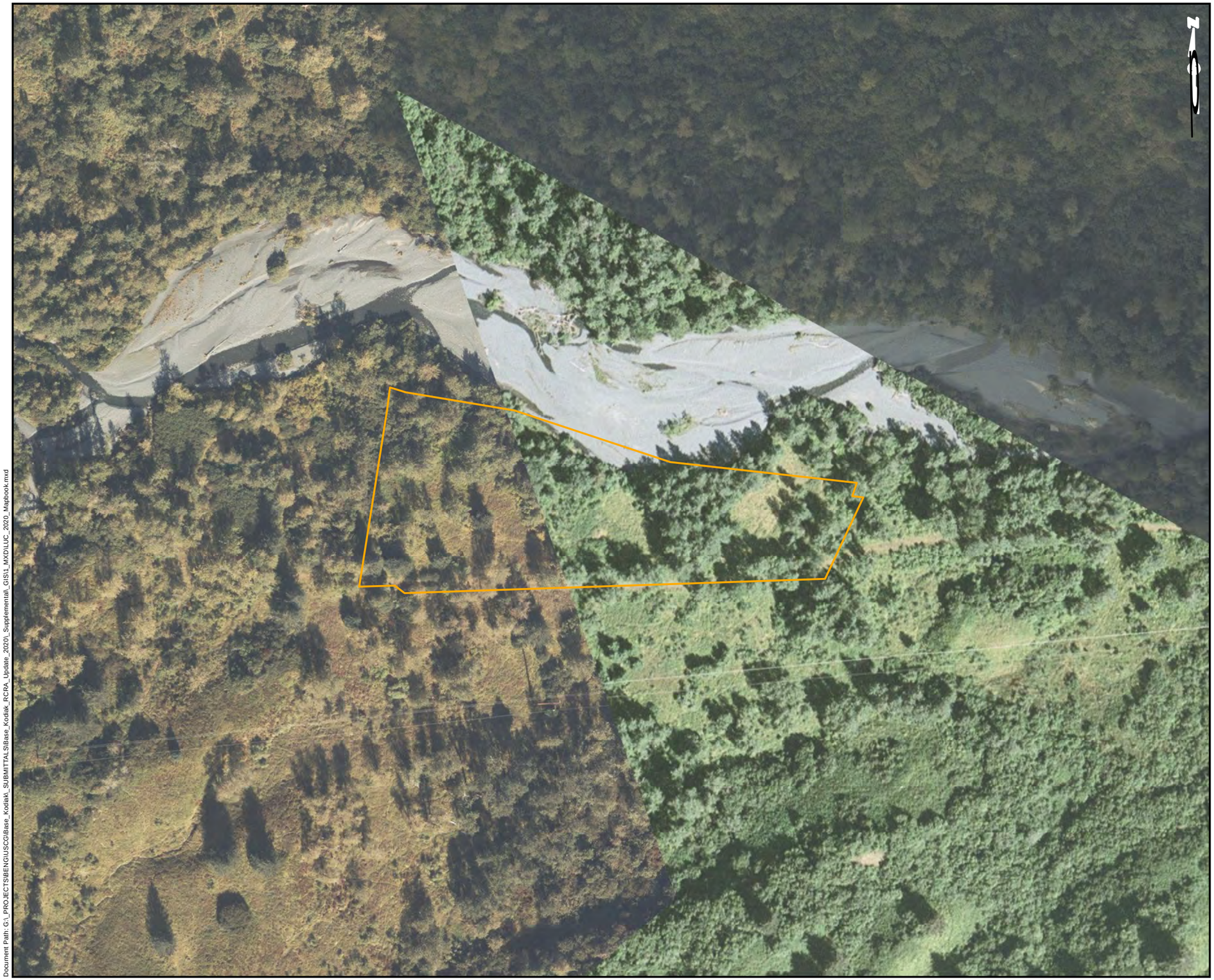
Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 12



Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

150 75 0 150 300

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	11
P.M.: CS	DRAWN: JC	

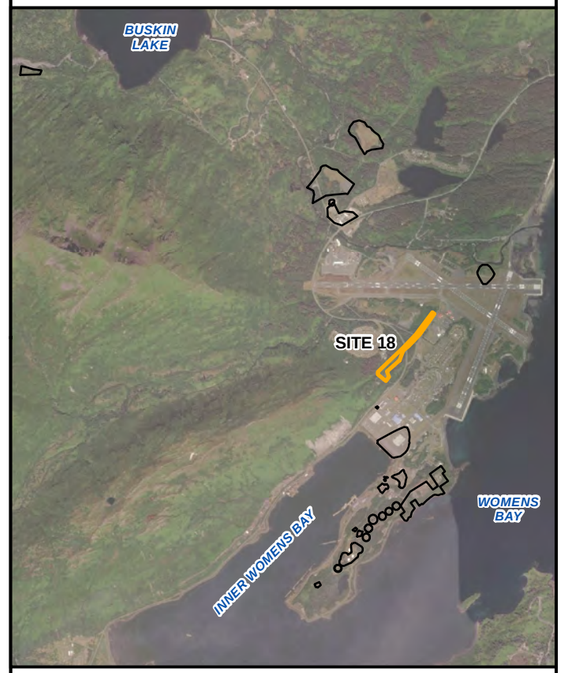
Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 18



Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

400 200 0 400 800

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	12
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENGUSCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 22

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

40 20 0 40 80

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	13
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 23

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

60 30 0 60 120

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	14
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 28

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

40 20 0 40 80

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	15
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 33A

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

80 40 0 80 160

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	**16**
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 34

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

100 50 0 100 200

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	17
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

1 INCH

LAND USE CONTROL IMPLEMENTATION PLAN

USCG BASE KODIAK, KODIAK, ALASKA

SITE 35

Legend

Land Use Control

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, US FEET

HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

100 50 0 100 200

SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680411	8/20/2020	18
P.M.: CS	DRAWN: JC	

Document Path: G:_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Base_Kodiak_RCRA_Update_2020_Supplemental_GIS\1_MXD\LUC_2020_Mapbook.mxd

Draft
Attachment 11
Summaries of Selected Remedies

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

March 2021

This page intentionally blank

TABLE OF CONTENTS

SWMU 1 – COAST GUARD LANDFILL 1
SWMU 10/11 – AIR STATION/PAINT STORAGE AREA.....3
SWMU 18 – DRURY GULCH.....5
SWMU 28 – FORMER BUILDING 17, FORMER ENGINE TEST CELL BUILDING 7
SWMU 33A – EMPTY CONTAINER STORAGE AREA, SUBAREA 33A.....9

APPENDICES

Appendix A Site 1 – Surface Water Sampling Plan
Appendix B Site 10/11 – Corrective Measures Implementation Work Plan
Appendix C Site 18 – Post-Remedial Action Long-Term Monitoring and Maintenance Work Plan

This page intentionally blank

SWMU 1 – COAST GUARD LANDFILL

Selected Remedy

- Re-grading the existing landfill cover and installing the landfill cover system. The cover system consists of a layer of geosynthetic clay liner overlain by 6 inches of compacted material and 6 inches of topsoil.
- Installation of five new passive methane gas vents.
- Seeding the landfill cover and other areas disturbed by construction.
- Raising the manholes of the existing leachate, sewer, and drain lines, as required, to match the final surface of the landfill cover.
- Repairing damaged sections of the perimeter fence and installing access gates in the existing fence.
- Ongoing semi-annual groundwater and surface water monitoring activities to assess water quality and determine the need for additional actions in accordance with Alaska Department of Environmental Conservation (ADEC) Solid Waste program requirements.

In addition to the above actions already implemented at this site, the USCG will implement the following controls at this Solid Waste Management Unit (SWMU):

- Ongoing groundwater and surface water monitoring activities to assess water quality and determine the need for additional actions in accordance with ADEC Solid Waste program requirements.
- The final landfill cover, passive venting system, and surface water and groundwater diversion systems will remain in place and will be inspected semi-annually.
- Access restrictions by a locked vehicle gate at the south end, and signage indicating that unauthorized access is prohibited.
- Requirement in the Base Kodiak dig permit that any intrusive activity in the vicinity of the landfill requires review and approval by the Base Kodiak Facilities Engineer.
- Provisions for annual and five-year review of the land use controls to evaluate their effectiveness.

The Corrective Measures Implementation Work Plan (Site 1 Surface Water Sampling Plan) is provided in Appendix A.

This page intentionally blank

SWMU 10/11 – AIR STATION/PAINT STORAGE AREA

Selected Remedy

- Intrusive activities must be reviewed and approved by the Base Kodiak Facilities Engineer, and notification will be made to any contractors working at the site that petroleum-contaminated soil may be present, and appropriate health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for petroleum hydrocarbons prior to offsite disposal.
- Stormwater monitoring and management in accordance with the U.S. Environmental Protection Agency's Multi-Sector General Permit.
- Groundwater monitoring in sentry wells and seep sampling in the intertidal zone to ensure that any there is no release of contaminants above Alaska ambient water quality standards to Inner Women's Bay.
- Product monitoring and removal in all wells where product has been detected.

The Site 10/11 Corrective Measures Implementation Work Plan is provided in Appendix B.

This page intentionally blank

SWMU 18 – DRURY GULCH

Selected Remedy

- Maintenance of the soil cover to prevent exposure of soils containing PCBs.
- Access restrictions by a locked vehicle gate, and signage indicating that unauthorized access is prohibited.
- Signage provided at either end of the fiber optic cable indicating that intrusive activity requires review and approval by the Base Kodiak Facilities Engineer.
- Requirement in the Base Kodiak dig permit that any intrusive activity in the Gulch requires review and approval by the Base Kodiak Facilities Engineer.
- Provisions for annual and five-year review of the land use controls and five-year review of remedy to evaluate their effectiveness.

The Corrective Measures Implementation Work Plan (Drury Gulch Post-Remedial Action Long-Term Monitoring and Maintenance Work Plan) is provided in Appendix C.

This page intentionally blank

SWMU 28 – FORMER BUILDING 17, FORMER ENGINE TEST CELL BUILDING

Selected Remedy

- The asphalt cover will be maintained over the area.
- Signage has been placed to restrict access to authorized personnel and requiring permission for any intrusive activity.
- Intrusive activities must be reviewed and approved by the Base Kodiak Facilities Engineer, and notification will be made to any contractors working at the site that PCB-contaminated soil may be present, and appropriate health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for PCBs prior to offsite disposal.

This page intentionally blank

SWMU 33A – EMPTY CONTAINER STORAGE AREA, SUBAREA 33A

Selected Remedy

- Signage will be placed to restrict access to authorized personnel and requiring permission for any intrusive activity.
- Intrusive activities must be reviewed and approved by the Base Kodiak Facilities Engineer, and notification will be made to any contractors working at the site that petroleum- contaminated soil may be present and appropriate health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for petroleum prior to off- site disposal.

This page intentionally blank

APPENDIX A
SITE 1 – SURFACE WATER SAMPLING PLAN

This page intentionally blank

Draft Revision
Post-Closure Surface Water Sampling Plan
Former Landfill Site 1
U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

Prepared by:
Ahtna Environmental, Inc.
110 West 38th Avenue, Suite 200B
Anchorage, Alaska 99503

Revised by:
Brice Engineering, LLC
3700 Centerpoint Drive, Suite 8223
Anchorage, Alaska 99503

August 2017
(Revised December 2020)

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **III**

1.0 INTRODUCTION **1-1**

1.1 Site Location 1-1
1.2 Site Background and Monitoring History 1-1
1.3 Geology and Hydrology 1-1
1.4 Project / Data Quality Objectives 1-2
1.5 Regulatory Regime 1-2

2.0 FIELD ACTIVITY PLAN **2-1**

2.1 Field Documentation 2-1
2.2 Landfill Cap Inspection 2-1
2.3 Monitoring Well Inspection 2-1
2.4 Monitoring Well Sampling 2-1
2.5 Surface Water Sampling 2-1

3.0 SAMPLING AND ANALYSIS PLAN **3-1**

3.1 Monitoring Well Purging and Sampling 3-1
3.2 Surface Water Sampling 3-2
3.3 Analytical Methods and Sample Containers 3-2
3.4 Field Quality Control Samples 3-3
3.5 Sample Handling 3-3
3.5.1 Sample Identification 3-3
3.5.2 Chain of Custody 3-4
3.5.3 Sample Packaging and Shipping 3-4
3.6 Decontamination Procedures 3-4

4.0 WASTE MANAGEMENT PLAN **4-1**

5.0 REFERENCES **5-1**

TABLES

Table 1 Water Quality Criteria 1-3
Table 2 Stability Criteria for Water Quality Criteria 3-1
Table 3 Sample Methods, Containers, and Preservation 3-2
Table 4 Field Quality Control Samples 3-3

FIGURES (END OF REPORT)

Figure 1 State and Site Vicinity Maps
Figure 2 Site Features and Sampling Locations

TABLE OF CONTENTS (CONTINUED)

APPENDICES

Appendix A Field Forms
Appendix B Quality Assurance Project Plan
Appendix C Well Construction Logs
Appendix D Alaska Department of Environmental Conservation Comments

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
Ahtna	Ahtna Environmental, Inc.
APDES	Alaska Pollutant Discharge Elimination System
Brice	Brice Engineering, LLC
CFR	Code of Federal Regulations
CoC	chain-of-custody
COD	chemical oxygen demand
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
H_2SO_4	sulfuric acid
HCl	hydrochloric acid
HDPE	high-density polyethylene
HNO_3	nitric acid
L	liter
MCL	maximum contaminant level
mL	milliliter
mg/L	milligrams per liter
MSGP	Multi-Sector General Permit
N/A	not applicable
NTU	nephelometric turbidity unit
ORP	oxidation-reduction potential
pH	potential hydrogen
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
SAIC	Science Applications International Corporation
SAR	sodium absorption ratio
SM	Standard Method
SOP	standard operating procedure
SWMU	Solid Waste Management Unit
TAH	total aromatic hydrocarbons
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
TTHM	total trihalomethanes

ACRONYMS AND ABBREVIATIONS (CONTINUED)

USCG	United States Coast Guard
VOA	volatile organic analysis
VOC	volatile organic compounds
WQC	water quality criteria

1.0 INTRODUCTION

Site 1, also referred to as the United States Coast Guard (USCG) Landfill or USCG Buskin River Landfill, is a Closed Class II landfill in Kodiak, Alaska. Ahtna Environmental, Incorporated (Ahtna) prepared this work plan in 2017 for semi-annual surface water monitoring in support of post-closure detection monitoring at Site 1. At the request of USCG, Brice Engineering, LLC (Brice) prepared and submitted revisions to the work plan in December 2020 in response to comments received from Alaska Department of Environmental Conservation (ADEC) Solid Waste Program, included in Appendix D.

Revisions to the work plan include water quality criteria revised to reflect ADEC Solid Waste Program Surface Water Standards Table criteria, updated references, and generalizing the work plan for applicability to any contractor performing post-closure monitoring on behalf of USCG.

This work plan describes the requirements and methods for continued monitoring at Site 1 and includes a Field Activity Plan (Section 2.0), Sampling and Analysis Plan (Section 3.0), and Waste Management Plan (Section 4.0). The Quality Assurance Project Plan (QAPP) is included in Appendix B.

1.1 Site Location

The Site 1 landfill encompasses approximately 12.6 acres of land. Site 1 is located within the Buskin River drainage, north of the Kodiak Airport in Kodiak, Alaska at 57° 46’ North, 152° 30’ West (Figure 1).

1.2 Site Background and Monitoring History

The landfill at Site 1 was used almost exclusively for municipal solid waste from the early 1970s until 1987, when it stopped accepting waste, and landfill closure was initiated. Landfill closure involved installing surface water diversion ditches around the perimeter of the landfill to prevent surface water runoff from entering the landfill, and a groundwater diversion system to intercept groundwater before it enters the landfill. Also installed were both a passive methane venting system and a leachate collection system that routes collected leachate to the USCG Base Kodiak wastewater treatment plant. Site 1 was officially closed in 2000 when it was capped with a geoclay barrier, covered with soil, and revegetated. Post-closure groundwater monitoring began in 2002 (Hart Crowser, 2003).

1.3 Geology and Hydrology

Bedrock in this area of Kodiak Island consists of the Kodiak Formation of the Late Cretaceous period. The Kodiak Formation consists mainly of graded beds of sandstone and shale (United States Geological Survey, 2013). Site 1 is situated in a basin formed by relatively steep bedrock-supported slopes (Science Applications International Corporation [SAIC], 1995). Exposed bedrock in the vicinity of the landfill has been described as low-grade metamorphic shale and slate that is fine-grained, thinly bedded to laminated, and dark gray to black. In general, porosity is low as a result of metamorphic texture and secondary mineral growth, although subsequent fracturing has resulted in localized increases in permeability (SAIC, 1991).

Colluvial and alluvial deposits overlay the bedrock within the basin and consist of poorly sorted mixtures of clayey and silty sands and gravels up to at least 10 feet thick. Katmai volcanic ash and peat have been identified in the drainages surrounding the landfill to the north, northwest, and southeast (SAIC, 1995).

Groundwater flow at Site 1 is controlled by low-permeability bedrock surrounding the landfill and water discharges through three saddle areas located northwest, south, and east of the landfill (Figure 2). A series of groundwater diversion devices (vertical, impermeable membranes keyed into the bedrock) have been installed to reduce groundwater flow into the landfill area. A leachate collection system routes leachate to the Base Kodiak wastewater treatment plant. Previous wells which were used to describe groundwater flow have been decommissioned, and the four remaining wells are strategically placed in the saddle regions to monitor groundwater quality migrating from the landfill area.

Groundwater near the landfill occurs at shallow depths from 2 to 15 feet below ground surface. The seasonal groundwater table fluctuation at the site is typically between 1 and 2 feet. Groundwater elevations are generally lower in the spring than in the fall.

1.4 Project / Data Quality Objectives

The project objectives are to ensure there are no releases of contaminants from the closed landfill and to ensure the integrity of the landfill cap. The following tasks will be performed to achieve this objective:

- Water will be sampled semi-annually at the site from four monitoring wells and three surface water locations
- Landfill cap inspection will be completed semi-annually

The USCG and ADEC will reevaluate the monitoring frequency after three years of surface water monitoring, beginning October 2016. As of November 2020, no changes to the sampling frequency have been requested; recent semi-annual monitoring reports and comments from ADEC suggest continued semi-annual monitoring in order to assess seasonal changes (comments dated 16 October 2020, Appendix D). A discussion of the data quality objectives is provided in the QAPP included in Appendix B.

1.5 Regulatory Regime

Site 1 is currently regulated by the ADEC Solid Waste Division under Title 18 of the Alaska Administrative Code (AAC), Chapter 60 (18 AAC 60), Solid Waste Management (ADEC 2013). The site is also regulated as a Solid Waste Management Unit (SWMU) by the Environmental Protection Agency (EPA) under the Corrective Action Process identified in the Base Kodiak Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit AK 969 033 0742 (EPA 2021). After closure of the landfill, the EPA allowed ADEC to manage the post-closure monitoring. Analytical laboratory results were historically compared to ADEC-approved Groundwater Protection Standards.

Due to the shallow nature of the groundwater and the similarity in analytical results between groundwater and surface water, the USCG, in a letter dated August 25, 2016, requested that all water at the site be considered surface water for the purpose of regulation. On September 6, 2016, ADEC approved USCG's request to consider all water at Site 1 as surface water. Subsequently, beginning in October 2016, analytical results were compared to criteria in accordance with 18 AAC 70 *Water Quality Standards* and the *Alaska Water Quality Criteria Manual* (ADEC 2008); analytes without criteria were compared to 18 AAC 75 Table C groundwater cleanup levels. However, as of November 2020, analytical results will be compared to Water Quality Criteria (WQC) as defined in ADEC Solid Waste Program's *Surface Water Standards Table*, due to requested revisions. The WQC are based on a hierarchy of standards presented in the *Surface Water Standards Table*, *Technical Memorandum 18.02* (ADEC 2019a). The WQC and source of criteria are presented in Table 1.

Table 1 Water Quality Criteria

ANALYTE	WQC	SOURCE OF CRITERIA[1]
Field Measured Parameters		
DO	>4 mg/L	F
pH	6.5-8.5	B
Temperature	<15°C	18 AAC 70*
Turbidity	<5 NTU *above natural conditions*[2]	F
Conventional by E300.0/SM2540C/SM2540D/SM5220D/SM5310B	**mg/L**	
Total Organic Carbon (TOC)	-	
Chemical Oxygen Demand (COD)	-	
Total Dissolved Solids (TDS)	500 mg/L	C
Total Suspended Solids (TSS)	-	
Chloride	250 mg/L	C
Sulfate	250 mg/L	C
Metals by E200.8/E245.1	**µg/L**	
Antimony	6	A
Arsenic	10	A
Barium	2000	A
Beryllium	4	A
Cadmium	5	A
Calcium	-	
Chromium	100	A
Cobalt	-	
Copper	1300	A
Iron	1000	B
Lead	15	A
Magnesium	-	
Manganese	50	C
Nickel	390	D
Selenium	50	A
Silver	100	C
Thallium	2	A
Vanadium	86	D
Zinc	200	B
Mercury	2	A
VOCs by SW8260C	**µg/L**	
1,1,1,2-Tetrachloroethane	5.7	D
1,1,1-Trichloroethane	200	A
1,1,2,2-Tetrachloroethane	0.76	D
1,1,2-Trichloroethane	5	A

Table 1 Water Quality Criteria

ANALYTE	WQC	SOURCE OF CRITERIA[1]
1,1-Dichloroethane	28	D
1,1-Dichloroethene	7	A
1,2,3-Trichloropropane	0.0075	D
1,2-Dibromo-3-chloropropane	0.2	A
1,2-Dibromoethane	0.075	D
1,2-Dichlorobenzene	600	A
1,2-Dichloroethane	5	A
1,2-Dichloropropane	6	A
1,4-Dichlorobenzene	75	A
2-Butanone	5600	D
2-Hexanone	38	D
4-Methyl-2-pentanone	6300	D
Acetone	14000	D
Acrylonitrile	6	A
Benzene	5	A
Bromochloromethane	90	E
Bromodichloromethane	1.3	D
Bromoform	33	D
Bromomethane	7.5	D
Carbon disulfide	810	D
Carbon tetrachloride	5	A
Chlorobenzene	100	A
Chlorodibromomethane	8.7	D
Chloroethane	21000	D
Chloroform	2.2	D
Chloromethane	190	D
cis-1,2-Dichloroethene	70	A
cis-1,3-Dichloropropene	4.7	D
Dibromochloromethane	8.7	D
Dibromomethane	8.3	D
Ethylbenzene	700	A
m,p-Xylene	10000	A
Methyl iodide	-	G
Methylene chloride	110	D
o-Xylene	10000	A
Styrene	100	A
Tetrachloroethene	5	A
Toluene	1000	A
trans-1,2-Dichloroethene	360	D

Table 1 Water Quality Criteria

ANALYTE	WQC	SOURCE OF CRITERIA[1]
trans-1,3-Dichloropropene	4.7	D
trans-1,4-Dichloro-2-butene	-	G
Trichloroethene	5	A
Trichlorofluoromethane	5200	D
Vinyl acetate	410	D
Vinyl chloride	2	A
Total Xylenes	10000	A
Calculated Constituents		
SAR	2.5	A
TAH	10 µg/L	F
TTHM	80 µg/L	40 CFR 141*

Notes:

[1] Sources of water quality criteria as defined in ADEC Solid Waste Program Surface Water Standards Table:
A = EPA Primary Drinking Water MCLs (40 CFR 141)
B = APDES MSGP, Sector L
C = EPA Drinking Water Secondary MCLs (40 CFR 143)
D = 18 AAC 75 Table C
E = EPA Lifetime Health Advisory Level
F = Alaska WQS (18 AAC 70)
G = No standard exists, one may be developed by the facility in consultation with ADEC

[2] Turbidity may not exceed 5 NTU above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU.

* Criteria not established in ADEC Solid Waste Program Surface Water Standards Table.

\- Indicates the criteria is not established.

°C = degrees Celsius
µg/L = microgram per liter
AAC = Alaska Administrative Code
ADEC = Alaska Department of Environmental Conservation
APDES = Alaska Pollutant Discharge Elimination System
CFR = Code of Federal Regulations
COD = chemical oxygen demand
DO = dissolved oxygen
EPA = U.S. Environmental Protection Agency
MCL = maximum contaminant level
mg/L = milligram per liter
MSGP = Multi-Sector General Permit
NTU = nephelometric turbidity unit
SAR = sodium absorption ratio
TAH = total aromatic hydrocarbons
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
TTHM = total trihalomethanes
VOC = volatile organic compound
WQC = Water Quality Criteria

As necessary, hardness will be calculated from calcium and magnesium to determine sample-specific hardness dependent WQCs. Metals samples will be collected and analyzed by the laboratory as total concentrations, and dissolved concentrations will be calculated from the totals. Total aromatic hydrocarbons (TAH), total trihalomethanes (TTHM), and sodium absorption ratio (SAR) will be calculated and compared to the WQC; the SAR formula is provided in *Surface Water Standards Table* (ADEC 2019a). A trend analysis will be performed on analytes/constituents that exceed WQCs to ensure there are no statistically significant changes in water quality over time.

This page intentionally blank

2.0 FIELD ACTIVITY PLAN

The following field activities will be performed semi-annually during high flow and low flow conditions. The high flow event will occur in April and the low flow event will occur in October. Exact dates are unknown and will be scheduled with respect to weather and other potential travel issues. Field activities will be performed in accordance with 18 AAC 60, ADEC's *Field Sampling Guidance* (ADEC 2019b), and the Sampling and Analysis Plan in Section 3.0 of this work plan. Waste will be managed according to the Waste Management Plan in Section 4.0 of this work plan.

2.1 Field Documentation

Field documentation will include sample identification labels, photographs, laboratory analysis requests, and permanently bound field logbooks. A field logbook will be maintained by the contractor's field team lead to record a detailed description of all field activities and samples collected. Pages will not be removed from any data logbook for any reason.

2.2 Landfill Cap Inspection

The landfill cap will be inspected for damage, signs of erosion, or ponding water during each field event. Surrounding drainage ditches will be inspected for debris and leachate. The perimeter of the cap will be inspected for indications of intrusion, damage, and frost heaving of the fence posts. Any surface water staining or other possible signs of leaching will be noted and documented with photographs. The landfill cap inspection form (Appendix A) will be completed for each inspection.

2.3 Monitoring Well Inspection

Each monitoring well will be inspected for damage prior to sampling activities. The monitoring well inspection form will be completed for each field event and a discrepancy form will be completed for every well with a discrepancy noted. If a discrepancy is noted, the USCG project manager will be notified at the completion of the field event. Monitoring well inspection and deficiency forms are included in Appendix A.

2.4 Monitoring Well Sampling

Four monitoring wells will be purged and sampled during each field event. Figure 2 depicts the sample locations. The existing monitoring wells to be inspected and sampled are:

- MW-01-007
- MW-01-060B
- MW-01-061
- MW-01-062

2.5 Surface Water Sampling

Three surface water locations will be sampled during each field event. Figure 2 depicts the sample locations. The three surface water sample locations are designated:

- SW-01-050
- SW-01-051
- SW-01-052

Surface water sample locations are marked in the field with wooden stakes next to the drainage area to be sampled.

3.0 SAMPLING AND ANALYSIS PLAN

3.1 Monitoring Well Purging and Sampling

Monitoring well samples will be collected utilizing low-flow sampling procedures in accordance with ADEC's *Field Sampling Guidance* (ADEC 2019b) and Base Kodiak Post-Closure Monitoring SOPs: *Well Purging and Groundwater Sampling*. The SOPs, which are provided in the QAPP (Appendix B, Attachment B-1), are included as Attachment 4A, Exhibit 6 of the revised *RCRA Hazardous Waste Facility Management Permit* dated March 2021 (EPA 2021). All monitoring wells will be sampled using a pneumatic bladder pump Teflon-lined tubing. The methodology for purging and sampling is summarized below:

1. Measure water level and total depth to the nearest 0.01 foot using a water level meter.
2. Attach pump to the tubing and lower it into the water column. Attach the other end of the tubing to the flow-through cell.
3. Start the pump and check water level. Adjust purge rate to minimize and stabilize drawdown.
4. Routinely measure and record dissolved oxygen (DO), oxidation reduction potential (ORP), conductivity, potential hydrogen (pH), turbidity, temperature, and current groundwater level throughout the purge at approximately 3- to 5- minute intervals. Record parameters on a sampling form.
5. Water samples will be collected after a minimum of three field parameters have stabilized within the limits shown on Table 2 below. If parameters do not stabilize, a minimum of three well volumes will be removed (ADEC 2019b).
6. A final reading will be made for temperature, pH, conductivity, ORP, and DO. Disconnect flow-through cell and collect a final turbidity reading. Collect sample according to sample methods and containers described in Table 3.

Table 2 Stability Criteria for Water Quality Criteria

PARAMETER	UNIT	STABILITY CRITERION
Temperature	°C	± 3% °C (minimum of ±0.2°C)
pH	N/A	± 0.1
Conductivity	µS/cm	± 3% µS/cm
ORP	mV	± 10 mV
DO	mg/L	± 10% mg/L
Turbidity	NTU	± 10% NTU or <5 NTU

Notes:
°C = degrees Celsius
µS/cm = microsiemens per centimeter
mg/L = milligrams per liter
mV = millivolts
N/A = not applicable
NTU = nephelometric turbidity units
ORP = oxygen reduction potential

In the event a monitoring well dewaters during purging after following the procedures outlined above, the water samples will be collected as soon as the water level has recovered to approximately 80% of its original well volume.

3.2 Surface Water Sampling

Surface water samples will be collected using the EPA's Region 9 direct dip method. A closed, unpreserved sample jar will be submerged into the stream, then uncapped to allow water to fill the jar. The water in the jar will then be used to fill all the other sample containers. Containers will be filled in the order listed in Table 3. Water quality parameters (temperature, pH, conductivity, ORP, DO, and turbidity) will be recorded at each surface water location after sample collection is completed using a water quality meter.

3.3 Analytical Methods and Sample Containers

Monitoring well and surface water samples will be collected in laboratory-supplied jars and submitted for laboratory analysis of the following:

- Volatile organic compounds (VOCs; organic constituents from 40 Code of Federal Regulations [CFR] 258 Appendix I) by EPA Solid Waste Method (SW) Standard 8260C
- Total metals (antimony, arsenic, barium, beryllium, calcium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, zinc, iron, manganese, magnesium) by EPA 200.7/200.8
- Total mercury by EPA 245.1
- Chloride/sulfate by EPA 300.0
- Chemical oxygen demand (COD) by EPA Standard Method (SM) 5220D
- Total dissolved solids (TDS) by EPA SM 2540C
- Total suspended solids (TSS) by EPA SM 2540D
- Total organic carbon (TOC) by EPA SM 5310B

Table 3 describes the analytical methods, associated information, and presents the order for which sample jars will be filled.

Table 3 Sample Methods, Containers, and Preservation

ANALYTE / ANALYTE GROUP	ANALYTICAL METHOD	CONTAINERS (QUANTITY) VOLUME, TYPE	PRESERVATION	HOLDING TIME
VOC	SW8260C	(3) 40-mL VOA vials with Teflon-lined septa lids	HCl, 0°C to 6°C	14 days to analysis
TOC	SM 5310B	(2) 250-mL amber glass jar	H_2SO_4, 0°C to 6°C	28 days to analysis
COD	SM 5220D			28 days to analysis
Total Mercury	EPA 245.1	(1) 250-mL HDPE	HNO_3, 0°C to 6°C	28 days to analysis
Total Metals	EPA 200.7/200.8			6 months to analysis
Chloride / Sulfate	EPA 300.0	(1) 500-mL HDPE	0°C to 6°C	28 days to analysis
TDS	SM 2540C			7 days to analysis
TSS	SM 2540D	(1) 1-L HDPE	0°C to 6°C	7 days to analysis

Notes:
°C = degrees Celsius
COD = chemical oxygen demand
EPA = U.S. Environmental Protection Agency
H_2SO_4 = sulfuric acid
HCl = hydrochloric acid
HDPE = high density polyethylene
HNO_3 = nitric acid
L = liter
mL = milliliter
TDS = total dissolved solids
TOC = total organic content
TSS = total suspended solids
VOA = volatile organic analysis
VOC = volatile organic compounds

3.4 Field Quality Control Samples

Quality control (QC) objectives of this project are described in Section 3 of the QAPP. Table 4 summarizes the number, type, and methods of field QC samples that will be collected and sent to the laboratory for each analytical group and concentration level.

Table 4 Field Quality Control Samples

QUALITY CONTROL SAMPLE	MEDIA	ANALYTICAL METHOD	FREQUENCY
Field Duplicate	Water	Same as primary samples	1 per 10 samples (10%) per each analytical method
Equipment Blank	Deionized Water	Same as primary samples	1 per sampling event
Field Blank	Deionized Water	Same as primary samples	1 per sampling event
Trip Blank	Water	SW 8260C	1 per sample cooler containing volatile samples
Temperature Blank	40-mL vials of tap water	N/A	1 per sample cooler
Site Specific Matrix Spike	Water	Same as primary samples	1 per 20 (5%) per each analytical method
Site Specific Matrix Spike Duplicate	Water	Same as primary samples	1 per 20 (5%) and each analytical method

Notes:
N/A = not applicable

3.5 Sample Handling

3.5.1 Sample Identification

Each sample container will be sealed and labeled immediately after collection. Sample labels will be completed using waterproof ink and will be affixed firmly to sample containers. Samples will be identified by the following convention:

- Sample matrix
  - GW for samples collected from monitoring wells
  - SW for samples collected from surface water streams; and
  - WR for water (trip blanks, field blanks, etc.)
- Site Number – 01
- Location number – the last three digits of the well number or sample location number
- Sequence number
  - 01 for primary samples
  - 02 for duplicate samples
- Phase number
  - Phase numbers are assigned sequentially to sampling events. Phase numbers are also used for investigations other than at Site 1 and are assigned by the contract project manager and the contract data manager.

- For example, the first sample collected from monitoring well MW-01-062 during phase 201 will be identified as GW-01-062-01-201.

3.5.2 Chain of Custody

A chain-of-custody (CoC) record will be completed and shipped with the samples. A separate CoC form will be generated for each sample cooler, and will include only the samples within that cooler. Proper sample custody is maintained through adherence to the procedures listed below.

- Custody seals will be placed in two locations over the lid/cooler edge and secured with clear packing tape.
- A CoC record must accompany the coolers in which the samples are packed. When transferring samples, the individuals relinquishing and receiving the coolers must sign, date, and note the time on the CoC record.

3.5.3 Sample Packaging and Shipping

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. Adherence to the following sample package requirements is essential:

- Sample container lids will not be mixed. All lids must remain with their original container.
- Environmental samples must be cooled to 0 degrees Celsius (°C) to 6°C to preserve chemical constituents. Gel ice will be spaced throughout the coolers to maintain cooled temperature. All coolers will contain a temperature blank that the laboratory will use to document sample temperatures.
- Any cooler containing VOC samples will also include a trip blank.
- Any remaining space in the cooler should be filled with inert packing material such as bubble wrap, newspaper, etc. Under no circumstances should material such as sawdust, sand, or Styrofoam peanuts be used.

Environmental samples will be properly packaged and labeled inside an insulated cooler for transport via Alaska Air Cargo to the analytical laboratory. The airway bill will be sent to the contractor's chemist who will forward to the laboratory and notify them of the arrival time of the shipment.

3.6 Decontamination Procedures

Reusable, non-dedicated sampling equipment, including pumps and water level meters, will be decontaminated between each use. Decontamination procedures will consist of washing the equipment with an Alconox and deionized water mixture, followed by a deionized water rinse. Water generated during decontamination will be combined with purge water and collected in 5-gallon buckets with snap-top lids. Decontamination will be performed in accordance with Base Kodiak Post-Closure Monitoring SOP: *Decontamination of Sampling Equipment*.

4.0 WASTE MANAGEMENT PLAN

Investigation-derived solid wastes likely to be generated include purge and decontamination water, used sample tubing, nitrile gloves, and paper towels. All solid waste will be placed in trash bags for disposal in the general trash collection system as available in Kodiak.

Purge water and decontamination water generated during sampling activities will be discharged to the ground surface onsite near the sample location.

This page intentionally blank

5.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2008 (December). *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances*.

ADEC. 2017 (November). *Solid Waste Management*. 18 AAC 60.

ADEC. 2018 (April). *Water Quality Standards*. 18 AAC 70.

ADEC. 2019a (February). *Surface Water Standards Table, Technical Memorandum 18.02.* Division of Environmental Health Solid Waste Program.

ADEC. 2019b (October). *Field Sampling Guidance*.

Hart Crowser. 2003 (January). *Post-Closure Monitoring Report, Fall 2002, USCG ISC Kodiak, Site 1 – Landfill, Kodiak, Alaska*.

Science Applications International Corporation (SAIC). 1991 (January). *RCRA Facility Investigation Report, US Coast Guard Support Center Kodiak, Volume II*.

SAIC. 1995 (February). *Final RFI/CMS Report, Volume 1 – Introduction and Facility-Wide Information, U.S. Coast Guard Support Center Kodiak, Kodiak, Alaska*.

United States Environmental Protection Agency (EPA). 2021. (March) (revised). *Resource Conservation and Recovery Act Hazardous Waste Facility Management Permit, Permit No. AK9 69033 0742*. Issued by the EPA Region 10 in April 2011 to USCG Base Kodiak.

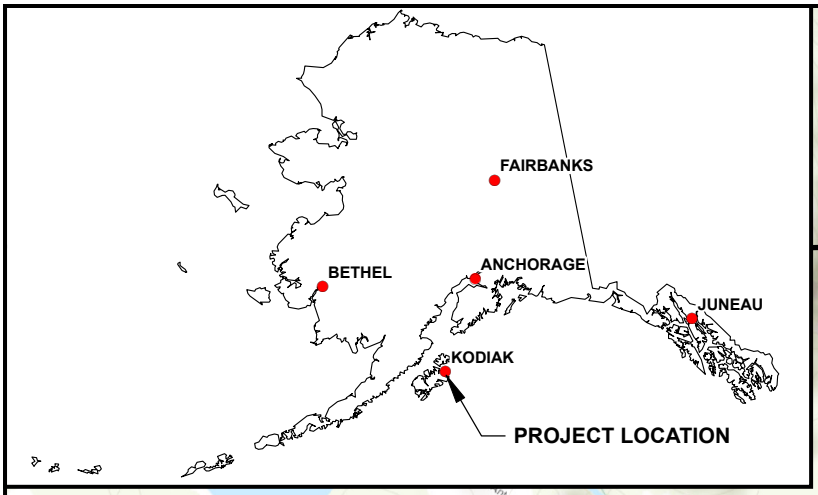
United States Geological Survey (USGS). 2013. *Reconnaissance Geologic Map of Kodiak Island and Adjacent Islands, Alaska*.

This page intentionally blank

FIGURES

This page intentionally blank

1 INCH



Site 1

BAROMETER MOUNTAIN

OLD WOMENS MOUNTAIN

Devils Creek

Pillar Creek

Catherine Lake

Louise Lake

Old Tom Stiles Rd

S Alheska Ave

W Rezanof Dr

Buskin River State Recreation Site

Bushkin Beach Rd

Buskin River

Kodiak Airport

Aviation Hill Loop Rd

Tom Stiles Rd

Polaris Ave

Atlantis Ave

Windrider Dr

Nyman Peninsula

Seafarer Dr

Alaska Maritime Nat'l Wildlife Ref

Cliff Point

Gibson Cove Rd

Larsen Bay Rd

Legend

- Site 1 Boundary
- Approximate USCG Property Boundary

0 0.5 1
Miles

POST-CLOSURE SURFACE WATER SAMPLING PLAN
FORMER LANDFILL SITE 1
USCG BASE KODIAK, KODIAK, ALASKA

STATE AND SITE VICINITY

DATE: 11/24/2020

PROJECT No.: 680403

DRAWN: CMH

FIGURE: 1

Document Path: \\brice.local\dfs\Anchorage\Environmental\Shared\GEOSPATIAL_PROJECTS\BENG\USCG\Base_Kodiak_SUBMITTALS\Site_1_WP_Revision_Supplemental_GIS\1_MXD\F_01_Vacinity.mxd

This page intentionally blank

1 INCH

POST-CLOSURE SURFACE WATER SAMPLING PLAN FORMER LANDFILL SITE 1

USCG BASE KODIAK, KODIAK, ALASKA

SITE FEATURES AND SAMPLING LOCATIONS

Legend

- 76.17 Groundwater Elevation (USFT)
- Surface Water Sample Location
- Monitoring Well
- Surface Water Flow
- Drains
- Topography
- Fence
- Cap Boundary
- Gravel Road
- Inferred Direction of Groundwater Flow

Abbreviations

USFT U.S. Survey Feet

Notes

1. Depth to groundwater and total depth measurements collected on 22 and 23 May 2020 prior to purging and sampling at each well.
2. Groundwater elevation presented in USFT based on Kodiak Land Surveying's value for well MW-01-060B.

References

1. Imagery Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
2. Monitoring well survey conducted in November and December 2018 by Kodiak Land Surveying.
3. Monitoring well vertical survey conducted in May 2020 by Brice Engineering, LLC.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5, U.S. SURVEY FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

150 75 0 150 300
SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
680403	11/24/2020	02
P.M.: CS	DRAWN: CMH	

This page intentionally blank

APPENDIX A
FIELD FORMS

This page intentionally blank

Groundwater Sampling Form

Project: Site 1 SW Monitoring **Site Location:** _____

Project #: **Sample Location:** _____

Water Column

Total Depth of Well (feet): _____ Water Level Measurement Date: _____

Depth to Water from TOC (feet): _____ Water Level Measurement Time: _____

Column of Water in Well (feet): _____ Pump Intake (feet BTOC): _____

Purge Information

Gallons per foot of 2" Screen: 0.17 Total Volume Removed (gal): _____

Column of Water in Well (feet): X Purge Method: _____

Volume of Water in Well Casing (gal): =

Field Parameters

Time	Depth to Water (ft)	Purge Rate (mL/min)	Temp (°C)	pH	Sp. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	ORP (mV)

Sample Information

Sample Date: _____ **Sample Number:** _____

Sample Time: _____ **Field Duplicate Number:** _____

Sample Method: _____ **Sampler:** _____

Laboratory Analyses Requested: _____

Comments: _____

This page intentionally blank

Surface Water Sampling Form

Project: Site 1 SW Monitoring **Site Location:** _____

Project #: **Sample Location:** _____

Sample Location Description:

Field Parameters

Time	Depth to Water (ft)	Purge Rate (mL/min)	Temp (°C)	pH	Sp. Cond. (mS/cm)	Turbidity (NTU)	DO (mg/L)	ORP (mV)

Sample Information

Sample Date: _____ **Sample Number:** _____

Sample Time: _____ **Field Duplicate Number:** _____

Sample Method: _____ **Sampler:** _____

Laboratory Analyses Requested:

Comments:

This page intentionally blank

COAST GUARD SITE 1 (LANDFILL)
POST CLOSURE INSPECTION CHECKLIST AND REPORT FORM

GROUNDWATER MONITORING WELLS
SEMI-ANNUAL INSPECTION

	Well Cover			Monitoring Well			Bollards			
Well ID	Signs of Tampering	Lock Condition	Seals (flushmount)	Indication of frost heave	Well ID	Downhole Obstructions	Damaged	Indications of frost heave	Secure in ground	Visibility
MW-01-060B										
MW-01-061										
MW-01-062										
MW-01-007										

If finding is unsatisfactory, fill out Groundwater Monitoring Well Deficiency Report for each unsatisfactory well.

Inspector's Signature:_____ Date: _____

This page intentionally blank

US COAST GUARD BASE KODIAK
POST-CLOSURE INSPECTION CHECKLIST AND REPORT FORM

MONITORING WELL DEFICIENCY REPORT

WELL ID:		
Item	**Finding**	**Comments/Action Taken**
Well Cover: ■ Signs of tampering ■ Lock condition ■ Seals (flushmount)		
Monitoring Well: ■ Indication of frost heave ■ Well ID ■ Downhole obstructions		
Bollards: ■ Damaged ■ Indications of frost heave ■ Secure in ground ■ Visibility		
Inspector's Signature:		Date:

This page intentionally blank

U.S. Coast Guard ISC Kodiak SITE 1 – U.S. Coast Guard Landfill Landfill Cover Checklist		
Item	**Finding**	**Comment**
Soil Cover: ■ Signs of settling or heave ■ Signs of environmental damage due to wind, water, freezing/thaw cycle, or intrusion by plants or animals ■ Signs of improper surface water drainage such as ponding.		
Leachate Collection System: ■ Piping conveying leachate ■ Manholes in good condition		
Gas Vent System ■ Protective bores remain in place ■ Screens in good condition		
Drainage System: ■ Drains clear of sediment and other debris ■ Manholes and piping in good condition		
Runon/Runoff Control: ■ Erosion problems ■ Signs of environmental damage or intrusion by plants (other than grasses) or animals ■ Swales in good condition ■ Perimeter ditches in good condition		
Protective Fences and Gates: ■ Hinges, latches, lock and gate in good condition ■ Posts secure in ground ■ Fence in good condition ■ Gate operational and secure		
Inspector's Signature:		**Date of Inspection:**

This page intentionally blank

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

This page intentionally blank

Draft Revision
Quality Assurance Project Plan
Former Landfill Site 1
U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

Prepared by:
Ahtna Environmental, Inc.
110 West 38th Avenue, Suite 200B
Anchorage, Alaska 99503

Revised by:
Brice Engineering, LLC
3700 Centerpoint Drive, Suite 8223
Anchorage, Alaska 99503

August 2017
(Revised December 2020)

This page intentionally blank

Distribution List

Kate von Rekowski
USCG Civil Engineering Unit Juneau
PO Box 25517
709 West Ninth, Room 817
Juneau, Alaska 99802-5517

Jennifer Nutt
USCG Environmental Division Chief
PO Box 195025
USCG Base Kodiak
Kodiak, Alaska 99619-5025

Jan Palumbo (AWT-121)
U.S. EPA Region 10
1200 6th Avenue, Suite 900
Seattle, Washington 98101

Kaylie Holland
ADEC Solid Waste Program
555 Cordova Street
Anchorage, Alaska 99501

Tong Li
EPA Contractor
14545 SE 56th Street
Bellevue, Washington 98006

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **B-III**

1.0 INTRODUCTION **B-1-1**

1.1 Project Organization, QAPP Distribution, and Personnel Qualifications B-1-1
1.2 Communication Pathways B-1-2
1.3 Problem Formulation and Background B-1-2
1.3.1 Regulatory Framework B-1-3
1.4 Monitoring Schedule B-1-3
1.5 Project Quality Objectives B-1-3
1.5.1 Plan for Obtaining Data B-1-3

2.0 SAMPLING LOCATIONS AND APPROACH **B-2-1**

3.0 SAMPLING DESIGN AND RATIONALE **B-3-1**

3.1 Sampling Procedures B-3-1
3.2 Field Equipment B-3-1
3.3 Field Quality Control Sample Summary B-3-2
3.4 Field Documentation B-3-2
3.5 Field Equipment Calibration, Maintenance, Testing, and Inspection B-3-3
3.6 Sample Handling, Custody, and Disposal B-3-3
3.7 Project Sampling SOP References B-3-4
3.8 Assessments and Corrective Action B-3-5
3.8.1 Documentation of Nonconforming Items B-3-5
3.8.2 Implementation of Corrective Action B-3-5
3.8.3 Verification and Documentation of Corrective Action B-3-5

4.0 ANALYTICAL METHODS **B-4-1**

5.0 DATA QUALITY OBJECTIVES **B-5-1**

6.0 PERFORMANCE OR ACCEPTANCE CRITERIA **B-6-1**

6.1 Measurement Performance Criteria B-6-1
6.2 Project Action Limits and Laboratory Specific Quantitation Limits B-6-9

7.0 DATA ASSESSMENT **B-7-1**

7.1 Data Reduction B-7-2
7.2 Data Validation Procedures B-7-2
7.3 Data Quality Requirements B-7-3
7.4 Data Usability Assessment B-7-4
7.5 Statistical Approach B-7-5

8.0 DELIVERABLES **B-8-1**

8.1 Project Documents and Records Table B-8-1
8.2 Reporting B-8-1

9.0 REFERENCES **B-9-1**

TABLE OF CONTENTS (CONTINUED)

TABLES

Table 1	Project Roles and Responsibilities	B-1-1
Table 2	Communication Pathways	B-1-2
Table 3	Sample Locations and Analytical Methods	B-3-1
Table 4	Field Quality Control Samples	B-3-2
Table 5	Sample Handling, Custody, and Disposal	B-3-4
Table 6	Standard Operating Procedures	B-3-4
Table 7	Assessment	B-3-7
Table 8	Assessment Response and Corrective Actions	B-3-7
Table 9	Sample Methods, Containers, and Preservation	B-4-2
Table 10	VOC, EPA Method SW8260C	B-6-2
Table 11	Total Metals, EPA Method 200.8	B-6-3
Table 12	Total Mercury, EPA Method 245.1	B-6-4
Table 13	Chloride/Sulfate, EPA Method 300.0	B-6-5
Table 14	COD, EPA Method SM 5220D	B-6-6
Table 15	TDS, EPA SM 2540C	B-6-7
Table 16	TSS, EPA SM 2540D	B-6-8
Table 17	TOC, EPA SM 5310B	B-6-9
Table 18	Water Quality Criteria and Lab-Specific Limits	B-6-10
Table 19	Data Validation Requirements	B-7-2
Table 20	Usability Assessment Process	B-7-4
Table 21	Project Documents and Record	B-8-1
Table 22	Document Distribution	B-8-2

ATTACHMENTS

Attachment B-1	USCG Kodiak Standard Operating Procedures
Attachment B-2	EMAX Laboratories, Inc. Standard Operating Procedures
Attachment B-3	Laboratory Certifications

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
%	percent
µg/L	micrograms per liter
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
Ahtna	Ahtna Environmental, Inc.
Brice	Brice Engineering, LLC
CoC	chain of custody
COD	chemical oxygen demand
DL	detection limit
DoD	Department of Defense
DQI	Data Quality Indicator
DQO	Data Quality Objective
DQR	Data Quality Report
EDD	electronic data deliverable
EMAX	EMAX Laboratories, Inc.
EPA	U.S. Environmental Protection Agency
GC/MS	gas chromatography/mass spectroscopy
HDPE	high-density polyethylene
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
mg/L	milligrams per liter
MS	matrix spike
MSD	matrix spike duplicate
N/A	not applicable
PDF	portable document file
QAPP	Quality Assurance Project Plan
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SAP	Sampling Analysis Plan
SM	Standard Method
SOP	standard operating procedures
SW	Solid Waste Method
TDS	total dissolved solids

ACRONYMS AND ABBREVIATIONS (CONTINUED)

TOC	total organic carbon
TSS	total dissolved solids
USCG	U.S. Coast Guard
VOC	volatile organic compounds
WP	Work Plan
WQC	Water Quality Criteria
µg/kg	micrograms per kilogram

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) provides guidelines and procedures for performing work at United States Coast Guard (USCG) Site 1, on Kodiak Island, Alaska. This site is also referred to as the USCG Landfill or USCG Buskin River Landfill. This QAPP was prepared to ensure that data collected as part of this effort are scientifically valid and defensible, and to establish the protocols and requirements to ensure the data are collected, reviewed, and analyzed in a consistent manner. Ahtna Environmental, Incorporated (Ahtna) prepared this QAPP and associated Work Plan (WP) in 2017 for semi-annual surface water monitoring in support of post-closure detection monitoring at Site 1. At the request of USCG, Brice Engineering, LLC (Brice) prepared and submitted revisions to the WP and QAPP in December 2020 in response to comments received from Alaska Department of Environmental Conservation (ADEC) Solid Waste Program, included in Appendix D.

Revisions to the QAPP include water quality criteria revised to reflect ADEC Solid Waste Program *Surface Water Standards Table* criteria, updated references, and generalizing the WP for applicability to any contractor performing post-closure monitoring on behalf of USCG.

It is a requirement of this QAPP that an approved copy be kept at the project site. In addition, all contractor personnel and subcontractors assigned to the project site are required to read, understand, and comply with the provisions and requirements in this QAPP, including attachments and documents incorporated by reference.

1.1 Project Organization, QAPP Distribution, and Personnel Qualifications

The project roles with primary quality assurance (QA) responsibility for continuing monitoring at Site 1 and a brief description of responsibilities are presented in Table 1.

Table 1 Project Roles and Responsibilities

PROJECT ROLE	RESPONSIBILITIES
USCG Project Manager	Ensure that all work is carried out in accordance with contractual obligations and the Task Order statement of work. Assist the Project Manager as needed with technical decisions and in resolving issues. Final reviewer.
Project Manager	Overall responsibility for execution of the WP. Coordinate with USCG Project Manager as necessary to resolve issues.
Corporate Health and Safety Officer	Overall responsibility for resolving health and safety issues (in coordination with Project Manager and Field Manager).
Field Manager	Ensure that field activities and analytical sampling are conducted in accordance with project specifications. Coordinate field activities with field personnel.
QA Officer, Project Chemist	Laboratory and data validation coordination. Conduct data quality review to ensure analytical methods and data are consistent with project needs and data quality objectives.
Subcontracted Laboratory	Provide analytical services.

Notes:
QA = quality assurance
USCG = U.S. Coast Guard
WP = Work Plan

1.2 Communication Pathways

Table 2 details the communication pathways between project personnel for this project

Table 2 Communication Pathways

COMMUNICATION DRIVERS	RESPONSIBLE ENTITY	PROCEDURE (TIMING, PATHWAYS, ADDITIONAL INFORMATION)
Overall Project Implementation	USCG Project Manager	Responsible for all direct communications with the regulatory agencies and other stakeholders.
Communication with ADEC	USCG Project Manager	Any communication with the regulatory agency will be completed with USCG as the liaison.
Approval of Amendments to the WP	USCG Project Manager	Suggested modifications to the WP will be evaluated by the contractor's Program and/or Project Manager. If required, the WP will be modified and submitted for approval.
Approvals to modification of the QAPP prior to fieldwork	USCG Project Manager	Suggested modifications to the QAPP will be evaluated by the contractor's Program and/or Project Manager. If required, the WP will be modified and submitted for approval.
Approvals to modification of the QAPP during project execution	USCG Project Manager	Suggested modifications to the QAPP will be communicated to the USCG Project Manager. Email approval or documentation of verbal approval will be added to the QAPP as an addendum.
Delays in site activities	Project Manager	Delays in site activities will be reported to the contractor's Project Manager. The Project Manager will notify the USCG Project Manager.
Stop work and initiation of field corrective action	Project Manager Field Manager	For safety- or quality-related reasons, all site personnel have the authority to temporarily stop work until an issue is resolved. The contractor team personnel will notify the Project Manager, who will then notify the USCG Project Manager. The Project Manager will document, in writing, the work stoppage.
Sample receipt variances and laboratory quality control variances	Project Chemist	Sample receipt and laboratory control variances will be communicated to the Chemist by the laboratory Project Manager at the time the variance is recorded, to ensure ample time for corrective action. The Chemist will inform the contractor's Project Manager.
Analytical corrective actions	Laboratory Project Manager	Analytical data issues will be reported to the laboratory Project Manager, who will initiate corrective action.

Notes:
QAPP = Quality Assurance Project Plan
USCG = U.S. Coast Guard
WP = Work Plan

1.3 Problem Formulation and Background

The landfill was previously used for municipal waste disposal from the early 1970s until 1987, when closure of the landfill began. Surface water diversion ditches were established around the perimeter, groundwater diversion systems were installed, and a passive methane venting system and leaching collection system were installed. In 2000, Site 1 was officially capped with a geoclay liner and closed. Post-closure groundwater monitoring began in 2002 (Hart Crowser 2003).

Previous environmental investigations have indicated no contamination leaching from the landfill. Continued monitoring is necessary to ensure potential contamination from the landfill is not leaching into surrounding surface waters, and to ensure the integrity of the landfill cap.

1.3.1 Regulatory Framework

Site 1 is regulated under Title 18 of the Alaska Administrative Code (AAC), Chapter 60 (18 AAC 60), *Solid Waste Management* (ADEC 2017b) by the ADEC Solid Waste Division. The site is also regulated as a Solid Waste Management Unit (SWMU) by the Environmental Protection Agency (EPA) under the Corrective Action Process identified in the Base Kodiak Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit AK 969 033 0742 (EPA 2021). After closure of the landfill, the EPA allowed ADEC to manage the post-closure monitoring. All water at Site 1 is currently considered surface water. Additional regulatory information as it relates to the project is outlined in Section 1.5 of the WP.

1.4 Monitoring Schedule

Currently, there are four monitoring wells and three surface water sample locations that are monitored semi-annually in April and October. The USCG and ADEC will reevaluate the monitoring frequency after three years of surface water monitoring beginning October 2016. No changes to the sampling frequency have been requested as of November 2020; recent semi-annual monitoring reports and comments from ADEC suggest continued semi-annual monitoring in order to assess seasonal changes (comments dated 16 October 2020, included as Appendix D of the WP).

1.5 Project Quality Objectives

The overall project objectives are to ensure there are no releases of contaminants from the closed landfill and to ensure the integrity of the landfill cap. The following tasks will be performed to achieve this objective:

- Water will be sampled semi-annually at the site from four monitoring wells and three surface water locations
- Landfill cap inspection will be completed semi-annually

1.5.1 Plan for Obtaining Data

The contractor's field team will be responsible for collecting field and analytical samples and generating field measurement data according to the methods specified in the Sampling and Analysis Plan (SAP), Section 3.0 of the WP. The subcontracted laboratory will analyze the samples, review sample information (e.g., Chain of Custody [CoC]), and generate the data packages. Section 3.0 and 4.0 and the Base Kodiak Post-Closure Monitoring Field Standard Operating Procedures (SOPs) (Attachment B-1) further define the data to be acquired in the process.

This page intentionally blank

2.0 SAMPLING LOCATIONS AND APPROACH

Water sampling and management in the field will be conducted in accordance with ADEC's *Field Sampling Guidance* (ADEC 2019b), and Base Kodiak Post-Closure Monitoring Field SOPs (Attachment B 1). Sample collection procedures and protocols are provided within the SAP of the WP. Field SOPs provided in Attachment B-1 provide further guidance for analytical sample collection, and decontamination. The analytical results will be compared to Water Quality Criteria (WQC), listed in Section 1.5 of the WP, as defined in *Surface Water Standards Table* (ADEC 2019a).

Four monitoring wells and three surface water locations are scheduled to be sampled. The monitoring wells to be sampled include MW-01-007 (North), MW-01-060B (South), MW-01-061 (Southeast), and MW-01-062 (Northwest). Three surface water sample locations to be sampled include SW-01-050 (South), SW-01-051 (East), and SW-01-052 (North). Figure 2 of the WP depicts the sample locations.

Laboratory data will be presented in electronic format consistent with the laboratory subcontract. Data deliverables will consist of an electronic data package as detailed in the laboratory subcontract and in accordance with the Department of Defense (DoD) Quality Systems Manual (QSM) Version 5.3 (DoD 2019) and the ADEC data review and requirements technical memorandums (ADEC 2017a, 2019c). The laboratory will be required to provide electronic data as an electronic data deliverable (EDD) per sample delivery group. A searchable and bookmarked electronic Level II Portable Document Format (PDF) file of the complete data package, containing sample and Quality Control (QC) results, will also be required.

EMAX Laboratories, Inc (EMAX) in Torrance, California is the designated offsite laboratory for analytical sample analyses. EMAX is accredited and certified by the ADEC Contaminated Sites (18-004) and DoD Environmental Laboratory Accreditation Program, expiration 10 January 2023. Laboratory certification is provided in Attachment B-3. A contractor may choose to use a different laboratory; the selected must be able to meet the QA/QC requirements and be certified by ADEC and DoD, as described above. The subcontract laboratory will be responsible for analytical work and for providing data of verifiable quality.

Analytical samples will be transported to EMAX (or approved laboratory) via Alaska Air Cargo for delivery in Los Angeles, California (or nearest airport). Analytical results will be provided within requested turnaround times, and all Level II finalized data packages, complete with EDD, are to be provided within 15 business days.

Any nonconformance, deviations, or corrective actions to the sampling locations and approach will be documented within the field notes or field sampling forms. Additional information regarding nonconformance and corrective actions are detailed within Section 3.8 of this QAPP.

This page intentionally blank

3.0 SAMPLING DESIGN AND RATIONALE

Four monitoring wells and three surface water locations will be sampled at Site 1. Table 3 details the sample locations, including the analytical methods. Monitoring wells and surface water wells will be monitored semi-annually in April and October.

Table 3 Sample Locations and Analytical Methods

MONITORING WELLS	LOCATION	ANALYTICAL METHODS
MW-01-007	North	VOC, EPA SW8260C
MW-01-060B	South	Total Metals*, EPA 200.7/200.8
MW-01-061	Southeast	Total Mercury, EPA 245.1
MW-01-062	Northwest	Chloride/Sulfate (Inorganic anions), EPA 300.0
SURFACE WATER	**LOCATION**	COD, EPA SM5220D
SW-01-050	South	TDS, EPA SM 2450C
SW-01-051	East	TSS, EPA SM 2450D
SW-01-052	North	TOC, EPA SM 5310B

Notes:

* Total metals analysis includes antimony, arsenic, barium, beryllium, calcium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, zinc, iron, manganese, magnesium.

COD = chemical oxygen demand
EPA = U.S. Environmental Protection Agency
SM = Standard Method
SW = Solid Waste Method
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
VOC = volatile organic compounds

3.1 Sampling Procedures

Monitoring wells MW-01-007, MW-01-060B, MW-01-061, and MW-01-062 will be sampled at the site. Figure 2 of the WP details monitoring well locations. Samples will be collected for the analytical methods listed in Table 3 using a pneumatic bladder pump and Teflon-lined tubing. The groundwater sampling procedure is outlined in Section 3.1 of the WP.

The three surface water sample locations to be sampled are SW-01-050, SW-01-051, and SW-01-052. Figure 2 of the WP details surface water sampling locations. Samples will be collected for the analytical methods listed in Table 3. The surface water sampling procedure is outlined in Section 3.2 of the WP.

3.2 Field Equipment

The pieces of field equipment to be used that require testing, maintenance, and/or calibration include a turbidity meter and water quality meter or a combined water quality and turbidity meter. The contractor should follow calibration and testing procedures and frequencies outlined in their SOPs and/or the equipment manufacturer's recommendations. Hand tools will be used in accordance with manufacturers' recommendations, and prior to use, will be inspected visually for any evidence of compromised integrity.

3.3 Field Quality Control Sample Summary

Table 4 summarizes the number of field QC samples that will be collected and sent to the laboratory for each analytical group, and concentration level.

Table 4 Field Quality Control Samples

QC SAMPLE	MEDIA	ANALYTICAL METHOD	FREQUENCY
Field Duplicate	Water	Same as primary samples	1 per 10 samples (10%) per each analytical method
Equipment Blank	Deionized Water	Same as primary samples	1 per sampling event
Field Blank	Deionized Water	Same as primary samples	1 per sampling event
Trip Blank	Water	SW 8260C	1 per sample cooler containing volatile samples
Temperature Blank	40-mL vials of tap water	N/A	1 per sample cooler
Site Specific Matrix Spike	Water	Same as primary samples	1 per 20 (5%) per each analytical method
Site Specific Matrix Spike Duplicate	Water	Same as primary samples	1 per 20 (5%) and each analytical method

Notes:
N/A = not applicable

Field duplicates are collected to assess errors associated with sample heterogeneity, sample methodology, and analytical procedures. Field duplicates will be submitted at the rate of 1 per 10 project samples (10 percent [%]) per analytical method for each field event.

Equipment blanks are used to establish that the sample has not been contaminated by external sources during the sampling process. Deionized water will be run through the decontaminated pump after all other samples are collected. One Equipment blank will be collected and submitted to the laboratory each sampling event.

Trip blanks are used to establish that the sample has not been contaminated by external sources during the transport of sample bottles to and from the field. The sealed and labeled blanks will accompany the VOC samples in the field during sampling and in the shipment to the offsite laboratory. One trip blank is required for each shipment cooler containing VOC sample containers.

Temperature blanks, consisting of plastic bottles filled with water, will be provided by the analytical laboratory at a rate of one per cooler.

Matrix spike and matrix spike duplicates (MS/MSDs) are used to document the accuracy and precision of the method for the sample batch. The recoveries of the spiked analytes are evaluated to determine the accuracy in a given matrix and comparison of the MS to the MSD will yield a precision measurement in a given matrix. MS/MSDs will be submitted at a rate of 1 per 20 project samples (5%) per analytical method for field event.

3.4 Field Documentation

All activities, communications, and decision-making during field activities will be documented. Standard entries will be recorded daily in a bound field notebook. Any unbound data documentation is considered part of the field records and will be maintained with safe document handling and archiving procedures.

When possible, standardized forms will be used for consistency and quality (e.g., water sampling form). These records will be recorded in waterproof, indelible ink and on weatherproof paper, as necessary. As soon as possible, the unbound records will be scanned to create an electronic record to ensure document preservation. Field forms for this project are included in Appendix A of the WP.

3.5 Field Equipment Calibration, Maintenance, Testing, and Inspection

The calibration of field equipment will be verified before the start of work each day, or more frequently as needed. If equipment calibration becomes necessary, the instrument "drift" from prior calibration will be recorded in a field notebook. Calibration will be conducted in accordance with the manufacturer's instructions and recommended frequency.

Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means. A label with the identification number and the date when the next calibration is due will be physically attached to the equipment. If this is not possible, records traceable to the equipment (showing the equipment identification) will be readily available for reference. In addition, the results of calibrations and records of repairs will be recorded in a logbook. Scheduled periodic calibration of testing equipment does not relieve field personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, the device shall be removed from service, tagged so that it is not inadvertently used, and the appropriate personnel notified so that a recalibration can be performed, or a substitute piece of equipment can be obtained.

Equipment that fails calibration or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate it is out of calibration. Such equipment will be repaired and satisfactorily recalibrated. Equipment that cannot be repaired will be replaced.

Field equipment and instruments, including a turbidity meter, water quality meter, and water level meter, will be maintained in accordance with the contractor's SOPs and the equipment manufacturer's recommendations. The contractor should follow calibration and testing procedures and frequencies outlined in their SOPs and/or the equipment user's manual, and in accordance with the corrective action requirements.

3.6 Sample Handling, Custody, and Disposal

Table 5 identifies components of the sample handling system specific to this project. The table lists personnel and their organizational affiliations that are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection, to laboratory delivery, to final sample disposal.

In accordance with Alaska State Regulation 18 AAC 75, a qualified environmental professional will collect the samples. Samples collection and management in the field will be conducted in accordance with ADEC's Field Sampling Guidance (ADEC 2019b), Base Kodiak Post-Closure Monitoring SOPs (Attachment B-1), and the contractor's field SOPs. The analytical results will be compared to WQC in accordance with 18 AAC 70.

Accurate and comprehensive recordkeeping is critical to documenting sample custody and includes CoC records. The field logbook will be the primary tool for capturing information collected during the field effort. Additional details of proper field and sample documentation are provided in Section 3.4.

Table 5 Sample Handling, Custody, and Disposal

LABORATORY: EMAX **METHOD OF SAMPLE DELIVERY:** AIR CARGO **NUMBER OF DAYS FROM REPORTING UNTIL SAMPLE DISPOSAL:** 30 DAYS AFTER FINAL REPORT IS ISSUED	
ACTIVITY	**RESPONSIBLE PERSON**
Sample documentation and labeling	Field Manager
Sampling identification	Field Manager
Packaging and shipping coordination	Field Manager
CoC form completion	Field Manager
Sample receipt, inspection, and log-in	Field Manager or Project Chemist Laboratory Project Manager
Sample custody and storage	Field Manager or Project Chemist Laboratory Project Manager
Sample disposal	Laboratory Project Manager

Notes:
CoC = chain of custody

A cooler receipt form will be prepared for each cooler of samples received by the project laboratory. Upon receipt at the laboratory, all discrepancies will be documented on the cooler receipt form. Examples of discrepancies include inappropriate sample container or sample container size, broken sample container, cooler temperature outside of the ADEC-required temperature, missing or incomplete CoC forms, errors or discrepancies in CoC forms, custody seals, and date and time missing from custody seals. The analytical laboratory will email a copy of the cooler receipt form to the contractor's Project Chemist and Project Manager within 24 hours of receipt for each sample delivery group. Copies of cooler receipt forms will be provided within the associated data packages. All corrective actions will be thoroughly documented in the final laboratory report. Additional information on assessments and corrective actions are in Section 3.8.

3.7 Project Sampling SOP References

Table 6 lists the Base Kodiak Post-Closure Monitoring SOPs and example contractor SOPs that may supplement those provided with the plan. The USCG Kodiak SOPs are provided in Attachment B-1; these SOPs originate from Attachment 4A, Exhibit 6 of the revised *Resource Conservation and Recovery Act Hazardous Waste Facility Management Permit* dated March 2021 (EPA 2021). The contractor shall supplement the SOPs with their own, such as, but not limited to, those listed in Table 6 without a reference number.

Table 6 Standard Operating Procedures

SOP	DESCRIPTION
1.0	Decontamination of Sampling Equipment
2.0	Well Development
3.0	Well Purging
4.0	Groundwater Sampling
	Logbook Documentation and Field Notes
	Sample Chain-of-Custody
	Labeling, Packaging and Shipping Samples

Table 6 Standard Operating Procedures

SOP	DESCRIPTION
	Quality Control Samples
	Drilling and Core Logging
	Surface Water Sampling
	Material Handling/Manual Lifting
	Driving Motor Vehicles
	Working with Hand Tools

3.8 Assessments and Corrective Action

Nonconforming items and activities are those that do not meet the project requirements. When such a condition is identified, the contractor will begin corrective action to:

- Document the nonconforming item or procedure and determine the cause of the nonconformance and its effect on project performance and the integrity of completed work
- Correct or replace the nonconforming item in the most efficient and effective manner
- Verify and document that the corrective action taken was successful.

QC assessments, shown in Table 7, will be performed to identify non-conformances and potential corrective actions; the table also identifies the frequency of the assessments and the responsible parties for each step of the corrective action process. Table 8 describes the corrective actions.

3.8.1 Documentation of Nonconforming Items

The field manager will document any nonconformance item within field notes, field forms or within a quality control report. Documentation will clearly state what is not compliant, the date the noncompliance was originally discovered, and the date the work was corrected.

3.8.2 Implementation of Corrective Action

The contractor will stop work on any item or feature, pending satisfactory correction of the deficiency noted by the Project Manager. The field manager has the authority to stop work until corrective actions have been implemented. In some cases, the corrective action may be obvious and may be implemented immediately upon identification of the nonconformance. Others may require additional input from technical and/or operations staff, additional equipment and/or materials, or changes in existing structures or completed work. The Project Manager will not allow work to be added to or built upon nonconforming work unless the USCG Project Manager concurs that the correction can be made without disturbing continuing work.

3.8.3 Verification and Documentation of Corrective Action

The Project Manager and field manager will verify successful completion of corrective actions for non-conformances on follow-up inspections. The field notes, field forms or a quality control report will reflect all corrective actions completed and will be appended. Recurring non-conformances of a similar nature will be investigated to determine the root cause of the problem, to eliminate or minimize future occurrences of the nonconformance.

Tables 7 identifies the type and frequency of assessment activities that will be performed for the project. Table 8 describes the corrective actions.

Table 7 Assessment

ASSESSMENT TYPE	FREQUENCY	INTERNAL / EXTERNAL	PERFORMING ORGANIZATION	PERSON(S) RESPONSIBLE FOR PERFORMING ASSESSMENT	PERSON(S) RESPONSIBLE FOR RESPONDING TO ASSESSMENT FINDINGS	PERSON(S) RESPONSIBLE FOR IDENTIFYING AND IMPLEMENTING CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR MONITORING EFFECTIVENESS OF CORRECTIVE ACTION
Laboratory technical evaluation	Once, prior to subcontract award and before sampling begins	Internal	Contractor	Project Chemist	Analytical Laboratory Project Manager	Analytical Laboratory Project Manager	Project Chemist
Field sampling technical evaluation	Initial and ongoing	Internal	Contractor	Field Manager	Field Manager and Project Manager	Field Manager and Project Manager	Field Manager and Project Manager
Analytical data review	After receipt of analytical results	Internal	Contractor	Project Chemist	Analytical Laboratory Project Manager	Project Chemist	Project Manager
Field inspection/audit	As determined by ADEC	External	ADEC	ADEC	USCG	USCG	USCG

Notes:
ADEC = Alaska Department of Environmental Conservation
USCG = U.S. Coast Guard

Table 8 Assessment Response and Corrective Actions

ASSESSMENT TYPE	NATURE OF DEFICIENCIES DOCUMENTATION	INDIVIDUAL(S) NOTIFIED OF FINDINGS	TIMEFRAME OF NOTIFICATION	NATURE OF CORRECTIVE ACTION RESPONSE DOCUMENTATION	INDIVIDUAL(S) RECEIVING CORRECTIVE ACTION RESPONSE	TIMEFRAME FOR RESPONSE
Field sampling technical evaluation	Logbook notes, groundwater sampling forms, core logs	Contractor Project Manager	Within 24 hours	Logbook notes, email correspondence, or documentation in report	Field Manager	While on site if possible; otherwise, document deviations in the logbook notes and/or in the report
Analytical data review	Email correspondence, CoC variance request forms, cooler receipt forms	Analytical Laboratory Project Manager	Within 24 hours	Email correspondence, formal corrective action report/letter, case narrative	Brice Project Chemist	Within holding times, if possible; otherwise, prior to reporting analytical data

Notes:
CoC = chain of custody

This page intentionally blank

4.0 ANALYTICAL METHODS

Analytical samples will be submitted to the laboratory and analyzed for the following analytes:

- VOCs (organic constituents from 40 Code of Federal Regulations 258, Appendix I) by EPA Solid Waste Method (SW) Standard 8260C
- Total metals (antimony, arsenic, barium, beryllium, calcium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, zinc, iron, manganese, magnesium) by EPA 200.8
- Total Mercury by EPA 245.1
- Chloride/Sulfate by EPA 300.0
- Chemical oxygen demand (COD) by EPA Standard Method (SM) 5220D
- Total dissolved solids(TDS) by EPA SM 2540C
- Total suspended solids (TSS) by EPA SM 2540D
- Total organic carbon (TOC) by EPA SM 5310B

The contractor will use EMAX in Torrance, California as the laboratory performing the sample analysis. EMAX is accredited and certified by the ADEC Contaminated Sites (18-004) and DoD Environmental Laboratory Accreditation Program.

The analytical methods listed may vary based on the selected subcontracted laboratory accreditations. If a different lab is chosen, they must meet the QA/QC requirements and be certified by ADEC and DoD, as described above. The Project Chemist will manage the laboratory contract to ensure all analyses are performed in accordance with this QAPP.

Analytical samples will be transported to the laboratory via air cargo for delivery in Los Angeles, California (or airport nearest selected laboratory). Analytical samples will be collected utilizing the sample containers as described in Table 9.

Table 9 Sample Methods, Containers, and Preservation

ANALYTE / ANALYTE GROUP	ANALYTICAL METHOD	CONTAINERS (QUANTITY) VOLUME, TYPE	PRESERVATION	ANALYTICAL HOLDING TIME	TURNAROUND TIME
SURFACE WATER					
VOC	SW8260C	(3) 40-mL VOA vials with Teflon-lined septa lids	HCl, 0°C to 6°C	14 days to analysis	30 days
TOC	SM 5310B	(2) 250-mL amber glass jar	H_2SO_4, 0°C to 6°C	28 days to analysis	
COD	SM 5220D			28 days to analysis	
Total Mercury	EPA 245.1	(1) 250-mL HDPE	HNO_3, 0°C to 6°C	28 days to analysis	
Total Metals	EPA 200.7/200.8			6 months to analysis	
Chloride / Sulfate	EPA 300.0	(1) 500-mL HDPE	0°C to 6°C	28 days to analysis	
TDS	SM 2540C			7 days to analysis	
TSS	SM 2540D	(1) 1-L HDPE	0°C to 6°C	7 days to analysis	

Notes:

°C = degrees Celsius
COD = chemical oxygen demand
EPA = U.S. Environmental Protection Agency
H_2SO_4 = sulfuric acid
HCl = hydrochloric acid
HDPE = high density polyethylene
HNO_3 = nitric acid
L = liter
mL = milliliter
TDS = total dissolved solids
TOC = total organic content
TSS = total suspended solids
VOA = volatile organic analysis
VOC = volatile organic compounds

5.0 DATA QUALITY OBJECTIVES

The development and implementation of approved procedures and plans for field sampling, laboratory and field analysis, data reporting, data validation and assessment, and sample integrity increases the technical and evidentiary adequacy of the study. Data Quality Objectives (DQOs) are quantifiable and verifiable quality goals that serve to demonstrate that data generated under approved plans and procedures were of sufficient quality and quantity to allow appropriate decisions to be made within allowable decision error limits.

DQOs have been developed in accordance with the EPA DQO process. The DQOs provide the project team with the information necessary to determine whether any potential remedial actions are necessary to protect human health and the environment.

The DQOs are listed below.

- DQO 1—Identify any possible releases of contaminants from the closed landfill
- DQO 2—Determine integrity of the landfill cap

Data will be collected according to the methods described in the WP. Analytical results will be evaluated against the WQC displayed in Table 18, as well as Table 1 of the WP. All laboratory detection limits must be less than the associated WQC. Laboratory data must pass the QC standards and data quality assessment as described in the following sections.

This page intentionally blank

6.0 PERFORMANCE OR ACCEPTANCE CRITERIA

Data acceptability is determined by the laboratory QC measures and the limits of detection (LOD) of each analyte. Section 6.1 provides laboratory QC measurement performance criteria that will be used to ensure sufficient quality of the data. If any of these QC measures are not within acceptable parameters, professional judgment will be used to assess the usability of the data. This information will be presented in a data quality assessment, which will be provided in the semiannual reports.

Detection limits should be less than their associated WQC, if possible, using the proposed methodology. Section 6.2 provides the analytical laboratory's achievable limits of quantitation (LOQ) and LODs. In cases where the WQC is less than the LOD of the low-level analytical method, the determination of contaminants of potential concern at the site will be coordinated with ADEC. Data will be assessed for QC issues during the reporting process.

6.1 Measurement Performance Criteria

Tables 10 through 17 detail the measurement performance criteria for this project.

Table 10 VOC, EPA Method SW8260C

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field duplicate	Collect and analyze 1 per 10 project samples, per day, per method	≤ 30% RPD
Sample Handling Accuracy	Temperature blank	1 measurement per cooler	0°C – 6°C
Overall Accuracy / Bias (contamination)	Equipment blank	Collect and analyze 1 per sampling event, as necessary	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Sample Handling Accuracy / Bias (contamination)	Trip blank (SW8260C)	Analyze 1 per shipment of volatile samples	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Analytical Accuracy / Precision (laboratory performance)	LCS/LCSD	Analyze 1 per extraction batch	DoD QSM 5.3 Table C-24 RPD ≤ 20%
Analytical Accuracy / Precision (matrix interference)	MS/MSD	Analyze 1 per extraction batch	DoD QSM 5.3 Table C-24 RPD ≤ 20%
Analytical Accuracy (laboratory performance)	Surrogate spikes	Every sample	DoD QSM 5.3 Table C-24
Accuracy (laboratory)	Laboratory method blank	Analyze 1 per extraction batch	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.

Notes:

°C = degrees Celsius
DoD QSM = Department of Defense Quality Systems Manual
EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference
SW = Solid Waste Method
VOC = volatile organic compound

Table 11 Total Metals, EPA Method 200.8

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field duplicate	Collect and analyze 1 per 10 project samples, per day, per method	≤ 30% RPD
Sample Handling Accuracy	Temperature blank	1 measurement per cooler	0°C – 6°C
Overall Accuracy / Bias (contamination)	Equipment blank	Collect and analyze 1 per sampling event, as necessary	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Analytical Accuracy / Precision (laboratory performance)	LCS/LCSD	Analyze 1 per extraction batch	85-115% RPD ≤ 20%
Analytical Accuracy / Precision (matrix interference)	MS/MSD	Analyze 1 per extraction batch	70-130% RPD ≤ 20%
Accuracy (laboratory)	Laboratory method blank	Analyze 1 per extraction batch	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.

Notes:
°C = degrees Celsius
EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference

Table 12 Total Mercury, EPA Method 245.1

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field duplicate	Collect and analyze 1 per 10 project samples, per day, per method	≤ 30% RPD
Sample Handling Accuracy	Temperature blank	1 measurement per cooler	0°C – 6°C
Overall Accuracy / Bias (contamination)	Equipment blank	Collect and analyze 1 per sampling event, as necessary	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Analytical Accuracy / Precision (laboratory performance)	LCS/LCSD	Analyze 1 per extraction batch	85-115% RPD ≤ 20%
Analytical Accuracy / Precision (matrix interference)	MS/MSD	Analyze 1 per extraction batch	70-130% RPD ≤ 20%
Accuracy (laboratory)	Laboratory method blank	Analyze 1 per extraction batch	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.

Notes:
°C = degrees Celsius
EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference

Table 13 Chloride/Sulfate, EPA Method 300.0

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field duplicate	Collect and analyze 1 per 10 project samples, per day, per method	≤ 30% RPD
Sample Handling Accuracy	Temperature blank	1 measurement per cooler	0°C – 6°C
Overall Accuracy / Bias (contamination)	Equipment blank	Collect and analyze 1 per sampling event, as necessary	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Analytical Accuracy / Precision (laboratory performance)	LCS/LCSD	Analyze 1 per extraction batch	90-110% RPD ≤ 20%
Analytical Accuracy / Precision (matrix interference)	MS/MSD	Analyze 1 per extraction batch	90-110% RPD ≤ 20%
Accuracy (laboratory)	Laboratory method blank	Analyze 1 per extraction batch	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.

Notes:
°C = degrees Celsius
EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference

Table 14 COD, EPA Method SM 5220D

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field duplicate	Collect and analyze 1 per 10 project samples, per day, per method	≤ 30% RPD
Sample Handling Accuracy	Temperature blank	1 measurement per cooler	0°C – 6°C
Overall Accuracy / Bias (contamination)	Equipment blank	Collect and analyze 1 per sampling event, as necessary	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Analytical Accuracy / Precision (laboratory performance)	LCS/LCSD	Analyze 1 per extraction batch	90-110% RPD ≤ 25%
Analytical Accuracy / Precision (matrix interference)	MS/MSD	Analyze 1 per extraction batch	90-110% RPD ≤ 25%
Accuracy (laboratory)	Laboratory method blank	Analyze 1 per extraction batch	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.

Notes:

°C = degrees Celsius
COD = chemical oxygen demand
EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference
SM = Standard Method

Table 15 TDS, EPA SM 2540C

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field duplicate	Collect and analyze 1 per 10 project samples, per day, per method	≤ 30% RPD
Sample Handling Accuracy	Temperature blank	1 measurement per cooler	0°C – 6°C
Overall Accuracy / Bias (contamination)	Equipment blank	Collect and analyze 1 per sampling event, as necessary	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Analytical Accuracy / Precision (laboratory performance)	LCS/LCSD	Analyze 1 per extraction batch	75-125% RPD ≤ 5%
Analytical Accuracy / Precision (matrix interference)	Sample Duplicate	Analyze 1 per extraction batch	RPD ≤ 5%
Accuracy (laboratory)	Laboratory method blank	Analyze 1 per extraction batch	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.

Notes:

°C = degrees Celsius
EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference
SM = Standard Method
TDS = total dissolved solids

Table 16 TSS, EPA SM 2540D

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field duplicate	Collect and analyze 1 per 10 project samples, per day, per method	≤ 30% RPD
Sample Handling Accuracy	Temperature blank	1 measurement per cooler	0°C – 6°C
Overall Accuracy / Bias (contamination)	Equipment blank	Collect and analyze 1 per sampling event, as necessary	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Analytical Accuracy / Precision (laboratory performance)	LCS/LCSD	Analyze 1 per extraction batch	75-125% RPD ≤ 5%
Analytical Accuracy / Precision (matrix interference)	Sample Duplicate	Analyze 1 per extraction batch	RPD ≤ 5%
Accuracy (laboratory)	Laboratory method blank	Analyze 1 per extraction batch	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.

Notes:

°C = degrees Celsius
EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference
SM = Standard Method
TSS = total suspended solids

Table 17 TOC, EPA SM 5310B

DATA QUALITY INDICATOR	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	FREQUENCY OF PERFORMANCE	MEASUREMENT PERFORMANCE CRITERIA
Overall Precision	Field duplicate	Collect and analyze 1 per 10 project samples, per day, per method	≤ 30% RPD
Sample Handling Accuracy	Temperature blank	1 measurement per cooler	0°C – 6°C
Overall Accuracy / Bias (contamination)	Equipment blank	Collect and analyze 1 per sampling event, as necessary	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.
Analytical Accuracy / Precision (laboratory performance)	LCS/LCSD	Analyze 1 per extraction batch	80-120% RPD ≤ 20%
Analytical Accuracy / Precision (matrix interference)	Sample Duplicate	Analyze 1 per extraction batch	80-120% RPD ≤ 20%
Accuracy (laboratory)	Laboratory method blank	Analyze 1 per extraction batch	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.

Notes:
°C = degrees Celsius
EPA = U.S. Environmental Protection Agency
LCS = laboratory control sample
LCSD = laboratory control sample duplicate
LOQ = limit of quantitation
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
RPD = relative percent difference
SM = Standard Method
TOC = total organic carbon

6.2 Project Action Limits and Laboratory Specific Quantitation Limits

The estimated limits of detection (LODs) from the project analytical laboratory, as listed in Table 18, are less than the most stringent analytical WQC, except 1,2,3-Trichloropropane, 1,2 Dibromo-3-chloropropane, 1,2-Dibromoethane, and Acrylonitrile. The WQC are based on a hierarchy of standards presented in ADEC Solid Waste Program's *Surface Water Standards Table, Technical Memorandum 18.02* (ADEC 2019a). The full list WQC and the sources of the criteria are presented in Table 1 of the WP.

Table 18 Water Quality Criteria and Lab-Specific Limits

ANALYTE	UNITS	WQC[1]	DL	LOD	LOQ
Inorganic Anions by EPA 300.0					
Chloride	mg/L	250	0.05	0.1	0.2
Sulfate	mg/L	250	0.0125	0.25	0.5
COD by SM 5220D					
COD	mg/L	N/A	3	6	10
TOC by SM 5310B					
TOC	mg/L	N/A	3	6	10
TDS/TSS by SM 2540C/SM 2540D					
TDS	mg/L	500	10	10	10
TSS	mg/L	N/A	10	10	10
Metals by EPA 200.8					
Antimony	µg/L	6	0.25	0.5	1
Arsenic	µg/L	10	0.125	0.25	1
Barium	µg/L	2000	0.25	0.5	1
Beryllium	µg/L	4	0.1	0.2	0.5
Cadmium	µg/L	5	0.1	0.2	1
Calcium	µg/L	N/A	50	100	200
Chromium	µg/L	100	0.1	0.2	1
Cobalt	µg/L	NA	0.1	0.2	0.75
Copper	µg/L	1300	0.5	1	2
Iron	µg/L	1000	25	50	200
Lead	µg/L	15	0.05	0.1	1
Magnesium	µg/L	N/A	20	50	100
Manganese	µg/L	50	0.25	0.5	1
Nickel	µg/L	390	0.25	0.5	1
Selenium	µg/L	50	0.15	0.3	1
Silver	µg/L	100	0.1	0.2	1
Thallium	µg/L	2	0.1	0.2	0.5
Vanadium	µg/L	86	0.25	0.5	1
Zinc	µg/L	200	5	10	20
Mercury by EPA 245.1					
Mercury	µg/L	2	0.1	0.2	0.5
VOC by SW 8260C					
1,1,1,2- Tetrachloroethane	µg/L	5.7	0.1	0.2	1
1,1,1-Trichloroethane	µg/L	200	0.1	0.2	1
1,1,2,2-Tetrachloroethane	µg/L	0.76	0.1	0.2	1
1,1,2-Trichloroethane	µg/L	5	0.1	0.2	1
1,1-Dichloroethane	µg/L	28	0.1	0.2	1
1,1-Dichloroethene	µg/L	7	0.1	0.2	1

Table 18 Water Quality Criteria and Lab-Specific Limits

ANALYTE	UNITS	WQC[1]	DL	LOD	LOQ
1,2,3-Trichloropropane	µg/L	0.0075	0.25	***0.5***	2
1,2-Dibromo-3-chloropropane	µg/L	0.2	0.25	***0.5***	2
1,2-Dibromoethane	µg/L	0.075	0.1	***0.2***	1
1,2-Dichlorobenzene	µg/L	600	0.1	0.2	1
1,2-Dichloroethane	µg/L	5	0.1	0.2	1
1,2-Dichloropropane	µg/L	6	0.1	0.2	1
1,4-Dichlorobenzene	µg/L	75	0.1	0.2	1
2-Butanone	µg/L	5600	5	10	20
2-Hexanone	µg/L	38	5	10	20
4-methyl-2-pentanone	µg/L	6300	5	10	20
Acetone	µg/L	14000	5	10	20
Acrylonitrile	µg/L	6	5	***10***	20
Benzene	µg/L	5	0.1	0.2	1
Bromochloromethane	µg/L	90	0.1	0.3	1
Bromodichloromethane	µg/L	1.3	0.15	0.2	1
Bromoform	µg/L	33	0.15	0.3	1
Bromomethane	µg/L	7.5	0.25	0.5	1
Carbon Disulfide	µg/L	810	0.25	0.5	1
Carbon Tetrachloride	µg/L	5	0.1	0.2	1
Chlorobenzene	µg/L	100	0.1	0.2	1
Chloroethane	µg/L	21000	0.5	1	2
Chloroform	µg/L	2.2	0.1	0.2	1
Chloromethane	µg/L	190	0.25	0.5	1
cis-1,2-Dichloroethene	µg/L	70	0.1	0.2	1
cis-1,3-Dichloropropene	µg/L	4.7	0.1	0.2	1
Dibromochloromethane	µg/L	8.7	0.1	0.2	1
Dibromomethane	µg/L	8.3	0.1	0.2	1
Ethylbenzene	µg/L	700	0.1	0.2	1
m,p-Xylene	µg/L	10000	0.21	0.5	2
Methylene Chloride	µg/L	110	0.5	1	2
Methyl Iodide	µg/L	N/A	0.25	0.5	1
o-Xylene	µg/L	10000	0.1	0.2	1
Styrene	µg/L	100	0.25	0.5	1
Tetrachloroethene	µg/L	5	0.15	0.3	1
Toluene	µg/L	1000	0.1	0.2	1
trans 1,4-dichloro-2-butene	µg/L	N/A	1	2	5
trans-1,2-Dichlorothene	µg/L	360	0.1	0.2	1
trans-1,3-Dichloropropene	µg/L	4.7	0.25	0.5	1
Trichloroethene	µg/L	5	0.1	0.2	1

Table 18 Water Quality Criteria and Lab-Specific Limits

ANALYTE	UNITS	WQC[1]	DL	LOD	LOQ
Trichlorofluoromethane	µg/L	5200	0.25	0.5	1
Vinyl Acetate	µg/L	410	0.5	1	2
Vinyl Chloride	µg/L	2	0.11	0.3	1

Notes:

[1] WQC presented in ADEC Solid Waste Program's *Surface Water Standards Table, Technical Memorandum 18.02* (ADEC 2019a).

Bold italics indicate the LOD is greater than or equal to (i.e. does not meet) the WQC.

µg/L = microgram per liter
ADEC = Alaska Department of Environmental Conservation
COD = chemical oxygen demand
DL = detection limit
EPA = U.S. Environmental Protection Agency
LOD = limit of detection
LOQ = limit of quantitation
mg/L = milligram per liter
N/A = not applicable
SM = Standard Method
SW = Solid Waste Method
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
VOC = volatile organic compound
WQC = water quality criteria

7.0 DATA ASSESSMENT

Analytical data will be assessed for quality using this QAPP, laboratory SOPs, and the EPA National Functional Guidelines (EPA 2017). A data assessment summary will be provided within a Data Quality Report (DQR).

Following verification of data deliverables, the Project Chemist will perform an assessment of data quality on all laboratory data. This includes, but is not limited to the following: documenting the data verification process; summarizing the samples and analyses; reviewing samples and analyses; reviewing sample handling; reviewing the laboratory QC data; assigning qualifiers; reviewing the QA data from the third party laboratory; reviewing LOQ and LODs to determine if non-detect results are greater than the project quantitation limits; defining LOQs greater than the project quantitation limits, compiling a table of rejected data; and compiling a sample summary table. Results will be reported down to the LOD and any non-detects will be reported at the LOD.

For field duplicate samples submitted to the laboratory, relative percent differences (RPDs) will be calculated and assessed against the ADEC guidelines of less than 30% between primary and duplicate water samples. As necessary, data qualifiers will be assigned. The data qualifiers to be used are included below.

Qualifiers to be applied to the analytical dataset, as appropriate, include the following:

J Analyte result is considered an estimated value because the level is below the laboratory LOQ but above the LOD.

B Analyte result is considered a high estimated value due to contamination being present in the method or trip blank.

QH, QL, QN Analyte result is considered an estimated value biased (high, low, or uncertain) due to matrix effects or a QC failure.

R Analyte result was rejected – the result is not usable. A rejected result was not usable and therefore, was deleted from the report and replaced with an "R" flag.

Qualification will not be required in the following circumstances:

- Surrogate or MS recoveries were outside QC limits, and the sample was diluted by a factor of five or greater.
- MS recoveries were outside QC limits, and the parent sample concentration was greater than the spike concentration.
- An analyte was detected in the method blank, but there was no detection in the sample.
- Surrogate, MS/MSD, or laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recoveries exceeded upper confidence limits, and there was no detection in the sample(s)

Rejection of data will be made on a case-by-case basis and a detailed explanation will be included in the data quality assessment. In the event of a corrective action, reanalysis, resampling, or nonconformance, data will be reduced following ADEC guidance detailed in Section 7.1 of this QAPP.

7.1 Data Reduction

In the event of multiple analytical results (due to field duplicates, reanalysis, etc.) for the sample constituent in the same sample, data reduction will follow ADEC's Guidelines for *Treatment of Non-Detect Values, Data Reduction for Multiple Detections, and Comparison of Quantitation Limits to Cleanup Values* (ADEC 2017a).

In the event that more than one contaminant result is reported due to multiple analyses by a single method, the highest detected value will be used. If more than one result is reported from alternate analytical method(s) for a single contaminant, the highest detected value or the result from the confirmatory method shall be used. This determination is made on a compound-specific basis. Any method-specific reporting requirements should also be adhered to.

If results are reported as non-detect by multiple analyses or methods, the undetected result with the lowest DL may be selected for reporting.

For data reduction from field duplicate samples, ADEC requires that the most conservative detectable sample result of the primary and duplicate results be used for management decision making purposes. Primary and duplicate results shall not be averaged. If one of the results is reported as non-detect and the other is a detectable concentration, the detected value should be used.

7.2 Data Validation Procedures

This section shows procedures that will be used to validate project data. Data qualifiers to be applied by the data validator are defined in Section 7.0. The objective of data validation is to assess the performance associated with the analysis to determine the quality of the data. This will be accomplished by evaluating whether the collected data comply with the predefined requirements of the project (including method, procedural, and contractual requirements) and by comparing the collected data with criteria established based on the project DQOs.

The analytical data will be evaluated for compliance with project-specific DQOs. In the absence of guidance, the most current version of the QSM (DoD 2019), method criteria, laboratory criteria, and best professional judgment will apply, in that order. The data quality assessment will identify any data requiring qualification and identify effects on data usability.

The contractor's Project Chemist will perform data validation for all analytical data packages. Table 19 summarizes the data validation requirements. All verification/validation findings will be documented in the DQR and ADEC Laboratory Data Review Checklists, which will be appended to the project report.

Table 19 Data Validation Requirements

ANALYTICAL GROUP/METHOD	Methods analyzed by analytical laboratory
DATA DELIVERABLE REQUIREMENTS	Level II PDF, EDD
ANALYTICAL SPECIFICATIONS	Section 6 of QAPP
MEASUREMENT PERFORMANCE CRITERIA	Section 6 of QAPP
PERCENT OF DATA PACKAGES TO BE VALIDATED	100% (PDF data packages are verified manually)
PERCENT OF RAW DATA REVIEWED	Varies: raw data are reviewed when matrix interference is suspected or discrepancies are identified by the laboratory

Notes:
EDD = electronic data deliverable
PDF = portable document file
QAPP = Quality Assurance Project Plan

7.3 Data Quality Requirements

The data quality indicator criteria will be measured as precision, accuracy, representativeness, completeness, comparability, and sensitivity. Data quality indicators will be evaluated by reviewing the QA parameters and criteria presented below.

Precision. Precision will be evaluated by comparing the following:

LCS and LCSD (if prepared and analyzed) to determine the precision of the laboratory procedures and verify matrix interference

MS and MSD samples to determine the effect of the sample matrix on the precision of the results generated using the selected analytical method

Primary and field duplicate sample results

Relative percent difference (RPD) will be calculated for LCS/LCSD, field duplicates, and MS/MSD by using the following formula:

$$RPD\ [\%] = \left| \frac{(R_1 - R_2)}{\left((R_1 + R_2) \div 2\right)} \right| \times 100$$

Where: R_1 = sample concentration
R_2 = field duplicate concentration

Accuracy. Accuracy will be evaluated by reviewing the following:

- Calibrations—initial and continuing, acceptance, and frequency (deviations are assumed to be noted in case narratives)
- Surrogates—recovery and frequency
- LCS and LCSD recoveries
- MS and MSD recoveries
- Method blanks (detections in the method blank may indicate potential high bias in associated samples)
- Relative response factors and relative standard deviation (appropriate calibration procedures improve accuracy of measurement results; deviations are assumed to be noted in case narratives)
- Tune criteria gas chromatography/mass spectroscopy (GC/MS)—acceptability and frequency (deviations are assumed to be noted in laboratory case narratives)
- Internal standards (GC and GC/MS)—acceptability and frequency (deviations are assumed to be noted in laboratory case narratives)

Accuracy formula for surrogates, laboratory control samples, and matrix spikes:

$$\%\ Recovery = \frac{(\theta - X)}{T} \times 100$$

Where: θ = measured quantity of analyte in sample plus spiked solution
X = measured sample prior to spiking
T = quantity of analyte spiked

Representativeness. The following will be reviewed to evaluate representativeness:

- Sample quantities and locations
- Sampling procedures and equipment
- Sample CoCs and field logbooks
- Holding times and preservation
- Data Usability Assessment

7.4 Data Usability Assessment

This section describes the procedures, methods, and activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision making for the project. The section also describes how data quality issues will be addressed and how limitations on the use of the data will be handled.

The contractor's Project Chemist will perform data verification/validation and usability assessment. The data usability assessment is based on the findings of data verification and validation and determines whether the project execution and resulting data meet the DQOs. Both the sampling and analytical activities will be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data. The findings of the data usability assessment will be presented in the DQR, which will accompany the project report. Table 20 presents the general usability assessment process.

Table 20 Usability Assessment Process

STEP	ACTIVITY
1	*Review the project's objectives and sampling design* Review the key outputs defined during systematic planning (i.e., LODs) to make sure they are still applicable. Review the sampling design for consistency with stated objectives. This provides the context for interpreting the data in subsequent steps.
2	*Review the data verification and data validation outputs* Review the DQR, which summarizes the verification and validation outputs, to determine whether project DQOs have been met. Review the DQI, to include completeness, comparability, representativeness, precision, and accuracy. Verify that analytical methods provide low enough LODs to meet project objectives. Review deviations from planned activities (e.g., number and locations of samples, holding time exceedances, damaged samples, and SOP deviations) and determine their impacts on the data usability. Evaluate implications of unacceptable QC sample results.
3	*Compare new data with historical data for the site (when applicable)* Look for patterns, trends, and anomalies (i.e., unexpected results). Evaluate the implications of applied data qualifiers on the project data.

Table 20 Usability Assessment Process

STEP	ACTIVITY
4	*Document data usability and draw conclusions* Determine whether the data can be used as intended, considering implications of deviations and corrective actions. Discuss DQIs that are presented in the DQR. Assess the performance of the sampling design, and identify limitations on data use. Update the conceptual site model, and document conclusions. Prepare the data usability summary report, which can be in the form of text and/or a table within the DQR.

Notes:
DQI = data quality indicator
DQO = data quality objective
DQR = Data Quality Report
LOD = limit of detection
QC = quality control
SOP = standard operating procedure

7.5 Statistical Approach

Water quality data will be analyzed by evaluating concentrations at the compliance point over time to determine if a statistically significant change in water quality has occurred. Mann-Kendall trend analyses will be performed on analytes and sample locations that exceed WQC and where an increase in concentration is observed. Mann-Kendall is a non-parametric test, so the effect of outliers is minimized. The Mann-Kendall test is applicable to individual constituents that have been detected at least 50 percent of the time at a particular sample location. Non-detect results will be input as the LOD. If an increasing trend is suspected but not enough detections have been made to use the Mann-Kendall analysis, a graph of concentrations over time will be produced for visual analysis.

A finding of no trend or a decreasing trend would indicate the compounds are naturally occurring in the area. An increasing trend would indicate potential leachate from the closed landfill. If an increasing trend is found, the USCG and ADEC will discuss the potential corrective actions to be made.

This page intentionally blank

8.0 DELIVERABLES

Semi-annual reports will be submitted as part of the monitoring activities at Site 1 as described in the following sections.

8.1 Project Documents and Records Table

Table 21 identifies the documents and records that will be generated for all aspects of the project, including, but not limited to, sample collection and field measurement, onsite and offsite analysis, and data assessment. These documents will be included in the project reports.

Table 21 Project Documents and Record

RECORD	GENERATION	VERIFICATION	STORAGE LOCATION / ARCHIVE
Sample Collection and Field Records			
Field logbooks	Field Manager	Project Manager	Project Files
Data collection sheets	Field Sampler	Project Manager	Project Files
CoC forms	Field Manager	Project Chemist	Project Files
Data Assessments			
Data verification checklists	Project Chemist	Review by another Project Chemist	Project Files
Data quality report	Project Chemist	Review by another Project Chemist	Project Files
Laboratory Records			
Electronic data deliverables (Level II PDF, EDD)	Analytical Laboratory (EMAX)	Project Chemist	Project Files

Notes:
CoC = chain of custody
EDD = electronic data deliverable
EMAX = EMAX Laboratories, Inc.
PDF = portable document file

8.2 Reporting

The contractor will submit a report after completion of each fieldwork event. The report will document the activities and findings, and provide recommendations. The contractor will provide complete chemical analytical data to USCG with the draft report. Analyses shall give the identification number of the sample used, and sample identification numbers shall correspond to those provided on drawings and figures. Sample identification numbers shall be tabulated and each sample shall be clearly identified as a primary, duplicate, or split sample (with QC sample results compared side by side). Any deviations to the WP or QAPP will be clearly documented in the report. The contractor will review the data and will be responsible for incorporation into the draft report.

Draft reports will be submitted to the USCG within 60 days following receipt of analytical results. Final reports will be submitted within 90 days following receipt of analytical results. Final reports will be distributed according to Table 22.

Table 22 Document Distribution

NAME	AFFILIATION	DOCUMENT TYPE
Kate von Rekowski	USCG CEU Juneau	1 Hard Copy 1 CD/electronic
Jennifer Nutt	USCG Base Kodiak	1 Hard Copy 1 CD/electronic
Jan Palumbo	EPA Region 10	1 Hard Copy 1 CD/electronic
Kaylie Holland	ADEC Solid Waste Program	1 CD/electronic

Notes:
ADEC = Alaska Department of Environmental Conservation
CD = compact disc
CEU = Civil Engineering Unit
EPA = U.S. Environmental Protection Agency
USCG = U.S. Coast Guard

9.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2017a (April). *Guidelines for Treatment of Non-Detect Values, Data Reduction for Multiple Detections, and Comparison of Quantitation Limits to Cleanup Values.*

ADEC. 2017b (November). *Solid Waste Management*. 18 AAC 60.

ADEC. 2018 (April). *Water Quality Standards*. 18 AAC 70.

ADEC. 2019a (February). *Surface Water Standards Table, Technical Memorandum 18.02*. Division of Environmental Health Solid Waste Program.

ADEC. 2019b (October). *Field Sampling Guidance.*

ADEC. 2019c (October). *Minimum Quality Assurance Requirements for Sample Handling, Reports, and Laboratory Data.*

U.S. Department of Defense (DoD). 2019. *Quality Systems Manual (QSM) for Environmental Laboratories*. Version 5.3. January.

Hart Crowser, 2003 (January). *Post-Closure Monitoring Report, Fall 2002, USCG ISC Kodiak, Site 1 – Landfill, Kodiak, Alaska.*

United States Environmental Protection Agency (EPA). 2017 (January). *National Functional Guidelines for Organic Superfund Methods Data Review.*

EPA. 2021. (March) (revised). *Resource Conservation and Recovery Act Hazardous Waste Facility Management Permit, Permit No. AK9 69033 0742*. Issued by the EPA Region 10 in April 2011 to USCG Base Kodiak.

This page intentionally blank

ATTACHMENT B-1
USCG KODIAK STANDARD OPERATING PROCEDURES

This page intentionally blank

Draft
Attachment B-1
USCG Kodiak Field Standard Operating Procedures

U.S. Coast Guard Base Kodiak
Kodiak, Alaska

Prepared for:

U.S. Coast Guard

Civil Engineering Unit Juneau
PO Box 25517
Juneau, Alaska 99802-1747

December 2020

This page intentionally blank

TABLE OF CONTENTS

1.0 DECONTAMINATION OF SAMPLING EQUIPMENT 1

1.1 Purpose 1
1.2 Scope 1
1.3 Requirements 1
1.4 Definitions 1
1.5 Responsibilities 1
1.5.1 Project Manager 1
1.5.2 Field Operations Leader 1
1.6 Equipment 1
1.7 Procedure 2
1.7.1 Decontamination 2
1.7.2 Requirements and Limitations 2
1.7.3 Quality Control Procedures for Decontamination 3

2.0 WELL DEVELOPMENT 5

2.1 Purpose 5
2.2 Scope 5
2.3 Requirements 5
2.4 Definitions 5
2.5 Responsibilities 5
2.5.1 Field Operations Leader 5
2.5.2 Field Geologist 6
2.6 Equipment 6
2.7 Procedure 6
2.7.1 Development 6
2.7.2 Groundwater Sampling 7
2.7.3 Surging 7
2.8 Attachments 7

3.0 WELL PURGING 9

3.1 Purpose 9
3.2 Scope 9
3.3 Requirements 9
3.4 Definitions 9
3.5 Responsibilities 9
3.5.1 Project Manager 9
3.5.2 Site Hydrogeologist or Geochemist 10
3.5.3 Site Geologist 10
3.6 Equipment 10
3.7 Procedure 10
3.7.1 General 10
3.7.2 Calculations of Well Volume 10
3.7.3 Specific Procedure for Well Purging 11
3.8 Attachments 12

TABLE OF CONTENTS (CONTINUED)

4.0 GROUNDWATER SAMPLING 13

4.1 Purpose 13
4.2 Scope 13
4.3 Requirements 13
4.4 Definitions 13
4.5 Responsibilities 13
4.5.1 Project Manager 13
4.5.2 Site Hydrogeologist or Geochemist 13
4.5.3 Site Geologist 14
4.6 Equipment 14
4.7 Procedure 15
4.7.1 General 15
4.7.2 Sampling Approach 15
4.7.3 Records 18
4.7.4 Chain-of-Custody 18
4.8 Attachments 18

1.0 DECONTAMINATION OF SAMPLING EQUIPMENT

Procedure No.: FP 1 Revision Date: August 2020

Project: Base Kodiak Post-Closure Monitoring

1.1 Purpose

The purpose of this procedure is to provide reference information on the proper decontamination of sampling equipment used to perform field investigations.

1.2 Scope

This procedure addresses decontamination of sampling equipment. Personnel decontamination guidelines are presented in the project-specific work plan.

1.3 Requirements

To ensure that chemical analysis results are reflective of the actual concentrations present at sampling locations, equipment used in sampling activities must be properly cleaned and decontaminated. This will minimize the potential for cross-contamination between sampling locations and the transfer of contamination offsite.

1.4 Definitions

Deionized Water - Volatile-free, ion-free, and organic-free water.

Detergent - Standard brand of non-phosphate, laboratory-grade detergent such as Alconox or Liquinox.

Tap or Potable Water - Water from an approved municipal water treatment system.

1.5 Responsibilities

1.5.1 Project Manager

The Project Manager is responsible for ensuring that decontamination procedures for all chemical sampling and field analytical equipment are programmed prior to the actual field effort and that personnel required to accomplish the task have been briefed and trained to execute the task.

1.5.2 Field Operations Leader

The Field Operations Leader is responsible for ensuring that project-specific plans and the implementation of field investigations are in compliance with this procedure.

1.6 Equipment

1. Disposable Nitrile or Equivalent Gloves
2. Laboratory-Grade, Non-Phosphate Detergent
3. Deionized Water

4. Scrub Brushes
5. Five- to 10-gallon Stainless Steel or Plastic Buckets

1.7 Procedure

1.7.1 Decontamination

Prior to the collection of samples, the equipment used to collect water, soil, sediment, and other samples will be decontaminated as follows:

- Wash and scrub with laboratory-grade, non-phosphate detergent (Alconox or Liquinox)
- Rinse with deionized water
- Air dry

NOTE: Disposal of all wastes generated during the field activities is described in the project-specific work plan.

1.7.2 Requirements and Limitations

1.7.2.1 Sampling Pumps

Most sampling pumps are normally low volume pumps (less than two gpm). These include various types of positive displacement pumps. Pumps that allow air or other gases to come in contact with the sample will not be used. If pumps are used for sampling more than one sampling point, they must be decontaminated between sample locations.

The procedures to be used for decontamination of sampling pumps are generally the same as those described in Section 1.7.1. Each of the liquid fractions is to be pumped through the system. The amount of pumping is dependent upon the size of the pump and the length of the intake and discharge hoses.

1.7.2.2 Filtering Equipment

One aspect of the sampling plan may involve the filtering of groundwater samples and subsequent preservation. Filtering, if required, will be done in the field as soon as the sample is obtained. The sample will be preserved immediately after filtration. Three basic filtration systems are most commonly used: the in-line disposal filter, the inert gas over-pressure filtration system, and the vacuum filtration system.

For the in-line filter, decontamination is not required since the filter cartridge is disposable; however, the cartridge must be disposed of in an approved receptacle, and the intake and discharge lines must still be decontaminated.

For the over-pressure and vacuum filtration systems, the portions of the apparatus which come in contact with the sample must be decontaminated depending on the analyses to be performed.

1.7.2.3 Water Level Indicators

The method for decontaminating water level indicators is as follows:

- Wash and scrub with laboratory-grade, non-phosphate detergent (Alconox or Liquinox)
- Rinse with deionized water
- Air dry or blot dry with a paper towel

Additional steps such as methanol rinsing and/or scrubbing are acceptable. If FS-6 or other heavy oils are present, the following decontamination procedure should be followed:

- Rinse with JP-5 to cut FS-6 or heavy oil (containerize all waste)
- Blot dry with paper towel
- Wash and scrub with laboratory-grade, non-phosphate detergent (Alconox or Liquinox)
- Rinse with deionized water
- Rinse with pesticide-grade methanol or isopropanol
- Rinse with pesticide-grade hexane (if analysis for pesticides is part of sampling plan)
- Rinse with deionized water
- Air dry

1.7.2.4 Probes

Probes (e.g., pH or specific ion electrodes, geophysical probes, multi-parameter probes, or thermometers) that come in direct contact with the sample will be decontaminated using the procedure described in Section 1.7.1. For probes which make no direct contact (e.g., OVA equipment) the probe will be wiped with a clean paper towel or cloth.

1.7.3 Quality Control Procedures for Decontamination

The effectiveness of field cleaning procedures shall be monitored by following quality assurance/quality control procedures outlined in the project-specific work plan.

This page intentionally blank

2.0 WELL DEVELOPMENT

Procedure No.: FP 2 Revision Date: August 2020

Project: Base Kodiak Post-Closure Monitoring

2.1 Purpose

The purpose of this procedure is to define the requirements for developing monitoring wells to increase permeability, remove fines, and ensure that a representative sample of groundwater is obtained from the aquifer.

2.2 Scope

This procedure applies to development of wells by either the bailing or pumping techniques. The development water will be stored in appropriate containers, analyzed, and handled in accordance with the project-specific work plan.

2.3 Requirements

The selection of the well development method shall be made by a hydrogeologist and is based on the drilling methods, well construction and installation details, and the characteristics of the formation in which the well is screened. Any equipment introduced into the well during development shall be decontaminated in accordance with Field Procedure FP 1.

Each monitoring well will be developed by bailing or pumping. Centrifugal pumps will generally be used to develop shallow wells with high yield. Submersible or positive displacement pumps will generally be used to develop deep wells of low to high yield. Equipment availability or other circumstances may occasion the use of a submersible or positive displacement pump to develop a shallow high-yield well or hand pumps and bailers to develop any well. Physical and chemical parameters including temperature, pH, specific conductance, and turbidity of the water will be measured during well development.

2.4 Definitions

Surging - Surging is a process in which a plunger-type device called a surge plunger or surge block is moved up and down within the well screen to force groundwater to alternately flow in and out through the sand pack. This back and forth movement of water facilitates removal of fines from the formation immediately adjacent to the well while preventing bridging (wedging) of sand grains.

2.5 Responsibilities

2.5.1 Field Operations Leader

The Field Operations Leader is responsible for ensuring that field personnel have been trained in the use of this procedure and for verifying that well development activities are performed in compliance with the contract.

2.5.2 Field Geologist

The Field Geologist is responsible for withdrawing sufficient water to clarify the well, and for performing physical measurements such as pH, temperature, specific conductance, and turbidity to ensure proper development. All data should be entered on the Well Development Log (Permit Attachment 4A, Appendix A).

2.6 Equipment

1. Pump
2. Pump Suction Line
3. Surging Equipment (as necessary)
4. Bailer
5. Bailer Line
6. Steel Retractable Engineer's Measuring Tape
7. Water Level Indicator
8. Water Quality Meter(s) (temperature, ph, specific conductance, and turbidity)
9. Drums or Mobile Tanks to Contain the Development Water
10. Field Logbook
11. Well Development Log

2.7 Procedure

2.7.1 Development

Development of wells will begin between 24 hours and seven days after installation. Water level will be measured initially and at the end of development. The next water level measurement is preferably recorded 24 hours later; however, it may be longer. The water level will be measured prior to purging and initial sampling, which generally occurs within a few days of well development. The development procedure includes:

- Open and check the condition of the well head. Check for organic vapors.
- Measure the water level in the well before development begins. Record the value to the nearest 0.01 foot on the Well Development Log.
- Measure the total depth of the well prior to development. Record the value to the nearest 0.01 foot on the Well Development Log.
- Prepare the equipment for developing the well. For screened intervals longer than 10 feet, develop the well in two to 3-foot intervals from bottom to top.
- Continue development until water appears to run clear or the turbidity stabilizes. A minimum of five well volumes plus three times any water used during the well installation shall be removed.
- After most of the sediment appears to have been removed from the well begin collecting samples for measurements of pH, temperature, specific conductance, and turbidity. Samples should be collected at intervals of at least one well casing volume.

- Development will be considered complete when:
  - three consecutive measurements of pH, temperature, and specific conductance are within 10 percent of each other, or
  - the well is purged dry.
- Should the recharge be so slow that the required volume cannot be removed in 24 hours, the water remains discolored, or excess sediment remains after the well pumps dry; contact the Field Operations Leader for guidance.
- Measure the total depth of the well after development. Record the value to the nearest 0.01 foot in the Well Development Log.
- The record of well development shall be submitted to the Field Operations Leader for QA/QC review and submittal to data management.

2.7.2 Groundwater Sampling

A pump or bailer will be lowered into the well. Water will be removed from the well at varying depths along the entire interval of the screen until the effluent begins to clear of suspended solids. A sample of the development water will be tested for turbidity, pH, temperature, and specific conductance. Measurement will be taken with an appropriate water quality meter calibrated in accordance with the manufacturer's instructions.

2.7.3 Surging

- A surge plunger (also called a surge block or swab) is approximately the same diameter as the well casing and is used to agitate the water.
- In formations with a low yield, a solid plunger is the most effective.
- In formations with a high yield, a valved surge plunger may be preferred, as they are designed to create greater inflow than outflow during surging.

2.8 Attachments

Well Development Form is located in Permit Attachment 4A, Appendix A.

This page intentionally blank

3.0 WELL PURGING

Procedure No.: FP 3 Revision Date: August 2020

Project: Base Kodiak Post-Closure Monitoring

3.1 Purpose

The purpose of this procedure is to provide general reference information on well purging techniques prior to the sampling of groundwater wells. The methods and equipment described are for the purging of water samples from the saturated zone of the substrata.

3.2 Scope

This procedure applies to purging water from relatively low volume wells. The site hydrogeologist, geochemist, and risk assessment personnel shall define the objective of the groundwater sampling program in the project-specific work plan.

3.3 Requirements

Methods for purging from completed wells include the use of pumps, bailers, and various types of samplers. The primary considerations in obtaining a representative sample of the groundwater are to avoid collection of stagnant (standing) water in the well and to avoid physical or chemical alteration of the water due to purging and sampling techniques. In a non-pumping well, there will be little or no vertical mixing of water in the well pipe or casing, and stratification will occur. The well water in the screened section will mix with the groundwater due to normal flow patterns, but the well water above the screened section will remain isolated and become stagnant.

3.4 Definitions

Bailer - A cylindrical section of polyethylene or Teflon® with a floating ball check-valve at the bottom. The bailer is submerged, the ball floats, and water enters from the bottom. As the bailer is raised, the ball settles on the bottom creating a seal, allowing retrieval of a quantity of trapped water.

Purge - An action that removes water from a well, commonly accomplished using a pump or bailer.

Surge - An action causing water to move rapidly in and out of the well screen thereby removing fine material from the surrounding aquifer.

3.5 Responsibilities

3.5.1 Project Manager

The Project Manager is responsible for reviewing the purging procedures used by the field crew and for performing in-field spot checks for proper purging procedures.

3.5.2 Site Hydrogeologist or Geochemist

The Site Hydrogeologist or Geochemist is responsible for selecting and detailing the specific well purging techniques and equipment to be used, documenting these in the Field Logbook, and properly briefing the site sampling personnel.

3.5.3 Site Geologist

The Site Geologist is primarily responsible for the proper well purging techniques. When appropriate, such responsibilities may be performed by other qualified personnel (engineers, field technicians). The Site Geologist will be responsible for purging of wells, performing necessary physical measurements and observations, and containment of purged water. The Site Geologist must record pertinent information including amount of water purged, pH, specific conductivity, redox potential, dissolved oxygen, temperature, and turbidity on the Groundwater Sampling Form, provided in Permit Attachment 4A, Appendix A.

3.6 Equipment

1. Teflon® tubing (or Teflon® lined tubing)
2. Pump
3. Graduated cylinder
4. Steel Retractable Engineer's Measuring Tape (Calibrated to 0.01 Foot)
5. Water Level Indicators
6. Swabbing Equipment (as necessary)
7. Water Quality Meter(s) (Temperature, pH, Specific Conductance, Turbidity, Dissolved Oxygen, and Oxidation-Reduction Potential)
8. Drums and Buckets to Contain the Purge Water
9. Groundwater Sampling Form
10. Field Logbook
11. Calculator

3.7 Procedure

3.7.1 General

The intention of well purging prior to sampling is to produce a sample representative of actual groundwater conditions. Stagnant water is removed from the monitoring well, causing it to be replaced by groundwater from the adjacent formation.

3.7.2 Calculations of Well Volume

To ensure that the proper volume of water has been removed from the well prior to sampling, it is first necessary to determine the volume of standing water in the well pipe. The volume can be easily calculated, and the calculations shall be entered on the Groundwater Sample Form:

1. Obtain information on well construction (location, casing, screens, etc.).
2. Determine well casing diameter.

3. Measure and record static water level (depth below ground level or top of casing reference point), using a decontaminated water level indicator.
4. Determine depth of well by sounding, using a clean, decontaminated weighted tape measure or water level indicator.
5. Calculate number of linear feet of static water (total depth or length of well pipe minus the depth to static water level).
6. Calculate the volume of water in the casing by one of the following methods.
   a.

$$V_c = \pi \left(\frac{d_i}{2}\right) 2(TD - H)$$
$$V_t = V_c \times 7.48$$

   Where:
   V_c = Volume of water in casing (cubic feet)
   V_t = Total volume (gallons)
   d_i = Inside diameter of casing (feet)
   TD = total depth of well (feet below top of casing)
   H = depth to water (feet below top of casing)
   b.
   For a 2-inch inside diameter well, multiply the well casing water column (TD-H), measured in feet, by 0.17 to obtain the well volume in gallons.
7. Determine the minimum number of gallons to be evacuated before sampling.

3.7.3 Specific Procedure for Well Purging

- Work crew members must use either new disposable gloves or decontaminated reusable gloves.
- If the relative degrees of contamination between wells is unknown or insignificant, a sampling sequence which facilitates sampling logistics may be followed. Where some wells are known or strongly suspected of being highly contaminated, these should be sampled last to reduce the risk of cross-contamination between wells.
- Using a water level indicator, measure the "depth to water" in the well from the top of the well casing.
- Calculate the volume of water in the well. Record this information on the groundwater sample form and calculate the volume of water required to be purged. Normally:
  - the well will be purged of three volumes of water, or
  - water quality parameters will be monitored until a minimum of three (minimum of four if using temperature as an indicator) of the parameters listed below stabilize, or
  - for low yield wells, the entire well casing is evacuated.
- All water quality parameters, except for turbidity, must be obtained using a flow- through-cell and turbidity measurements must be obtained before the water enters the flow-through-cell. Field parameter measurements will be recorded on a groundwater monitoring form.
- Monitoring wells will be purged using low-flow techniques, with the goal of minimum drawdown (< 0.3 feet) during purging. Measure the water level at each interval that the water

quality field parameters are measured and recorded on the groundwater monitoring form. Flow rate must be between 50 and 500 milliliters per minute.

- Water quality parameters are considered stable when three successive readings, collected 3 to 5 minutes apart, are within:
  - ± the lesser of 0.2°C or 3 percent (%) for temperature,
  - ± 0.1 for pH,
  - ± 3% for conductivity,
  - ± 10 mV for redox potential,
  - ± 10% for dissolved oxygen, and
  - ≤ 5 NTU or ± 10% for turbidity.
- A minimum of three (minimum of four if using temperature as an indicator) of these parameters must be monitored and recorded. Additional parameters may be measured as specified in the project-specific work plan. Record the field parameters on the Groundwater Sampling Form.
- If a low yield well purges dry, do not collect a sample until it has recharged to approximately 80% of its pre-purge volume.
- Record the total volume of water removed on the Groundwater Sampling Form.
- In general, chemical samples will be collected in accordance with FP 4 immediately after purging is complete.
- Whenever the receptor drum has become filled, the water shall be stored, analyzed, and disposed of in accordance with the project-specific work plan.
- If reusable equipment is used, decontaminate the equipment in accordance with FP 1 after purging and sampling are complete.

3.8 Attachments

Groundwater Sampling Form is located in Permit Attachment 4A, Appendix A.

4.0 GROUNDWATER SAMPLING

Procedure No.: FP 4 Revision Date: August 2020

Project: Base Kodiak Post-Closure Monitoring

4.1 Purpose

The purpose of this procedure is to obtain groundwater samples that are representative of the source from which they are taken and minimize sampler exposure to groundwater contaminants. The methods and equipment described are for the collection of water samples from the saturated zone of the substrata.

4.2 Scope

This procedure provides information on proper equipment and techniques for groundwater sampling. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described should be followed whenever applicable, noting that site-specific conditions and the project-specific work plan may require adjustments in methodology.

4.3 Requirements

Generally, wells should be sampled within three hours of purging. However, wells with poor recharge should be sampled within 24 hours of purging. If a well is low yield and purged dry, a sample should not be collected until it has recharged 80% of its pre-purge volume, when practical.

Many analytes require a preservative. Typically, the appropriate preservatives are already in the sample containers provided by the laboratory. Care should be taken while sampling to not spill the preservative or to overfill the sample container. All reusable sampling equipment must be decontaminated in accordance with Field Procedure FP 1, Decontamination of Sampling Equipment, before commencement of sampling.

4.4 Definitions

None.

4.5 Responsibilities

4.5.1 Project Manager

The Project manager is responsible for reviewing the sampling procedures used by the field crew and for performing in-field spot checks for proper sampling procedures.

4.5.2 Site Hydrogeologist or Geochemist

The Site Hydrogeologist or Geochemist is responsible for selecting and detailing the specific groundwater sampling techniques and equipment to be used, documenting these in the project-specific work plan, and properly briefing the site personnel.

4.5.3 Site Geologist

The Site Geologist is primarily responsible for the proper acquisition of the groundwater samples. When appropriate, such responsibilities may be performed by other qualified personnel (engineers, field technicians).

4.6 Equipment

Sample containers shall conform with EPA regulations for preservation of appropriate contaminants (see the project-specific work plan). Ideally, sample withdrawal equipment should be completely inert, economical, easily decontaminated or disposable, easily sterilized, able to operate at remote sites in the absence of power sources, and capable of delivering variable rates for well purging and sample collection. The following pieces of equipment may be needed to collect groundwater samples:

1. Sample Containers
2. Coolers for Sample Shipping and Cooling
3. Chemical Preservatives
4. Ice Packs or Ice
5. Appropriate Packing Cartons and Filler
6. Labels
7. Chain-of-Custody Documents
8. Water quality meter, such as a YSI or similar, equipped with a flow-through cell
9. Appropriate Keys (for Locked Wells)
10. Tape Measure
11. Water-Level Indicator
12. Appropriate Sampling Gloves
13. Field Sampling Logbooks
14. Groundwater Sampling Form
15. Scissors
16. Plastic Trash Bags
17. Indelible Marking Pens
18. Black, Permanent Ink Pens
19. Shallow-Well Pumps (centrifugal, bladder, positive displacement or peristaltic pumps where applicable)
20. Deep-Well Pumps (submersible pump and electrical power generating unit or bladder pump with compressed air source, where applicable)
21. Sample Tubing Such as Teflon®, Polyethylene and Polypropylene (tubing type shall be selected based on specific site requirements and must be chemically inert to groundwater being sampled)
22. Decontamination Supplies

4.7 Procedure

4.7.1 General

To be useful and accurate, a groundwater sample must be representative of the particular saturated zone of the substrata being sampled. The physical, chemical, and/or bacteriological integrity of the sample must be maintained from the time of sampling to the time of testing in order to keep any changes in water quality parameters to a minimum.

Purging wells prior to sampling includes the use of pumps, Teflon® tubing and a flow through cell. The procedure is described in FP 3 and will be used for purging wells prior to sampling. Purging is not required when sampling private supply wells. Water produced during purging shall be collected, stored, or treated and discharged as indicated in the project-specific work plan.

Stratification of contaminants may exist in the aquifer formation, either in terms of concentration gradients as a result of mixing and dispersion processes in a homogeneous layer, or due to layers of variable permeability into which a greater or lesser amount of the contaminant plume has flowed. Excessive pumping can dilute or increase the contaminant concentrations in the recovered sample compared to what is representative of the integrated water column at that point. This can result in the collection of a non-representative sample.

4.7.2 Sampling Approach

The sampling approach consisting of the following, is developed in the project-specific work plan and includes:

1. Background and objectives of sampling.
2. Brief description of area and waste characterization.
3. Identification of sampling locations, with map or sketch, and applicable well construction data (well size, depth, screened interval, reference elevation).
4. Sampling equipment to be used.
5. Assigned number, sequence, volumes, and types of samples. If the relative degrees of contamination between wells is unknown or insignificant, a sampling sequence which facilitates sampling logistics may be followed. Where some wells are known or strongly suspected of being highly contaminated, these should be sampled last to reduce the risk of cross-contamination between wells as a result of the sampling procedures.
6. Sample preservation requirements.
7. Working Schedule.

4.7.2.1 Sampling Methods

The collection of a groundwater sample is made up of the following steps.

1. Purge the well following the appropriate procedure (FP 3 Well Purging).
2. Fill out sample labels for each of the required sample containers and place labels onto the appropriate sample containers. The following information must be included on the sample label:
    a. site name
    b. sample number
    c. date and time of sample collection

d. printed initials of the sampler
e. sample preservative used
f. types of analyses to be performed.

If a sample is split with another party, sample labels with identical information should be attached to each of the sample containers.

3. When samples are collected for laboratory analysis, any device used to collect additional information, such as a flow-through cell, must be removed from the sample train before sampling. During laboratory analytical sample collection, do not use constricting devices on the sample tubing to reduce the flow rate because the constrictor will cause a pressure difference in the water column and a loss of VOCs and dissolved gasses. To ensure that groundwater samples are representative of actual conditions, samplers must work efficiently to minimize the loss of groundwater contaminants and the introduction of foreign contaminants. To prevent contamination of samples, the sample bottles should be opened only when receiving sample preservatives or groundwater samples and closed immediately afterwards. Sample bottles or other potentially contaminating objects should be held away from the well opening to prevent introduction of foreign contaminants into the well.

   Sample the wells least likely to be contaminated first. Collect water quality parameters and samples in the following order:

   a. In-field water quality measurements,
   b. Volatile organic compounds,
   c. Semi-volatile organic compounds,
   d. TOC,
   e. TOX,
   f. Total metals, and
   g. Dissolved metals.

   The sampler should quickly add the sample into the sample containers, while minimizing aeration and loss of volatile contaminants. When a sample bottle is filled, the bottle must be tightly capped as soon as possible.

4. Efficiency and care must be utilized to obtain representative samples for volatile organic analysis. Unnecessary delays or poor sampling technique will lead to loss of the volatile constituents from the sample. Prevent unnecessary stripping of volatile constituents from the sample by minimizing turbulence and aeration when extracting water from the well through the tubing and filling the sample container. Quickly fill the sample container until a positive meniscus is achieved above the rim of the container and cap the container immediately. Gently tap the sample container to dislodge any air bubbles and verify that no bubbles are present. If bubbles are detected, immediately uncap the sample, add additional sample from the tubing until a positive meniscus is re-established, immediately recap the sample and check the sample for bubbles. After the sample container has been opened twice, the sampling process must start over with a new sampling container. Repeat this step until the volatile organics sample contains no bubbles and all required samples are obtained.
5. Water samples should typically not be filtered prior to analysis. If filtering is approved by ADEC in a site-specific work plan, both filtered and non-filtered samples will need to be collected and

analyzed so the effects (bias) of the filtering process on the contaminant concentrations can be evaluated.

6. After sample collection, promptly place the samples in a chilled cooler. Samples that will be stored overnight prior to shipping should be kept at between 0 and 6 degrees Celsius.
7. Record all sampling information on the Groundwater Sampling Form.
8. Decontaminate all reusable sample equipment.
9. Prepare the samples for shipment in accordance with procedures specified in the Quality Assurance Project Plan (QAPP; Permit Attachment 4A, Appendix B).

4.7.2.2 Collection of Split Samples or Field Duplicates

Whenever field duplicates are collected or samples are split with another organization the additional samples for identical analyses will be collected along with the original sample (i.e., containers for all volatile organic analyses will be filled first and together, all semi-volatiles together and in proper sequence, and so forth until all sample parameters are in the proper containers).

4.7.2.3 Sample Containers, Preservation, and Volume Requirements

Sample container materials, preservation techniques, and volume requirements depend on the type and concentration of the contaminant and on the type of analysis to be performed. The project-specific work plan describes the sample container, preservation, and volume requirements for the targeted analytes.

4.7.2.4 Field Filtration

If field filtering is required by the analytical method, it must be approved by ADEC in the site-specific work plan. The recommended method is through the use of a disposable in-line filtration module (2.0 micron filter for metals and 0.30 micron filter for gross alpha/gross beta) using the pressure provided by the pumping device for its operation. Filters must be certified as "clean." Both filtered and non-filtered samples will need to be collected and analyzed so the effects (bias) of the filtering process on the contaminant concentrations can be evaluated.

Samples for organic analyses must never be filtered.

4.7.2.5 Handling and Transporting Samples

After collection, samples should be handled as little as possible. It is preferable to use self-contained "chemical" ice (e.g., "gel ice") to reduce the risk of contamination. All sample containers should be enclosed in plastic bags or cans to prevent cross-contamination.

Samples should be secured in the cooler to prevent movement of sample containers and possible breakage. Sample packing and transportation requirements are described in the QAPP (Permit Attachment 4A, Appendix B) and requirements for chilling samples are described in the project-specific work plan.

4.7.2.6 Sample Holding Times

Holding times, allowed time between sample collection and analysis for routine samples, are given in the project-specific work plan.

4.7.3 Records

Records will be maintained for each sample that is taken. The Groundwater Sampling Form (Permit Attachment 4A, Appendix A) will be used to record the following information:

- Sample identification (site name, location, project number; sample name/number and location; sample type and matrix; time and date; sampler's identity).
- Sample source.
- Field observations and measurements (appearance; field chemistry; sampling method).
- Sample disposition (analyses to be run and preservatives added).
- Additional remarks (e.g., sampled in conjunction with state, county, local regulatory authorities; samples for specific conductance value only; sampled for key indicator; etc.).

4.7.4 Chain-of-Custody

Proper chain-of-custody procedures play a crucial role in data gathering. The requirements for a correct chain-of-custody are specified in the QAPP (Permit Attachment 4A, Appendix B).

4.8 Attachments

Groundwater Sampling Form is located in Permit Attachment 4A, Appendix A.

ATTACHMENT B-2
EMAX LABORATORIES, INC. STANDARD OPERATING PROCEDURES

This page intentionally blank

STANDARD OPERATING PROCEDURES

TRACE METALS BY ICP-MS

SOP No.:	EMAX-200.8	Revision No.	6	Effective Date:	30-Oct-18
Prepared By:	Tina Huang			Date:	10-29-18
Approved By:	Kenette Pimentel QA Manager			Date:	10.29.18
Approved By:	Caspar Pang Laboratory Director			Date:	10-29-18

Control Number: 200.8-06

1.0 SCOPE AND APPLICATION

1.1. This procedure is applicable for the determination of dissolved elements in drinking water, ground waters, and surface waters. It may also be used for the determination of total recoverable element concentrations in wastewater, soil, sludge, drinking water, ground waters, and surface waters using the Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) method. All matrices require proper sample preparation prior to analysis.

1.2. The elements and their corresponding isotopes are listed in Table 1.

1.3. This SOP is an adaptation of the EPA Method 200.8.

2.0 SUMMARY OF METHOD

2.1. This method has two types of analysis preparation, one for total recoverable analysis and the other for dissolved or direct analysis.

2.2. For total recoverable analysis of a solid or an aqueous sample containing undissolved material, analytes are gently refluxed with nitric and hydrochloric acids. After cooling, the sample is made up to volume, mixed, and centrifuged or allowed to settle overnight prior to analysis.

2.3. The dissolved or direct method is applied to a filtered aqueous sample aliquot or for drinking water samples with turbidity of < 1 NTU. The sample is prepared by the addition of nitric acid and then diluted to a predetermined volume and mixed before analysis.

2.4. Digestates are introduced by pneumatic nebulization resulting aerosol into a high temperature argon plasma, where they are decomposed, atomized and ionized. The ions produced are extracted from the plasma via the sample and skimmer orifices in the interface region of the mass spectrometer. The extracted ions are guided by an off-axis Lens System to reduce background noise, passes through an Octopole Reaction System (ORS) where some ions require a simple reaction with H_2 or He to eliminate matrix interference prior to entering the Quadrupole Mass Filter (QMF). The QMF separates ions based on their mass-to-charge ratios and ions are counted by electron multiplier detector. For drinking water analysis, the collision cell is turned off and interference equation for drinking water is applied.

2.5. Quantitation is accomplished by comparing the response of a major ion relative to an internal standard using a calibration curve.

2.6. **Interference**

2.6.1. Isobaric Elemental Interference - Are caused by isotopes of different elements which form singly or doubly charged ions of the same nominal mass-to-charge ratio. The signal of an isotope of an interfering element is determined and subtracted from the analyte isotope signal.

2.6.2. Isobaric Polyatomic Ion Interference - Are caused by ions consisting of more than one atom which have the same nominal mass-to-charge ratio as the isotope of interest. To correct for isobaric

polyatomic ion interferences, optimize the cell gas pressure on each analyte so that when the ORS employs simple reaction gases (H_2 and He) side reactions create new and unpredictable interferences. The ORS is equipped with notch filters and by using scanning voltages the created interferences are prevented from reaching the analyzer.

2.6.3. Physical Interference **-** Nebulization and transport processes can be affected if a matrix component causes a change in surface tension or viscosity. An internal standard can be used to correct physical interference if carefully matched to the analyte so that the two elements are similarly affected by matrix changes. When the intensity level of the internal standard is less than 60% or greater than 125% of the intensity of the first standard used during calibration, the sample must be diluted and re-analyzed.

2.6.4. Memory Interference - Contamination by carry-over can occur whenever high concentrations are analyzed in sequence with a low concentration sample. To reduce potential carry-over the rinse period between samples must be long enough to eliminate significant memory effect.

3.0 DETECTION LIMITS

3.1. **Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ)**

3.1.1. Refer to EMAX-QA04 for generation, validation and verification for DL, LOD and LOQ.

3.1.2. Established limits are shown in Tables 5 and 6.

4.0 DYNAMIC RANGE

4.1. Linear Dynamic Range (LDR) is the concentration over which the instrument response remains linear.

4.2. Establish LDR of each analyte by determining the signal response from a minimum of three preferably five different concentration across the range. The upper limit is within 10% of the true value.

4.3. Verify the established LDR whenever a change in analytical performance caused by either a change in instrument hardware or operating conditions occurs.

4.4. Determined sample analyte concentrations that are greater than 90% of the determined upper LDR limit must be diluted and reanalyzed.

5.0 SAMPLE HOLDING TIME AND PRESERVATION

5.1. **Holding Time**

5.1.1. Analyze all samples within 180 days from collection date.

5.2. **Preservation**

5.2.1. Expected sample condition when received in the lab:

- water samples in HDPE, preserved to pH < 2 with HNO_3.
- soil samples in glass jar or brass tubes.

5.2.2. For dissolved metal analysis, samples received are expected to have been filtered through a 0.45 µm filter at the time of collection and preserved with HNO_3 to pH < 2. In the event that the lab is

requested to perform this step, document this step and observe at least 24 hours from the time preservative is added before sample digestion.

5.2.3. Store water samples in the same condition as received unless specified in the project requirement.

5.2.4. Store soil samples at ≤ 6°C without freezing.

5.2.5. For aqueous samples, a field blank should be prepared and analyzed as required by the data user. Use the same type of container and acids as used in the sample connection.

6.0 ASSOCIATED SOPs

6.1.	EMAX-DM01	Data Flow and Review
6.2.	EMAX-QA04	Detection Limit (DL)
6.3.	EMAX-QA05	Training
6.4.	EMAX-QA08	Corrective Action
6.5.	EMAX-QC01	Quality Control for Chemicals
6.6.	EMAX-QC02	Analytical Standard Preparation
6.7.	EMAX-QC04	Balance Calibration
6.8.	EMAX-QC05	Calibration of Thermometers
6.9.	EMAX-QC06	Volumetric Labware and Micropipette Verification
6.10.	EMAX-SM03	Waste Disposal
6.11.	EMAX-SM01	Sample Management
6.12.	EMAX-SM02	Sample Receiving
6.13.	EMAX-SM04	Analytical and QC Sample Labeling
6.14.	EMAX-2130B	Turbidity

7.0 SAFETY

7.1. Read all SDS of chemicals listed in this SOP.

7.2. Observe the following precautions during operation or maintenance of the instrument:

- Close the instrument hoods and panels prior to operation.
- Check the exhaust system for a positive extraction at the exhaust duct.
- Handle acids properly.
- Check the drain vessels frequently.
- Make sure that the argon tank is chained.
- Wait for the instrument interface region to cool down prior to instrument maintenance.
- Observe all cautions and warnings stipulated in the Agilent 7500 ICPMS CE/CX Manuals.

7.3. Treat all reagents, standards, and samples as potential hazards. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, gloves, at all times when performing this procedure. Observe all chemical hygiene procedures as mentioned in the Chemical Hygiene Plan.

7.4. If for any reason, solvent and/or other reagents get in contact with the skin or any other part of the body, rinse the affected body part thoroughly with tap water. If irritations persist, inform your supervisor immediately so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS AND REAGENTS

8.1. Instruments and Supplies

8.1.1. ICP-MS: Agilent 7500CE Octopole Reaction System : Agilent 7500CX Octopole Reaction System

8.1.2. Autosampler: CETAC ASX-520

8.1.3. Computer: IBM Compatible

8.1.4. RF Generator: Agilent RF Generators

8.1.5. Data Acquisition Software:

- Instrument ID 98 - Agilent Chemstation version B.03.04
- Instrument ID F6 - Agilent Chemstation version B.04.00

8.1.6. Autosampler rack(s): 17 x 100 mm, 60 positions

8.1.7. ASX press Rapid Sample Introduction System

8.1.8. Culture tubes: 17 x 100 mm, polypropylene

8.1.9. Volumetric Flask: 10 mL, 50 mL, 500 mL, 1000 mL

8.1.10. Micropipettes: 1 mL, 0.100 mL, 5 mL

8.1.11. Pipet Tips: 100 - 1000 µL

8.1.12. Polyethylene bottles: 250, 500, 1000 mLl

8.1.13. Liquid argon

8.1.14. Hydrogen, Compressed: Ultra-high purity

8.1.15. Helium, compressed: Ultra-high purity

8.1.16. Balance: Sartorius LC 620 S or equivalent

8.1.17. Spatula: Stainless steel or equivalent

8.1.18. Digestion vessel: 50 mL, 100 mL snap seal

8.1.19. Digestion block: Aluminum blocks or equivalent

8.1.20. Thermometer: Range 0 - 110°C

8.1.21. Filters: Whatman #41 or equivalent, 0.45 µm syringe filter

8.1.22. Digestate Container: 50 mL polyethylene vessel, 100 mL Corning snap seal or equivalent

8.1.23. Disposable watch glass

8.2. **Chemicals and Reagents**

8.2.1. Reagent water : BDH Type II or equivalent

8.2.2. Solid Matrix Blank

8.2.3. Nitric Acid : Trace high purity grade, concentrated

8.2.4. Hydrochloric acid : Trace high purity grade, concentrated

9.0 STANDARDS

9.1. Refer to EMAX-QC02 for proper analytical standard preparation and EMAX-SM04 for standard labeling.

9.2. All standard concentrations described in Sec. 9 are typical concentrations. Other standard concentrations may be used as necessary in consideration of project requirements and/or for conformance purposes. Where changes are made, apply the same Method QC requirements and/or project requirements to validate acceptability.

9.3. **Tune Check Standard**

9.3.1. Purchase tune check standard as certified solutions at concentrations as suggested below.

STANDARD	SOURCE	ELEMENTS	CONC. (mg/L)	MATRIX
Tuning Solution	Agilent	Li, Y, Ce, Tl, Co	0.01	2% HNO_3
Tuning Check Standard	High Purity	Co, In, Li, Tl	10	2% HNO_3

9.3.2. Prepare tuning check standard at concentration level suggested below 2% HNO_3 reagent water.

STANDARD	ALIQUOT (mL)	FINAL VOL. (mL)	FINAL CONC. (mg/L)	MATRIX
Intermediate Tuning Check Standard	0.5	50	0.100	2% HNO_3

9.4. **Internal Standard (IS)**

9.4.1. Purchase stock internal standard as certified standard at concentration as suggested below.

STANDARD	SOURCE	ELEMENTS	CONC. (mg/L)	MATRIX
IS	Agilent	Li6, Sc, Ge, Rh, In, Tb, Bi, Lu	100	10% HNO_3

9.5. **Calibration Standards**

9.5.1. Calibration Stock Standard

9.5.1.1. Purchase custom-made certified individual and mixed stock standards as suggested below.

STANDARD	SOURCE	ELEMENTS	CONC. (µg/mL)	MATRIX
ICAL 1 (Mix)	High	As, B, Se, Sr, Tl, Ti, V, Zn,	10	2% HNO_3 and

STANDARD	SOURCE	ELEMENTS	CONC. (µg/mL)	MATRIX
	Purity	Sb, Mo, Sn		Trace HF Acid
ICAL 2 (Mix)	High Purity	Ba, Be, Cd, Cr, Co, Cu, Pb, Li, Mn, Ni, Ag, U	10	2% HNO_3
ICAL 3 (Mix)	High Purity	Al, Fe, K, Ca, Mg, Na	1,000	4% HNO_3
ICAL 4 (Mix)	High Purity	Al, Ca, Fe, K, Mg, Na	500	2% HNO_3
		As, Cd, Co, Cr, Cu, Pb, Ni, P, Se, Sr, Tl, U, V, Zn	5	
		B	1	
		Ba	10	
		Be, Li	0.5	
		Mn	30	
ICAL 5 (Mix)	High Purity	Ag	0.5	2% HNO_3 and Trace HF Acid
		Sb	1	
		So, Sn, Ti	5	
Single Element Cations	Accu-Standard	Al, Ca, Fe, Mg, K, Na	10,000	2-5% HNO_3
Zinc	High Purity	Zn	1000	2% HNO_3

9.5.2. Calibration Working Standard

9.5.2.1. Prepare working standards in S0 as suggested below.

Working Standard	Stock Standard Name	Conc. (µg/mL)	Preparation		
			Aliquot (mL)	Final vol. (mL)	Final conc. (µg/mL)
Cation Mix	Al	10,000	2.5	500	50
	Ca	10,000	2.5		50
	Fe	10,000	2.5		50
	Mg	10,000	2.5		50
	K	10,000	2.5		50
	Na	10,000	1.25		25
Zn – 1	Zn	1000	0.5	50	10
Mix 7A	ICAL 1	10	1.0	10	1.0
	ICAL 2	10	1.0		1.0
	ICAL 3	1000	1.0		100

9.5.3. Matrix Acid Blank (S0)

9.5.3.1. Prepare matrix solution blank (S0) using nitric acid or a mixture of nitric and hydrochloric acids in reagent water as suggested below.

S0 for	% HNO_3 by vol.	% HCl by vol.
Samples without Digestion (Direct Analysis)	3%	-
Samples with Digestion	3%	1%

9.5.3.2. Transfer into a clean HDPE bottle and identify the solution as S0. Use this solution for standards or digestate dilutions.

9.5.4. Initial Calibration Standard

9.5.4.1. The initial calibration consists of a blank (S0) and four standards (S1, S2, S3 and S4). Prepare the standards as suggested below. Refer to Table 3 for final concentrations for each analyte. Please note: More standard points may be added at the discretion of the analyst.

Standard Name	ICAL 1 (ml)	ICAL 2 (ml)	Cation Mix (ml)	Trace Mix (ml)	Zn - 10 ppm (ml)	Final volume (ml)	Final Concentration (µg/L)
S1	NA	NA	0.050	0.025	0.0025	50	0.5/25/50/1
S2	0.025	0.025	0.500	NA	0.025		5/250/500/10/50
S3	0.125	0.125	2.5	NA	0.125		25/1250/2500/50/250
S4	0.250	0.250	5.0	NA	0.250		50/2500/5000/100/500

9.5.5. Continuing Calibration Verification (CCV) Standard

9.5.5.1. Prepare CCV using the stock standards and S0 as suggested below. Refer to Table 3 for final concentrations for each analyte.

Stock Standard	Aliquot (ml)	Final volume (ml)	CCV Final Concentration (µg/ml)
ICAL 1	0.125	50	0.025
ICAL 2	0.125		0.025
Cation Mix	2.500		2.5/1.250
Zn – 10 ppm	0.125		0.050

9.6. **Secondary Source Standard**

9.6.1. Purchase secondary stock standard from a different source as certified standards or equivalent. Refer to list below.

SOURCE	STANDARD	ELEMENTS	CONC. (mg/L)	MATRIX
CPI	EMAX MIX 2	As, Ba, Be, B, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Sr, Tl, Ti, V, Zn, Ag, Sb, Mo, Li, U, Sn	10	5% HNO_3 + Tr HF
	EMAX MIX 3	Al, Fe, Ca, Mg, K, Na	1000	5% HNO_3

9.6.2. Secondary Source Working Standard – Prepare a secondary source working standard using S0 as suggested below or equivalent.

Standard	Element	Stock Conc. (mg/L)	Source	Aliquot (ml)	Final Volume (ml)	Final Conc. (mg/L)
Cation Mix 2	Al	10,000	CPI	2.5	500	50
	Ca	10,000	CPI	2.5		50
	Fe	10,000	CPI	2.5		50
	Mg	10,000	CPI	2.5		50
	K	10,000	CPI	2.5		50
	Na	10,000	CPI	1.25		25

9.6.3. Refer to EMAX-QC02 for detailed procedure of standard preparation and labeling.

9.7. **Initial Calibration Verification (ICV)**

9.7.1. Prepare ICV using the secondary stock working standards and S0 as suggested below. Refer to Table 3 for final concentrations for each analyte.

Stock Standard	Aliquot (ml)	Final Volume (ml)	ICV Final conc. (µg/ml)
ICV1	0.150	50	0.030/0.060
Cation Mix 2	3.000		3.000/1.500

9.8. **Laboratory Control Sample (LCS) /Matrix Spike (MS) Spike Standard**

9.8.1. Use the Secondary Stock Standard (Sec. 9.4.1) to spike LCS and MS samples.

9.9. **P/A Tuning Standard**

9.9.1. Using the calibration stock standard from 9.3.1, prepare a 50 µg/L and 100 µg/L mixed standard. These standards also include 50 µg/L and 100 µg/L of internal standard, which can be prepared by using the internal standard stock from Sec. 9.2.1.

10.0 PROCEDURES

10.1. **Sample Preparation**

10.1.1. Water Samples

10.1.1.1. Based from the work order, determine the samples to form a preparative batch (not to exceed 20 samples per preparative batch). Withdraw the sample(s) from the sample control room and bring them to the preparation area. Allow the samples to equilibrate at room temperature.

10.1.1.2. Shake the sample container. Pour a small amount of sample into the sample cap and trickle just enough to wet the pH indicator strip. Compare the color of the wet strip to the indicator chart displayed in the pH indicator box. Record the pH in the digestion log.

- If the pH value is <2, proceed to Sec. 10.1.1.3.
- If the pH value is ≥ 2, check if special instruction is written on the analysis folder or in the COC. Otherwise, inform the supervisor immediately. DO NOT PROCEED WITH THE DIGESTION. WAIT FOR FURTHER INSTRUCTION.

10.1.1.3. Line up the samples chronologically under the hood. Check and record the lot number of the digestion vessels if it has been verified for accuracy. Take digestion vessels and label each one corresponding to the samples withdrawn and place them in front of each sample making sure that their labels agree. Take four more vessels and label them as method blank (MB), LCS, matrix spike and matrix spike duplicate.

10.1.1.4. Mix the sample thoroughly to achieve homogeneity. Fill each digestion vessel up to the 50 ml mark. (The reduction of the volume is due to waste minimization). Use reagent water for blank and LCS. Record the volume in the digestion log.

10.1.1.5. For drinking water samples,

- If antimony and/or silver are requested analytes in the work order, proceed to standard addition (Sec. 10.1.1.6) and then to acid digestion in Sec. 10.1.1.8.
- If antimony and/or silver are not requested, check sample turbidity. Record sample turbidity in the turbidity analysis log (refer to EMAX-2130B for turbidity analysis).
  - If sample turbidity is < 1NTU, proceed to standard addition (Sec. 10.1.1.6) and then direct analysis preparation in Sec. 10.1.1.7.
  - If sample turbidity is ≥ 1NTU, perform standard addition (Sec. 10.1.1.6) and then acid digestion in Sec. 10.1.1.8.

10.1.1.6. **Standard Addition**

10.1.1.6.1. Call a witness for standard addition. Have the witness verify the setting of the micropipette and the expiration dates of the spike standards.

10.1.1.6.2. Add 0.125 mL each of EMAX MIX 2 and 3 (see Sec. 9.4.1) solutions to LCS and MS/MSD.

10.1.1.7. **Dissolved and Total Recoverable Metals for Drinking Water by Direct Analysis**

10.1.1.7.1 Pipet at least 50 mL of sample into an appropriate vessel.

10.1.1.7.2 Add appropriate volume of conc. nitric acid to make a 3% (v/v) nitric acid solution.

10.1.1.7.3 Mix thoroughly. Sample is ready for analysis.

Note: If precipitate forms at any time, the sample cannot be run as dissolved.

10.1.1.8. **Acid Digestion for Dissolved Metals and Total Recoverable Metals**

Note: If the desired analysis is for Dissolved Metals, samples must be filtered through 0.45 µm filter (refer to Sec. 5.2.2). If not filtered, the analysis will measure Total Recoverable Metals.

10.1.1.8.1 Take another digestion vessel and fill it with tap water to 50 mL mark. Place a thermometer into the vessel and let it sit on the digestion block. Turn the thermostat to a pre-determined mark to deliver heat at 85°C.

10.1.1.8.2 Add 0.5 mLl of concentrated HNO_3 and 0.25 ml concentrated HCl to each of the digestion vessels.

10.1.1.8.3 Check that the temperature of the digestion block is ≈ 85°C (open vessel) and adjust, if necessary. Record the temperature reading in the digestion log.

10.1.1.8.4 Place the digestion vessels on the digestion block and reduce volume of sample to 10 mL by continuous heating (without boiling).

10.1.1.8.5 Cap the digestion vessel with disposable watch glass and reflux gently for another 30 minutes. Remove the digestion vessels from the digestion block and allow the vessels to cool down.

10.1.1.8.6 Using a reagent water wash bottle, rinse the disposable watch glass collecting the rinsate on the same digestion vessel that it covered. Add 1.0 mL concentration HNO_3 and 0.25 mL concentration HCl for matrix matching.

10.1.1.8.7 Dilute the digestate with reagent water to the 50 mL mark of the digestion vessel. Seal the vessel and shake. If the digestate appears to be turbid, pass it through 0.45 µm filter and collect it in a new polyethylene container.

10.1.2. Soil Samples

10.1.2.1. **Sample Handling**

10.1.2.1.1. Based from the work order, determine the samples to form a preparative batch (not to exceed 20 field samples). Withdraw the sample(s) from the sample control room designated for metals analysis (passing # 10 sieve) and bring them to the weighing area. Allow the samples to equilibrate at room temperature.

Note: *Sample homogeneity is crucial in metals analysis. If sample is not solely designated for metals analysis (i.e., sample is to be used also for other analyses) and it is apparent that sample particles contain > #10 sieve, inform the Supervisor for further instruction.*

10.1.2.1.2. Take digestion vessels and label each one corresponding to the samples withdrawn. Take four more vessels and label them as MB, LCS, matrix spike and matrix spike duplicate.

10.1.2.1.3. Check project sub-sampling requirement. If multi-incremental sub-sampling (MIS) is required, refer to EMAX-SM01, Section on Sectorial Splitting[2] or Multi-incremental sub-sampling. Otherwise, follow the steps described in EMAX-SM01 Section on Sub-sampling for Soil Samples.

10.1.2.1.4. Scoop 1-2 g sub-sample and transfer into a properly labeled digestion vessel. Record the weight to the nearest 0.01 g. Use solid matrix blank for MB and LCS.

10.1.2.2. **Pre-heating the Digestion Block**

10.1.2.2.1. Place a digestion vessel with reagent water and a temperature monitoring thermometer on the digestion block.

10.1.2.2.2. Turn the digestion block on and set the thermostat to ≈95°C to obtain approximately 95°C once the digestion vessel is covered with a watch glass.

10.1.2.2.3. When the temperature reading is about 90°-95°C, the digestion block is ready for digestion.

10.1.2.3. **Standard Addition**

10.1.2.3.1. Call a witness for standard addition. Have the witness verify the setting of the micropipette and the expiration dates of the spike standards.

10.1.2.3.2. Add 2.5 mL of EMAX MIX 2 & 3 (Sec. 9.4.1) to LCS and MS/MSD.

10.1.2.4. **Acid Digestion**

10.1.2.4.1. Add 2 mL of concentrated HNO_3 and 2 mL of concentrated HCL into each vessel, swirl the vessel to mix the acid and the sample. Add same amount of acid into a clean and empty vessel and designate it as blank. Insert the vessels in the digestion block(s). Cap the vessels with conical watch glass.

10.1.2.4.2. Check the temperature of the digestion block 90°C-95°C, adjust if necessary. If temperature happens to be ≥ 100°C, adjust the thermostat and wait until temperature falls within 90°C-95°C. Record the temperature reading in the digestion log.

10.1.2.4.3. Place the digestion vessels on the digestion block, heat and gently reflux for 30 minutes without boiling.

10.1.2.4.4. Allow the vessels to cool down and dilute to 100 mL final volume with reagent water.

10.1.2.4.5. Let the digestate settle and centrifuge or filter with Whatman #41 (see Sec. 10.1.2.5) if necessary. Otherwise, digestates are now ready for analysis.

10.1.2.5. **Digestate Filtration**

10.1.2.5.1. Place Whatman #41 filter paper into each funnel resting on holders. Rinse the filter papers with reagent water.

10.1.2.5.2. Place a pre-labeled digestate container under each funnel making sure that the labels are visible.

10.1.2.5.3. Check the labels to make sure that containers match with corresponding digestate. Pour the digestate into the filter.

10.1.2.5.4. Filter and collect the digestates in the labeled container. The digestates are now ready for analysis.

10.2. **Instrument Parameters**

10.2.1. Set instrument parameters as suggested below.

Parameters	Settings
Plasma Condition	
RF Power	1500W
RF Matching	1.68 V
Sample Depth	8.0 mm
Torch Height	-0.4 mm
Torch Vertical	0 mm
Carrier Gas	0.9 L/min
Make-up Gas *(Note: Total Carrier and Make-up gas not to exceed 1.1 L/min)*	0.15 L/min
Peristaltic pump	0.1 rps
Spray Chamber (S/C) Temp	2°C
Ion Lenses	
Extract 1	0 V
Extract 2	-140 V
Omega Bias-ce	-22 V
Omega Lens-ce	-1.2 V
Cell Entrance	-26 V
QP Focus	2V
Cell Exit	-30 V
Octopole Parameters	
Octopole RF	150 V
Octopole Bias	-6 V
Q-Pole Parameters	
AMU Gain	127
AMU Offset	125
Axis Gain	0.9996
Axis Offset	0.04
QP Bias	-3 V

Parameters	Settings
Detector Parameters	
Disciminator	8 mV
Analog HV	1630 V
Pulse HV	990 V
Reaction Cell	
H_2 Gas	3.0 ml/min
He Gas	4 ml/min
ASX Parameters	
Pre-load Delay	4.5 sec
Loop Load	4.0 sec
Probe Wash	8.0 sec
Rinse Station	9.9 sec

10.2.2. Set Reaction Cell H_2 Gas and He Gas off for Drinking Water regulated analytes listed below:

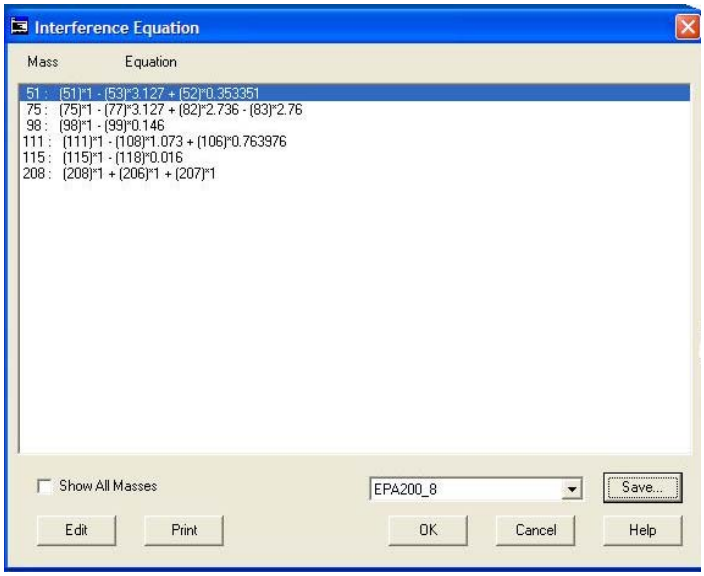
Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead and Selenium

10.2.3. Method Setup

10.2.3.1. Go to Methods menu. Select Edit Interference Equation from the pull down menu.

10.2.3.2. For Drinking Water method setup select EPA 200.8. For Wastewater method setup select EPA 6020. Upon selecting the method setup, the interference equation is displayed in the prompt.

10.2.3.3. Click save button and provide a name for the method, e.g., EM200_8.m (for 200.8) or EM6020MG.m (for wastewater).



10.2.4. Adjust the instrument parameters to optimize the instrument performance in conformance to the tuning requirement.

10.2.5. Print the most current instrument parameters and place in the appropriate binder for easy reference. Replaced instrument parameter set-up should be archived chronologically for future reference and historical record.

10.3. **Calibration**

10.3.1. Instrument Set-Up

10.3.1.1. Set up the ICP-MS with proper operating parameters. Refer to Sec. 10.2.1.

10.3.1.2. Select appropriate analysis method that has been setup, e.g., EM200_8.m to run drinking water samples or EM6020MG.m to run wastewater samples.

10.3.1.3. Ignite the plasma and allow the instrument to become thermally stable for at least 30 minutes.

10.3.1.4. Check the peristaltic pump to deliver a steady flow.

10.3.2. Tuning the Instrument

10.3.2.1. Tune the instrument according to Normal Mode, Hydrogen Mode and Helium Mode without the internal standard. Refer to Sec. 10.2 for parameters. On the ICP-MS main Menu, go to Instrument and click Tune and run the tuning solution without the internal standard. After about 60 seconds (making sure the solution is in the system) click start and evaluate the counts of the isotopes according to the table below.

Mode	Range		
Normal	Li6 ≥ 6400 counts	Y89 ≥ 16000 counts	Tl205 ≥ 9600 counts
Hydrogen	Ar/Ar78 < 10	Y89 ≥ 3000 counts	
Helium	V51/Co59 < 0.6	Co59 ≥ 7000 counts	ArCl-75 < 10 counts

10.3.2.2. If non-compliant, adjust parameters (e.g. Torch height, Torch vertical, Octopole Bias and QP Bias) and repeat the tune process until the required range is met.

10.3.2.3. Click Generate report for a full scan of the tune. Save all tune values to the current method.

10.3.3. Perform a P/A Factor Evaluation

10.3.3.1. Analyze the 50 µg/L P/A Tuning Standard.

10.3.3.2. Under "Tune," access "P/A Factor."

10.3.3.3. Select "Load masses from the acquisition method". Select and delete Ca, $(Cd)^{106}$, $(Cd)^{108}$, $(Pb)^{206}$, $(Pb)^{207}$ from the list of elements.

10.3.3.4. Select "run."

10.3.3.5. When complete accept the changes.

10.3.3.6. Print out P/A Factor and store the printout with the tuning data.

10.3.3.7. Accept the new P/A Factors.

10.3.3.8. Under "file" select "copy tune parameters" and copy the P/A Factors to both the H2 and He modes.

10.3.3.9. Save file as “norm.u”.

10.3.4. Perform Tune Check

10.3.4.1. Analyze the intermediate tune check solution (Sec. 9.1.1) using 5 replicates.

10.3.4.2. Evaluate the tune check so that the mass calibration differs no more than 0.1 AMU of the true value and peak width of approximately 0.75 AMU at 5% peak height. RSD should less than or equal to 5% for the 5 replicate analysis.

10.3.5. Initial Calibration (ICAL)

10.3.5.1. Analyze a calibration blank (S0) and a multi-point calibration standard (Sec. 9.3.3.1 and 9.3.4.1).

10.3.5.2. Set the instrument rinse time to 90 seconds between each standard solution.

10.3.5.3. Refer to Appendix 1 for ICAL acceptance criteria and corrective action.

10.3.6. Initial Calibration Verification (ICV)/ Instrument Calibration Blank (ICB)

10.3.6.1. Analyze the ICV (Sec. 9.5.1) from a second source to verify the concentration of the ICAL.

10.3.6.2. Analyze an ICB after ICV to demonstrate absence of instrument contamination.

10.3.6.3. Refer to Appendix 1 for ICV, and ICB acceptance criteria and corrective action.

10.3.7. Continuing Calibration Verification (CCV)/ Continuing Calibration Blank (CCB)

10.3.7.1. Analyze CCV (Sec. 9.3.5) to check the validity of the ICAL every 10 samples and at the end of the analytical sequence.

10.3.7.2. Analyze a CCB after every CCV to demonstrate the absence of instrument contamination.

10.3.7.3. Refer to Appendix 1 for CCV and CCB acceptance criteria and corrective action.

10.3.8. Establishing Instrument Detection Limit (IDL)

10.3.8.1. Analyze a series of 10 replicate measurements of the calibration blank.

10.3.8.2. Calculate the standard deviation of the replicate measurements.

10.3.8.3. Three times standard deviation of the measurements determines the IDL for each analyte.

10.3.8.4. Establish IDL at least every 3 months.

10.3.9. Verifying Linear Dynamic Range (LDR)

10.3.9.1. Verify the LDR by preparing a standard at the upper limit of the LDR. Analyze and quantitate against the normal calibration curve. Percent recovery must be within ± 10% of expected value. If non-complaint, re-establish LDR.

10.3.9.2. Verify the established LDR whenever a change in analytical performance caused by either a change in instrument hardware or operating conditions occurs.

10.4. **Analysis**

10.4.1. Analytical Sequence

10.4.1.1. From the main menu of the ICPMS top window, go to Sequence and create the analytical sequence by editing the sample log table. Refer to Table 4.

10.4.1.2. Set QC limits on QC samples for easy verification while analytical samples are running.

10.4.1.3. Using the sample log table, input the standards and the digestates to be analyzed. Samples are analyzed in the order they appear in the scanner.

10.4.1.4. Transfer about 5 mL into the autosampler tubes placing them on the autosampler rack in the same order as the analytical sequence. A dilution of 10X for soil samples is required due to the high acid content of the digestate.

10.4.1.5. A 100 µg/L internal standard shall be spiked into each sample.

10.4.1.6. Set the prepared analytical samples into the autosampler and start the analytical run.

10.4.2. Sample Result Evaluation

10.4.2.1. Check QC parameters as soon as the data is available.

- Check the initial calibration verification (ICV and ICB) against Appendix 1.
- Check MB and LCS against Appendix 1.
- Check the MS/MSD against Appendix 1.
- Check intensity of internal standard on each sample against Appendix 1.
- If any of the above checkpoints is non-compliant, perform the specified corrective action in Appendix 1. If results indicate digestion problem, redigest the affected samples. If unresolved, consult the Supervisor for further action.

10.4.2.2. Check the sample rack to ensure that the autosampler did not skip any sample.

10.4.2.3. Check concentration of target analytes. If the determined analyte concentration is greater than 90% of the determined upper LDR limit, dilute the sample and reanalyze.

10.4.2.4. Check other QC requirements like CCV and CCB against Appendix 1. Perform corrective action as necessary.

10.5. **Calculations**

10.5.1. Calculate for Sample Concentration

10.5.1.1. The computer software is designed to calculate the concentration in the digestate, based on the assumption that the initial calibration is linear through the origin. Thus, for aqueous samples, the computer-generated result represents the concentration of the sample.

10.5.1.2. Water Samples

$$C_s = C_i\left(\frac{ExpAmt}{Aliquot}\right)\left(\frac{Vd}{ExpVd}\right)DF \qquad \text{Eq.-10.5.1.2}$$

where:

C_s – Concentration in the sample, µg/L

C_i – Concentration in the digestate, (computer-generated), µg/L

V_d – Digestion volume, mL

ExpVd – Expected digestion volume, mL

DF – Dilution factor

ExpAmt – Expected amount for digestion, mL

Aliquot – Amount digested, mL

10.5.1.3. Soil Samples

$$C_s = C_i\left(\frac{ExpAmt}{Aliquot}\right)\left(\frac{V_d}{ExpVd}\right)\left(\frac{100}{100-\%H_2O}\right)\times DF\times 0.1 \qquad \text{Eq.-10.5.1.3}$$

where:

C_s – Concentration in the sample, mg/Kg

C_I – Concentration in the digestate (computer-generated), µg/L

V_d – Digestion volume, mL

ExpVd – Expected digestion volume, mL

ExpAmt – Expected amount for digestion, g

Aliquot – Amount digested, g

% H_2O – Percent moisture of the sample

DF – Dilution factor

0.1 – Conversion factor

10.5.2. Calculate the Percent Recovery (%R)

$$\%\,Recovery = \frac{Cf - C}{Cs}\times 100 \qquad \text{Eq.-10.5.2}$$

where:

C_f – Concentration found, µg/ L

C – Concentration of sample, µg/L

C_s – Concentration of spike, µg/L

10.5.3. Calculate for Relative Percent Difference (%RPD)

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)}\times 100 \qquad \text{Eq.-10.5.3}$$

where:

RPD – Relative Percent Difference

C_1 – Measured concentration of the first sample aliquot

C_2 – Measured concentration of the second sample aliquot

10.6. **Data Reduction**

10.6.1. Make a copy of the analytical run log, sample preparation log and turbidity analysis log (if applicable).

10.6.2. Highlight the data to be reported.

10.6.3. Print a copy of the raw data and the QC report.

10.6.4. Collate the reportable raw data separating the QC results from sample results.

10.6.5. Keep all other data generated with the analytical folder marked with "For record only" for traceability purpose.

10.7. **Report Generation**

10.7.1. Print the summary of the analytical run, perform a data transfer into a disk, and convert the instrument electronic output file into an ASCII file format.

10.7.2. Run the ICPCHK.exe program for calibration check.

10.7.3. Identify samples that need to be re-analyzed, if any, and report all samples that met the analytical requirements.

10.7.4. Generate the report using the following reporting program:

Executable Files	Required Support Files	Output
ICPMS00.EXE	Login File (requires network) Project support files (.met, .QC, .CRF, .DL, .pln, F:\ST\ProjectCode.txt) ICP raw data output (e.g.,ID8A023.RAW) Digestion log (e.g.,IPA027.CSV)	[Analytical Sequence].CAL – this file summarizes ICV, ICSA and ICSAB results. [Analytical Sequence].CCB – this file summarizes calibration blanks (ICB and CCBs relevant to reported SDG. [Analytical Sequence].CCV – this file summarizes CCVs relevant to reported SDG. Limits.CSV – this file contains target analytes and its LOQ,LOD and DL SQ.CSV – this file contains the samples analyzed for the SDG being processed. ARAW.CSV – this file contains the raw data of samples analyzed for the SDG being processed Method.txt [this file integrates the login sample information and the analytical sample information]

Executable Files	Required Support Files	Output
METF1F3.exe	Limits.CSV, SQ.CSV and ARAW.CSV	Sample Results (Form1) LCS Summary Forms (Form 3) MS Summary Forms (Form 3) Analytical Spike Summary Forms Serial Dilution Summary Forms
METF1C.exe	Form 1	[SampleID].TXC – Combines sample results with multiple dilutions.
LABCHRNX.exe	method.txt	Lab Chronicle
CN00.exe	Login File, method.txt, Form 1, Form 3	Case Narrative

10.7.5. Arrange the analysis package in sequence as detailed below.

10.7.5.1. Case Narrative

10.7.5.2. Lab Chronicle

10.7.5.3. Sample Results

10.7.5.4. LCS Summary

10.7.5.5. MS/MSD Summary

10.7.5.6. Sample Duplicate Summary (if any)

10.7.5.7. Analytical Run Log

10.7.5.8. ICAL/ICV Summary

10.7.5.9. CCV Summary

10.7.5.10. ICB/CCB Summary

10.7.5.11. Analytical log, Sample Preparation Log and Turbidity Analysis Log (if applicable)

10.7.5.12. Non-Conformance Report (if any)

10.8. **Data Review**

10.8.1. Perform a 100% data review in accordance to EMAX-DM01 and the PSR.

- ✓ Review the Calibration Checks against Project Specific Requirement (PSR) or Appendix 1 for acceptance criteria.
- ✓ Check frequency of calibration verifications. Verify results to be within acceptance limits.
- ✓ Check of target analytes concentration to be within linear range.
- ✓ Verify interference check results to be within acceptance limits.
- ✓ If any of the above checkpoints is non-compliant, re-analysis is required.

10.8.2. Review the attached logs that they are properly filled.

10.8.3. Check the generated reports against the raw data. Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.

10.8.4. Review the case narrative and check that it accurately describes what transpired in the analytical process. Edit as necessary to reflect essential issues not captured by the case narrative generator program.

10.8.5. Submit the analytical folder for secondary review.

10.9. **Preventive Maintenance**

10.9.1. Instruments shall receive routine preventive maintenance that is properly recorded in the instrument-specific maintenance logs. The list of maintenance is summarized in Form 200.8FM. The practice ensures optimum operating condition of the equipment thus reducing the possibility of frequent instrument malfunction.

Maintenance Activity	Description	Frequency
Verification	Verify instrument parameters to ensure normal operating conditions. Change tubings as necessary. Perform system tune check. Check instrument performance (e.g., ICV/ICB)	Daily prior to analysis
Vacuum System Maintenance	Inspect vacuum hoses and exhaust tubes for possible problems. Check pump for evidence of leakage	Daily prior to analysis
Documentation	Record all instrument maintenance performed in the instrument maintenance log.	Daily prior to analysis
Ion Lens Cleaning	Remove and clean surfaces of the ion lens. Sonicate ion lens parts	As necessary
System Cleaning	Remove covers and clean dust from fans and vent covers	Every 6 months or as necessary
Pump Maintenance	Replace oil mist filter, drain and replace mechanical pump oil. Verify proper pump operation	Every 6 months
Inspection	Perform general inspection of the complete system	Once a year

11.0 QUALITY CONTROL

11.1. **Sample Preparation QC**

11.1.1. A preparative batch consists of 20 or fewer samples of the same matrix that are prepared for analysis simultaneously or sequentially, using the same lot for all reagents.

11.1.2. Every preparative batch shall have at least one MB, one LCS and a set of MS/MSD to a minimum of 10% of the routine samples unless otherwise specified by the project. These QC samples shall be prepared together with the field samples.

11.1.3. All reagents shall be subjected to QC check prior to its use. Refer to EMAX-QC01 for details.

11.2. **Sample Analysis QC**

11.2.1. Before every analytical run, perform a tune check, initial calibration and initial calibration verification (ICV). Obtain the ICV standard from a different source from that of the initial calibration. Analyze an instrument calibration blank (ICB) after the ICV. No further analysis shall be valid unless acceptance criteria are met.

11.2.2. Monitor the intensities of all internal standards for every analysis. Refer to Appendix 1 for acceptance criteria.

11.2.3. Verify calibration with continuing calibration verification (CCV) standard and continuing calibration blank (CCB) after every ten samples and at the end of the analytical run.

11.2.4. Evaluate results of LFM/LFMD to document matrix interference.

11.2.5. Refer to Appendix 1 for acceptance criteria.

11.3. **Method QC**

11.3.1. Perform MDL study annually unless otherwise directed by the project. A valid DL and LOD must exist prior to sample analysis. Refer to EMAX-QA04 for details.

11.3.2. Perform Linear Dynamic Range study whenever there is a significant change in instrument response.

11.3.3. The annual review of this SOP shall include a review of the California Division of Drinking Water and Environmental Management guidelines on Drinking Water Analyses, Maximum Contamination Level (MCL) and Detection Limit for Reporting (DLR). Refer to reference in Sec. 16.3.

11.3.4. All analysts conducting this analysis must demonstrate capability (IDOC/DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTION

12.1. Quality control procedures and corresponding corrective actions are summarized in Appendix 1.

12.2. If tune is non-compliant, consider the following suggestions to correct the problem:

- Check the instrument settings and make sure that the instrument parameters are properly set up.
- Check argon gas flow.
- Perform auto tune or visual optimization
- If the problem persists, inform the Supervisor.

12.3. If correlation coefficient (R) of ICAL is non-compliant, consider the following suggestions to help you correct the problem:

- Check the calibration points for possible presence of out-lier. If out-lier is present, prepare a fresh standard and repeat the calibration.
- Check the connections and make sure that they are air-tight. Perform maintenance as needed.
  - Presence of bubbles is indicative of poor connection between the sipper and the nebulizer.
  - Poor precision to inability to light the plasma is a symptom of a poor drain tube connection
  - Poor precision and carry-over problems are indicative of a dirty spray chamber.

- Relative increase in the sensitivity ratio of the higher: lower atomic number elements are indicative of stretched pump tubing. The sample flow rate decreases as the tubing stretches.

- Check the argon gas flow. Loss of signal is indicative of low or no argon gas flow.
- Poor precision and a gradual loss of signal is indicative of "salting-out" in the nebulizer and/or spray chamber due to samples with high dissolved or suspended solids. This problem will necessitate nebulizer and spray chamber cleaning.
- If the problem persists, inform the Supervisor.

12.4. If ICV is non-compliant, consider the following suggestions to help you correct the problem:

- If the RSD is high it is indicative that the carry-over might be present in the spray chamber.
- If result is bias high, prepare a fresh standards and repeat calibration.
- If the problem persists, inform the Supervisor.

12.5. If ICB/CCB is non-compliant, consider the following suggestions to correct the problem:

- Prepare a fresh calibration blank solution. Perform instrument rinsing and repeat the ICB/CCB prior to re-analysis of associated sample(s).
- Carry-over problem is indicative of dirty spray chamber, nebulizer and/or torch. Perform instrument maintenance and repeat the calibration.
- If the problem persists, inform the Supervisor.

12.6. If CCV is non-compliant, consider the following suggestions to correct the problem:

- Check the connections prior to re-running the ICAL. Refer to Section 12.3.
- Prepare a new standard and repeat the ICAL.

12.7. If the intensity of the Internal Standard is non-compliant, consider the following suggestions to correct the problem:

- Check for drift occurrence by observing the internal standard intensities in the calibration blank.
- If drift has occurred, terminate the analysis, recalibrate, verify the new calibration and reanalyze the affected samples.
- If drift has not occurred, dilute affected samples five-fold and reanalyze with the addition of appropriate amounts of internal standards.

12.8. If Laboratory Reagent Blank is non-compliant, consider the following suggestions to correct the problem:

- Rule-out instrument contamination by checking the CCBs. Refer to Section 12.5.
- Rule-out reagent contamination by testing each reagent as described in EMAX-QC01.
- Rule-out digestate vessel contamination by adding verified reagents heating the vessels prior to testing.
  - Common environmental contaminants – Ca, Si, Fe, Na, Mg, K, Tl, Cu, Mn, can be minimized by maintaining the lab clean.
- Other sources of contamination:
  - Sweat contains Ca, Mg, Pb, K, NH_4^+, SO_4^{-2}, PO_4^{-3}, and Cd (for those who smoke).

- Cosmetics can contain high concentrations of Al, Be, Ca, Cu, Cr, K, Fe, Mn, Ti, and Zn.
- Some hair dyes contain $Pb(OAC)_2$.
- Dandruff shampoo can contain significant levels of Se.
- Eye make-up may contain Hg as a preservative.
- Calamine lotion is almost pure ZnO.
- Watches and jewelry contain an assortment of elements and should not be worn in the laboratory.

- Re-digest LRB and the associated samples with reagents free of contamination or with newly opened reagents.
- If the problem persists, inform the Supervisor.

12.9. If LCS is non-compliant, consider the following suggestions to correct the problem:

- If result is bias-high, check the LCS standard by analyzing at the spike level.
  - If the LFB check is within 85-115 % of the expected value, check the calibration of the micropipette use for spiking. Re-digest and re-analyze the LCS and the associated samples.

  If the LFB check is not within 85-115%, prepare a fresh LFB standard, re-digest and re-analyze LFB and the associated samples.
- Common Problems with Ag, As, Ba, Pb, and Cr, indicating stock standard degradation, are as follows:

  Low Silver (Ag) recovery is indicative of Chloride contamination causing AgCl precipitation

  Low Arsenic (As) recovery is indicative of loss during sample preparation as volatile oxides (AsO_3) or precipitation as $AsCl_3$

  Low Barium (Ba) recovery is indicative of SO_4or CrO_4 contamination. Barium will form precipitates with HF and H_2SO_4.

  High Lead (Pb) recovery is indicative of environmental contamination.

12.10. A Non-Conformance Report (NCR) is required when the following circumstances occur:

- Anomalies other than those specified in Appendix 1 are observed.
- Sample is out of technical holding time.

12.10.1. Refer to EMAX-QA08 for NCR details.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of solvent that may go to wastewater drains.

13.2. Prepare all standards in fume hoods.

14.0 WASTE MANAGEMENT

14.1. No sample shall be dumped in the laboratory sink.

14.2. Separate and properly identify all unused and expired analytical standards for proper disposal.

14.3. Place all waste generated during the analytical process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, digestates, expired analytical standards and other waste generated during the analytical process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. **Definition of Terms**

15.1.1. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.1.1.1 **Preparation Batch** - is composed of one to 20 samples of the same matrix, a laboratory reagent blank, a laboratory fortified blank and laboratory fortified matrix/laboratory fortified matrix duplicate.

15.1.1.1 **Analytical batch -** is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices, preparation batches, and can exceed 20 samples.

15.1.2. Safety Data Sheet (SDS) – is where the physical data, toxicology and safety precaution of a certain substance is listed.

15.1.3. Calibration – Is defined as an instrument response per unit measure. It is an experimental value by measuring the response of an instrument per unit target analyte under the method specific condition. A determinant measured from a standard to obtain the correct value of an instrument output.

15.1.4. Calibration Blank – A volume of reagent water acidified with the same acid matrix as in the calibration standards. The calibration blank is zero standard and is used to calibrate the ICP instrument.

15.1.5. Calibration Standard (CAL) – A solution prepared from the dilution of stock standard solutions. The CAL solutions are used to calibrate the instrument response with respect to analyte concentration.

15.1.6. Dissolved Analyte – The concentration of analyte in an aqueous sample that will pass through a 0.45 µm membrane filter assembly prior to sample acidification.

15.1.7. Field Reagent Blank (FRB) - An aliquot of reagent water or other blank matrix that is placed in a sample container in the laboratory and treated as a sample in all respects, including shipment to the sampling site, exposure to the sampling conditions, storage, preservation, and all analytical procedures. The purpose of the FRB is to determine if method analytes or other interferences are present in the field environment.

15.1.8. Instrument Detection Limit (IDL) – The concentration equivalent to the analyte signal which is equal to three times the standard deviation of a series of 10 replicate measurements of the calibration blank signal at the selected analytical mass(es).

15.1.9. Internal Standard – Pure analyte(s) added to a sample, extract or standard solution in known amount(s) and used to measure the relative responses of other method analytes that are components of the same sample or solution. The internal standard must be an analyte that is not a sample.

15.1.10. Laboratory Duplicates (LD1 and LD2) – Two aliquots of the same sample taken in the laboratory and analyzed separately with identical procedures. Analyses of LD1 and LD2 indicate precision associated with laboratory procedures, but not with sample collection, preservation or storage procedures.

15.1.11. Laboratory Fortified Blank (LFB) – also known as lab control sample (LCS). An aliquot of LRB to which known quantities of the method analytes are added in the laboratory. The LFB is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements.

15.1.12. Laboratory Fortified Matrix (LFM) – also known as matrix spike (MS) sample. An aliquot of an environmental sample to which known quantities of the method analytes are added in the laboratory. The LFM is analyzed exactly like a sample and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the LFM corrected for background concentrations.

15.1.13. Laboratory Reagent Blank (LRB) – also known as Method Blank (MB) an aliquot of reagent water or other blank matrices that are treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents and internal standards that are used with other samples. The LRB is used to determine if method analytes or other interferences 200.8-6 are present in the laboratory environment, reagents or apparatus.

15.1.14. Linear Dynamic Range (LDR) – The concentration range over which the instrument response to an analyte is linear.

15.1.15. Method Detection Limit (MDL) – The minimum concentration of an analyte that can be identified, measured and reported with 99% confidence that the analyte concentration is greater than zero.

15.1.16. Quality Control Sample – also known as initial calibration verification (ICV) A solution of method analytes of known concentrations which is used to fortify an aliquot of LRB or sample matrix. The QCS is obtained from a source external to the laboratory and different from the source of calibration standards. It is used to check either laboratory or instrument performance.

15.1.17. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in a different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.1.18. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.1.19. Solid Sample – for the purpose of this method, a sample taken from material classified as either soil, sediment or sludge.

15.1.20. Stock Standard Solution – a concentrated solution containing one or more method analytes prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source.

15.1.21. Total Recoverable Analyte – the concentration of analyte which is used to determine acceptable instrument performance prior to calibration and sample analyses.

15.1.22. Tuning Solution – a solution which is used to determine acceptable instrument performance prior to calibration and sample analyses.

15.1.23. Water Sample – for the purpose of this method, a sample taken from one of the following sources: drinking, surface, ground, storm runoff, industrial or domestic wastewater.

15.2. **Application of EMAX QC Procedures**

15.2.1. The procedures and QC criteria summarized in this SOP is applied to all projects when performing metals analysis. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.3. **Department of Defense (DoD) Projects**

15.3.1. Samples from DoD and DOE sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD Quality Systems Manual (QSM), latest update, is applied.

15.4. Note that SOP was revised on the merit of updating to current practice (e.g. frequency of MDL study, report processing program was updated). There is no change on analytical processes from that of the previous version.

16.0 REFERENCES

16.1. Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry, Method 200.8 Rev. 5.4, 1994.

16.2. Title 40 Code of Federal Regulations, Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants, latest edition.

16.3. California State Water Resources Control Board, Chemicals and Contaminants in Drinking Water, http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.shtml, latest update.

16.4. EMAX Quality Systems Manual, as updated.

17.0 APPENDICES

17.1. **Tables**

17.1.1. Table 1 ICP-MS Elements & Isotopes

17.1.2. Table 2 Initial Calibration Standard Preparation Method

17.1.3. Table 3 Calibration Standards Concentration

17.1.4. Table 4 Typical ICP-MS Analytical Sequence

17.1.5. Table 5 DL, LOD, LOQ and Linear Range Concentration Levels for Drinking Water

17.1.6. Table 6 DL, LOD, LOQ and Linear Range Concentration Levels for Soil and Waste Water

17.2. **Figures**

17.2.1. Figure 1 Typical Initial Calibration Verification Summary

17.2.2. Figure 2 Typical Continuing Calibration Verification Summary

17.2.3. Figure 3 Typical Initial and Continuing Calibration Blank Summary

17.2.4. Figure 4 Typical Sample Report

17.2.5. Figure 5 Typical LCS/LCD Summary

17.2.6. Figure 6 Typical MS/MSD Summary

17.2.7. Figure 7 Typical Case Narrative

17.3. **Appendices**

17.3.1. Appendix 1 Summary of Quality Control Procedures

17.3.2. Appendix 2 Demonstration of Capability

17.4. **Forms**

17.4.1. 200.820FS Sample Preparation Log

17.4.2. 200.8FA Analytical Run Log

17.4.3. 200.8FM Instrument Maintenance Log

Table 1: ICP-MS ELEMENTS & ISOTOPES

Element	Symbol	Drinking Water			Other Matrices		
		Mass	Tune Mode[1]	Internal Standard	Mass	Tune Mode[2]	Internal Standard
Aluminum	Al	27	3	Sc45	27	3	Sc45
Antimony *	Sb	121	3	In115	121	3	In115
Arsenic *	As	75	3	Ge72	75	2	Ge72
Barium *	Ba	137	3	In115	137	3	In115
Beryllium *	Be	9	3	Li6	9	3	Li6
Boron	B	11	3	Li6	11	3	Li6
Cadmium *	Cd	111	3	In115	111	3	In115
Calcium	Ca	40	1	Sc45	43	1	Sc45
Chromium *	Cr	52	3	Sc45	53	2	Sc45
Cobalt	Co	59	3	Sc45	59	3	Sc45
Copper *	Cu	63	3	Sc45	63	2	Sc45
Iron	Fe	56	1	Sc45	57	1	Sc45
Lead *	Pb	208	3	Bi209	208	3	Tb159
Lithium	Li	7	3	Li6	7	3	Li6
Magnesium	Mg	24	3	Sc45	24	3	Sc45
Manganese	Mn	55	3	Sc45	55	3	Sc45
Molybdenum	Mo	95	3	In115	95	3	In115
Nickel	Ni	60	2	Sc45	60	2	Sc45
Potassium	K	39	2	Sc45	39	3	Sc45
Selenium *	Se	82	3	Ge72	78	1	Ge72
Silver	Ag	107	3	In115	107	3	In115
Sodium	Na	23	1	Sc45	23	1	Sc45
Strontium	Sr	88	3	Ge72	88	3	Y89
Thallium *	Tl	205	3	Bi209	205	3	Tb159
Tin	Sn	118	3	In115	118	3	In115
Titanium	Ti	47	3	Sc45	47	3	Sc45
Uranium	U	NA	NA	NA	238	3	Tb159
Vanadium	V	51	2	Sc45	50	2	Sc45
Zinc	Zn	66	3	Ge72	66	3	Ge72

* Drinking Water Regulated Analytes – Mode must be set at 3.

[1] Tune Mode: 1 – Reaction H_2 Mode; 2 – Collision He Mode; 3 – Normal Mode

Table 2 : CALIBRATION STANDARD AND VERIFICATION PREPARATION

Standard #	Mixed Standard Name	Conc. (µg/ml)	Source	Preparation		
				Aliquot (ml)	Final Vol. (ml)	Final Conc. (µg/ml)
S1	Trace Mix	1	High Purity	0.025	50	0.0005
	Cation Mix	50/25	AccuStandard	0.050		0.050/0.025
	Zn	10	High Purity	0.0025		0.001
S2	ICAL 1	10	High Purity	0.025	50	0.005
	ICAL 2	10	High Purity	0.025		0.005
	Cation Mix	50/25	AccuStandard	0.500		0.500/0.250
	Zn	10	High Purity	0.025		0.010
S3	ICAL 1	10	High Purity	0.125	50	0.025
	ICAL 2	10	High Purity	0.125		0.025
	Cation Mix	50/25	AccuStandard	2.500		2.500/1.250
	Zn	10	High Purity	0.125		0.050
S4	ICAL 1	10	High Purity	0.250	50	0.050
	ICAL 2	10	High Purity	0.250		0.050
	Cation Mix	50/25	AccuStandard	5.000		5.000/2.500
	Zn	10	High Purity	0.250		0.100
ICV	ICV 1	10	CPI	0.150	50	0.030/0.060
	Cation Mix 2	50/25	CPI	3.000		3.000/1.500
CCV	ICAL 1	10	High Purity	0.125	50	0.025
	ICAL 2	10	High Purity	0.125		0.025
	Cation Mix	50/25	AccuStandard	2.500		2.500/1.250
	Zn	10	High Purity	0.125		0.050

Table 3: CALIBRATION STANDARDS CONCENTRATION

ELEMENT	ICAL (µg/L)				ICV (µg/L)	CCV (µg/L)
	S1	S2	S3	S4		
Aluminum	50	500	2500	5000	3000	2500
Antimony	0.5	5	25	50	30	25
Arsenic	0.5	5	25	50	30	25
Barium	0.5	5	25	50	30	25
Beryllium	0.5	5	25	50	30	25
Boron	0.5	5	25	50	30	25
Cadmium	0.5	5	25	50	30	25
Calcium	50	500	2500	5000	3000	2500
Chromium	0.5	5	25	50	30	25
Cobalt	0.5	5	25	50	30	25
Copper	0.5	5	25	50	30	25
Iron	50	500	2500	5000	3000	2500
Lead	0.5	5	25	50	30	25
Lithium	0.5	5	25	50	30	25
Magnesium	50	500	2500	5000	3000	2500
Manganese	0.5	5	25	50	30	25
Molybdenum	0.5	5	25	50	30	25
Nickel	0.5	5	25	50	30	25
Potassium	50	500	2500	5000	3000	2500
Selenium	0.5	5	25	50	30	25
Silver	0.5	5	25	50	30	25
Sodium	25	500	2500	5000	3000	2500
Strontium	0.5	5	25	50	30	25
Thallium	0.5	5	25	50	30	25
Tin	0.5	5	25	50	30	25
Titanium	0.5	5	25	50	30	25
Uranium	0.5	5	25	50	30	25
Vanadium	0.5	5	25	50	30	25
Zinc	1	10	50	1000	60	50

Table 4: ICP-MS ANALYTICAL SEQUENCE

RUN ID LABEL	SAMPLE DESCRIPTION	SOLUTION ID LABEL
S0	Calibration Standard 1 (blank)	S0
S3, S4, S5	ICAL Standards	S3, S4, S5
ICV	Initial Calibration Verification	ICV
ICB	Initial Calibration Blank	ICB
CCV1	Continuing Calibration Verification #1	CCV
CCB1	Continuing Calibration Blank #1	S0
IMSSSSB[2]	Preparation Blank	
IMSSSSL/C	Lab Control Sample	
Sample 1	Sample 1	
Sample 1M	Sample 1 Matrix Spike	
Sample 1S	Sample 1 Matrix Spike Duplicate	
Samples 2 to 4	Sample 2 to Sample 5	
CCV2	Continuing Calibration Verification #2	CCV
CCB2	Continuing Calibration Blank #2	S0
Samples 5 to 14	Maximum of 10 Samples	
CCV3	Continuing Calibration Verification #3	CCV
CCB3	Continuing Calibration Blank #3	S0
Samples 15 to 20	Sample 15 to 20 or a maximum of 10 samples (sample 15 to 24)	
CCV4	Continuing Calibration Verification #4	CCV
CCB4	Continuing Calibration Blank #4	S0

[2] where IMSSSS is the digestion batch reference.

Table 5: DL, LOD, LOQ AND LINEAR RANGE CONCENTRATION LEVELS FOR DRINKING WATER

Element	Drinking Water (µg/L)			Linear Range (µg/L)
	DL	LOD	LOQ	
Aluminum	7.5	15	50	50,000
Antimony	0.25	0.5	1	1,000
Arsenic	0.25	0.5	1	3,000
Barium	0.25	0.5	1	3,000
Beryllium	0.04	0.08	0.4	100
Boron*	2.5	5	10	100
Cadmium	0.1	0.2	1	1,000
Calcium*	30	60	100	50,000
Chromium	0.25	0.5	1	3,000
Cobalt	0.1	0.2	1	3,000
Copper	0.25	0.5	1	3,000
Iron*	10	20	100	50,000
Lead	0.05	0.1	0.5	3,000
Magnesium*	10	20	100	50,000
Manganese	0.25	0.5	1	3,000
Molybdenum	0.1	0.2	1	1,000
Nickel	0.25	0.5	1	3,000
Potassium*	20	40	100	50,000
Selenium	0.25	0.5	2.5	3,000
Silver	0.025	0.05	0.25	100
Sodium*	25	50	100	50,000
Strontium*	0.25	0.5	2	3,000
Thallium	0.025	0.05	0.25	1,000
Tin*	0.1	0.2	1	1,000
Titanium*	0.25	0.5	1	3,000
Vanadium	0.25	0.5	1	3,000

* Analytes are not listed in reference method EPA 200.8 Revision 5.4. Detection Limits were established and Demonstration of Capability and Performance Test were successfully completed. Hence this SOP is applicable for the analysis of these analytes.

Table 5: DL, LOD, LOQ AND LINEAR RANGE CONCENTRATION LEVELS FOR SOIL AND WASTE WATER

Element	Water (µg/L)			Soil (mg/Kg)			Linear Range µg/L
	DL	LOD	LOQ	DL	LOD	LOQ	
Aluminum	7.5	15	50	12.5	25	100	50,000
Antimony	0.25	0.5	1	0.1	0.2	0.5	100
Arsenic	0.1	0.2	1	0.1	0.2	0.5	500
Barium	0.125	0.25	1	0.1	0.2	0.5	1000
Beryllium	0.05	0.1	0.4	0.025	0.05	0.2	50
Boron*	2	4	10	1	2	10	100
Cadmium	0.1	0.2	1	0.05	0.1	0.5	500
Calcium*	30	60	100	25	50	100	50,000
Chromium	0.1	0.2	1	0.25	0.5	1	500
Cobalt	0.075	0.15	0.5	0.05	0.1	0.5	500
Copper	0.5	1	2	0.25	0.5	1	500
Iron*	10	20	100	12.5	25	100	50,000
Lead	0.05	0.1	0.5	0.05	0.1	0.5	500
Lithium*	0.5	1	2	0.2	0.4	1	50
Magnesium*	10	20	100	12.5	25	100	50,000
Manganese	0.25	0.5	1	0.5	1	2	3,000
Molybdenum	0.125	0.25	1	0.2	0.4	1	500
Nickel	0.25	0.5	1	0.15	0.3	1	500
Phosphorus*	20	40	200	12.5	25	100	500
Potassium*	20	40	100	12.5	25	100	50,000
Selenium	0.1	0.2	1	0.05	0.1	0.5	500
Silicon*	15	30	100	2	4	20	5,000
Silver	0.025	0.05	0.25	0.02	0.04	0.2	50
Sodium*	25	50	100	12.5	25	100	50,000
Strontium*	0.15	0.3	1	0.25	0.5	1	500
Thallium	0.05	0.1	0.5	0.05	0.1	0.5	500
Tin*	0.1	0.2	1	2.5	5	20	500
Titanium*	0.25	0.5	1	0.25	0.5	0.5	500
Tungsten*	0.15	0.3	1	0.15	0.3	1	50
Uranium	0.0375	0.075	0.3	0.05	0.1	0.5	500
Vanadium	0.15	0.3	1	0.25	0.5	1	500
Zinc	2.5	5	10	2	4	10	500
Zirconium*	2.5	5	10	2	4	10	50

* Analytes are not listed in reference method EPA 200.8 Revision 5.4. Detection Limits were established and Demonstration of Capability and Performance Test were successfully completed. Hence this SOP is applicable for the analysis of these analytes.

Figure 1: TYPICAL INITIAL CALIBRATION VERIFICATION SUMMARY

INITIAL CALIBRATION VERIFICATION SUMMARY FORM

Client : XYZ, INC.
Project : CLEAN WATER PROJECT
SDG NO. : YYMSSS
Method : METHOD E200.8
Sequence : I98M03
InstrumentID: 98

		ICV				ICSA			ICSAB		
Lab Samp ID :		ICV				ICSA			ICSAB		
QC Limit :		%R:90-110/RSD:<5				%R:80-120/<LOD			%R:80-120		
Lab File ID :		98I03009				98I03013			98I03014		
DateAnalyed :		MM/DD/YY HH:MM				MM/DD/YY HH:MM			MM/DD/YY HH:MM		
Parameter		Result	ICV EV	RSD	%Recovery	Result	ICSA EV	%Rec/LOD	Result	ICSAB EV	%Recovery
Lithium		30.14	30	2.11	100	.2942	0	<2.0	19.64	20	98
Beryllium	T	30.65	30	0.71	102	.000492	0	<0.1	21.75	20	109
Boron		31.67	30	1.71	106	.3146	0	<10	20.23	20	101
Sodium		29450	30000	0.80	98	101600	100000	102	97300	100000	97
Magnesium		29380	30000	2.68	98	94280	100000	94	93710	100000	94
Aluminum		29340	30000	3.05	98	95340	100000	95	94800	100000	95
Silicon		2868	3000	0.81	96	7.625	0	<50	7.751	200	4*
Phosphorus		303.5	300	1.54	101	105100	100000	105	103900	100000	104
Potassium		30410	30000	0.52	101	103800	100000	104	101200	100000	101
Calcium		28580	30000	1.17	95	101800	100000	102	100800	100000	101
Titanium		304.8	300	1.25	102	2181	2000	109	2203	2000	110
Vanadium		302.2	300	1.40	101	.03584	0	<1.0	21.42	20	107
Chromium	T	296.3	300	1.35	99	.2957	0	>0.2	21.32	20	107
Manganese		2008	2000	2.63	100	.4742	0	<1.0	21.4	20	107
Iron		31090	30000	1.63	104	105100	100000	105	107900	100000	108
Cobalt		305.6	300	3.28	102	.1356	0	<1.0	21.3	20	106
Nickel	T	292.9	300	1.24	98	-.1449	0	<0.2	20.77	20	104
Copper	T	297.9	300	0.81	99	.2102	0	<0.5	20.76	20	104
Zinc	T	310.3	300	1.30	103	.8659	0	<10	20.97	20	105
Arsenic	T	306	300	1.59	102	.1522	0	<0.2	21.58	20	108
Selenium	T	300.9	300	1.37	100	.0669	0	<0.3	23.37	20	117
Strontium		303.1	300	1.17	101	.9559	0	<2.0	22.76	20	114
Zirconium		30.12	30	0.90	100	.8147	0	<5.0	4.543	20	23*
Molybdenum		310.9	300	0.96	104	2143	2000	107	2105	2000	105
Silver	T	29.45	30	1.18	98	.0229	0	<0.2	19.68	20	98
Cadmium	T	312.8	300	0.23	104	.1248	0	<0.2	19.93	20	100
Tin	T	307.9	300	0.46	103	.04145	0	<0.2	20.22	20	101
Antimony		61.65	60	1.53	103	.05645	0	<1.0	20.45	20	102
Barium	T	308.1	300	0.85	103	.06288	0	<0.5	20.52	20	103
Tungsten		29.77	30	0.44	99	.2169	0	<2.0	20.45	20	102
Thallium	T	298.6	300	0.78	100	.006516	0	<0.2	19.25	20	96
Lead	T	304.6	300	0.41	102	.09167	0	<0.1	19.86	20	99
Uranium		307.3	300	1.51	102	.006976	0	<1.0	21.24	20	106

| Unit: ug/L
| T: Target analyte
| EV: Expected Value
| Comment: * Out of QC limit

Figure 2: TYPICAL CONTINUING CALIBRATION VERIFICATION SUMMARY

CONTINUING CALIBRATION VERIFICATION SUMMARY FORM

Client : XYZ, INC.
Project : CLEAN WATER PROJECT
SDG NO. : YYMSSS
Method : METHOD E200.8
Sequence : I98M03
Instrument ID: 98

CCV SampleID : CCV1 CCV2
CCV DataFileID : 98M03017 98M03025
CCV DateTime : MM/DD/YYHH:MM MM/DD/YYHH:MM

PARAMETER		CCV EV	RESULT	%REC	RSD	RESULT	%REC	RSD
Lithium		25	25.3	101	0.64	25.8	103	2.44
Beryllium	T	25	26.3	105	0.24	26.1	104	1.75
Boron		50	52.9	106	0.78	54.9	110	4.64
Sodium		25000	24600	98	1.17	24900	99	0.64
Magnesium		25000	24300	97	2.58	25100	100	2.85
Aluminum		25000	24900	100	4.21	25200	101	1.62
Silicon		2500	2470	99	0.74	2480	99	0.70
Phosphorus		250	251	101	1.21	266	106	7.67
Potassium		25000	26300	105	0.90	26400	106	3.66
Calcium		25000	25200	101	0.54	25200	101	0.80
Titanium		250	250	100	1.71	253	101	0.83
Vanadium		250	268	107	1.52	260	104	2.04
Chromium	T	250	262	105	1.03	257	103	2.64
Manganese		1500	1550	104	3.62	1510	100	3.37
Iron		25000	27100	108	1.49	26800	107	1.14
Cobalt		250	263	105	2.37	253	101	6.35
Nickel	T	250	260	104	0.73	252	101	2.02
Copper	T	250	257	103	1.07	251	100	2.47
Zinc	T	250	265	106	1.64	261	104	1.86
Arsenic	T	250	257	103	0.88	257	103	0.99
Selenium	T	250	263	105	0.52	261	104	0.69
Strontium		250	260	104	1.94	252	101	3.26
Zirconium		25	27.1	108	1.06	25.9	104	2.30
Molybdenum		250	259	104	1.25	267	107	0.84
Silver	T	25	25.2	101	0.94	25.7	103	1.96
Cadmium	T	250	265	106	1.30	266	106	0.63
Tin	T	250	263	105	1.26	262	105	0.68
Antimony		50	52.2	104	0.64	51.8	104	0.45
Barium	T	500	519	104	1.02	506	101	1.99
Tungsten		25	25.5	102	2.71	24.7	99	2.29
Thallium	T	250	253	101	1.58	243	97	3.89
Lead	T	250	263	105	2.38	252	101	3.29
Uranium		250	262	105	3.56	250	100	3.33

| Unit: ug/L
| T: Target analyte
|%Rec QC Limit: 90-110
| RSD QC Limit: <5
| CCV EV: CCV Expected Value ug/L
| Comment:

Figure 3: TYPICAL INITIAL AND CONTINUING CALIBRATION BLANK SUMMARY

CONTINUING CALIBRATION BLANK SUMMARY FORM

Client : XYZ, INC.
Project : CLEAN WATER PROJECT
SDG NO. : YYMSSS
Method : E200.8
Sequence : I98M03
Instrument ID: 98

CB SampleID		: ICB		CCB1		CCB2	
CB DataFileID		: 98M03010		98M03018		98M03026	
CB DateTime		: MM/DD/YYHH:MM		MM/DD/YYHH:MM		MM/DD/YYHH:MM	
PARAMETER	LOD	RESULT	< LOD >	RESULT	< LOD >	RESULT	< LOD >
Lithium	2.0	0.05	<2.0	0.2	<2.0	0.3	<2.0
Beryllium T	0.1	0.002	<0.1	0.0007	<0.1	0.004	<0.1
Boron	10	0.04	<10	0.1	<10	0.1	<10
Sodium	100	7	<100	7	<100	4	<100
Magnesium	100	1	<100	1	<100	2	<100
Aluminum	100	1	<100	1	<100	2	<100
Silicon	50	2	<50	1	<50	1	<50
Phosphorus	50	0.8	<50	2	<50	1	<50
Potassium	100	3	<100	2	<100	2	<100
Calcium	100	8	<100	7	<100	6	<100
Titanium	2.0	0.02	<2.0	0.009	<2.0	0.02	<2.0
Vanadium	1.0	0.04	<1.0	0.04	<1.0	0.04	<1.0
Chromium T	0.2	0.04	<0.2	0.04	<0.2	0.05	<0.2
Manganese	1.0	0.1	<1.0	0.06	<1.0	0.09	<1.0
Iron	100	10	<100	10	<100	10	<100
Cobalt	1.0	0.03	<1.0	0.02	<1.0	0.02	<1.0
Nickel T	0.2	0.2	>0.2	0.3	>0.2	0.3	>0.2
Copper T	0.5	0.02	<0.5	0.01	<0.5	0.01	<0.5
Zinc T	10	0.3	<10	0.3	<10	0.3	<10
Arsenic T	0.2	0.09	<0.2	0.06	<0.2	0.06	<0.2
Selenium T	0.3	0.2	<0.3	0.1	<0.3	0.1	<0.3
Strontium	2.0	0.01	<2.0	0.01	<2.0	0.02	<2.0
Zirconium	5.0	0.3	<5.0	0.3	<5.0	0.3	<5.0
Molybdenum	2.0	0.2	<2.0	0.2	<2.0	0.1	<2.0
Silver T	0.2	0.003	<0.2	0.003	<0.2	0.004	<0.2
Cadmium T	0.2	0.02	<0.2	0.02	<0.2	0.02	<0.2
Tin T	0.2	0.2	<0.2	0.09	<0.2	0.09	<0.2
Antimony	1.0	0.01	<1.0	0.01	<1.0	0.02	<1.0
Barium T	0.5	0.02	<0.5	0.03	<0.5	0.04	<0.5
Tungsten	2.0	0.03	<2.0	0.02	<2.0	0.02	<2.0
Thallium T	0.2	0.05	<0.2	0.03	<0.2	0.04	<0.2
Lead T	0.1	0.02	<0.1	0.03	<0.1	0.1	>0.1
Uranium	1.0	0.06	<1.0	0.05	<1.0	0.05	<1.0

| Unit: ug/L
| CB: Calibration Blank
| T: Target analyte
| Acceptance Criteria: CCB Result <LOD
| Comment:

Figure 4: TYPICAL SAMPLE REPORT

METHOD E200.8
METALS BY ICP-MS

Client : XYZ, INC. Date Collected: MM/DD/YY HH:MM
Project : CLEAN WATER PROJECT Date Received: MM/DD/YY
SDG NO. : YYMSSS Date Extracted: MM/DD/YY HH:MM
Sample ID: XX-Y-ZZNN Date Analyzed: MM/DD/YY HH:MM
Lab Samp ID: MSSS-01 Dilution Factor: 1
Lab File ID: F6M03047 Matrix: WATER
Ext Btch ID: IMM004W % Moisture: NA
Calib. Ref.: F6M03045 Instrument ID: F6

PARAMETERS	Result (ug/L)	RL (ug/L)	MDL (ug/L)
Arsenic	0.248J	1.00	0.200
Barium	4.80	1.00	0.500
Beryllium	ND	1.00	0.100
Cadmium	2.90	1.00	0.200
Chromium	2.01	1.00	0.200
Copper	46.1	1.00	0.500
Lead	ND	1.00	0.100
Nickel	378	1.00	0.200
Selenium	ND	1.00	0.300
Silver	ND	1.00	0.200
Thallium	ND	1.00	0.200
Tin	ND	1.00	0.200

Sample ID: XX-Y-ZZNN Date Analyzed: MM/DD/YY hh:mm
Lab Samp ID: MSSS-01I Dilution Factor: 10
Lab File ID: F6M03038 Matrix: WATER
Ext Btch ID: IMM004W % Moisture: NA
Calib. Ref.: F6M03033 Instrument ID: F6

PARAMETERS	Result (ug/L)	RL (ug/L)	MDL (ug/L)
Zinc	589	200	100

Note: Detection limits are reported relative to sample result significant figures.
Sample Amount : 50ml Final Volume:50ml

Figure 5: TYPICAL LCS/LCD SUMMARY

EMAX QUALITY CONTROL DATA
LAB CONTROL SAMPLE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN WATER PROJECT
BATCH NO. : YYMSSS
METHOD : E200.8

MATRIX	: WATER		% MOISTURE:NA
DILUTION FACTOR	: 1.00	1.00	1.00
SAMPLE ID	: MBLK1W	LCS1W	LCD1W
LAB SAMPLE ID	: IMM004WB	IMM004WL	IMM004WC
LAB FILE ID	: 98M03019	98M03020	98M03021
DATE PREPARED	: MM/DD/YY HH:MM	MM/DD/YY HH:MM	MM/DD/YY HH:MM
DATE ANALYZED	: MM/DD/YY HH:MM	MM/DD/YY HH:MM	MM/DD/YY HH:MM
PREP BATCH	: IMM004W	IMM004W	IMM004W
CALIBRATION REF	: 98M03017	98M03017	98M03017

ACCESSION:

PARAMETERS	MBResult (ug/L)	SpikeAmt (ug/L)	LCSResult (ug/L)	LCSRec (%)	SpikeAmt (ug/L)	LCDResult (ug/L)	LCDRec (%)	RPD (%)	QCLimit (%)	MaxRPD (%)
Arsenic	ND	30	31.3	104	30	32.0	107	2	85-115	20
Barium	ND	30	30.1	100	30	29.6	99	2	85-115	20
Beryllium	ND	30	32.6	109	30	32.7	109	0	85-115	20
Cadmium	ND	30	30.8	103	30	31.0	103	1	85-115	20
Chromium	ND	30	32.8	109	30	33.1	110	1	85-115	20
Copper	ND	30	33.2	111	30	33.4	111	1	85-115	20
Lead	ND	30	32.5	108	30	32.3	108	1	85-115	20
Nickel	ND	30	33.1	110	30	33.2	111	0	85-115	20
Selenium	ND	30	32.5	108	30	33.1	110	2	85-115	20
Silver	ND	30	34.3	114	30	34.6	115	1	85-115	20
Thallium	ND	30	33.2	111	30	32.1	107	3	85-115	20
Tin	ND	30	31.0	103	30	31.0	103	0	85-115	20
Zinc	ND	60	63.9	107	60	64.9	108	2	85-115	20

Figure 6: TYPICAL MS/MSD SUMMARY

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN WATER PROJECT
BATCH NO. : YYMSSS
METHOD : E200.8

MATRIX	: WATER		% MOISTURE: NA
DILUTION FACTOR	: 1	1	1
SAMPLE ID	: ZZ-XX	ZZ-XXMS	ZZ-XXMSD
LAB SAMPLE ID	: MSSS-01	MSSS-01M	MSSS-01S
LAB FILE ID	: F6M03047	F6M03048	F6M03049
DATE PREPARED	: MM/DD/YY HH:MM	MM/DD/YY HH:MM	MM/DD/YY HH:MM
DATE ANALYZED	: MM/DD/YY HH:MM	MM/DD/YY HH:MM	MM/DD/YY HH:MM
PREP BATCH	: IMM004W	IMM004W	IMM004W
CALIBRATION REF	: F6M03045	F6M03045	F6M03045

ACCESSION:

PARAMETERS	PSResult (ug/L)	SpikeAmt (ug/L)	MSResult (ug/L)	MSRec (%)	SpikeAmt (ug/L)	MSDResult (ug/L)	MSDRec (%)	RPD (%)	QCLimit (%)	MaxRPD (%)
Arsenic	0.248J	30	32.9	109	30	34.7	115	5	70-130	20
Barium	4.80	30	38.6	113	30	39.7	116	3	70-130	20
Beryllium	ND	30	32.9	110	30	34.4	115	4	70-130	20
Cadmium	2.90	30	35.7	109	30	36.5	112	2	70-130	20
Chromium	2.01	30	34.4	108	30	36.1	114	5	70-130	20
Copper	46.1	30	79.3	111	30	83.1	123	5	70-130	20
Lead	ND	30	32.7	109	30	33.9	113	4	70-130	20
Nickel	378	30	412	113	30	435	190*	5	70-130	20
Selenium	ND	30	32.5	108	30	33.9	113	4	70-130	20
Silver	ND	30	32.6	109	30	33.6	112	3	70-130	20
Thallium	ND	30	33.4	111	30	34.7	116	4	70-130	20
Tin	ND	30	33.1	110	30	34.3	114	4	70-130	20

DILUTION FACTOR	: 10	10	10
SAMPLE ID	: ZZ-XX	ZZ-XXMS	ZZ-XXMSD
LAB SAMPLE ID	: MSSS-01I	MSSS-01M	MSSS-01S
LAB FILE ID	: F6M03038	F6M03039	F6M03040
DATE PREPARED	: MM/DD/YY hh:mm	MM/DD/YY hh:mm	MM/DD/YY hh:mm
DATE ANALYZED	: MM/DD/YY hh:mm	MM/DD/YY hh:mm	MM/DD/YY hh:mm
PREP BATCH	: IMM004W	IMM004W	IMM004W
CALIBRATION REF	: F6M03033	F6M03033	F6M03033

ACCESSION:

PARAMETERS	PSResult (ug/L)	SpikeAmt (ug/L)	MSResult (ug/L)	MSRec (%)	SpikeAmt (ug/L)	MSDResult (ug/L)	MSDRec (%)	RPD (%)	QCLimit (%)	MaxRPD (%)
Zinc	589	60	651	103	60	686	162*	5	70-130	20

PSResult - Parent Sample Result
* - Out of QC Limits

Figure 7: TYPICAL CASE NARRATIVE

CASE NARRATIVE

Client : XYZ, INC.

Project: CLEAN WATER PROJECT

SDG : YYMMSSS

METHOD E200.8
METALS BY ICP-MS

One (1) water sample was received on MM/DD/YY to be analyzed for Metals by ICP-MS in accordance with Method E200.8 and project specific requirements.

Holding Time
The sample was digested and analyzed within the prescribed holding time.

Calibration
Initial Calibration was established as prescribed by the method and was verified using a secondary source (ICV). Interference checks were performed and results were within required limits. Continuing calibration verifications and continuing calibration blanks were carried out at the frequency specified by the project. All calibration requirements were satisfied.

Method Blank
Method blank was prepared and analyzed at the frequency required by the project. For this SDG, one (1) method blank was analyzed. IMM004WB - result was compliant to project requirement. Refer to sample result summary form for details.

Lab Control Sample
Lab control sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) set of LCS/LCD was analyzed. IMM004WL/IMM004WC were within LCS limits. Refer to LCS summary form for details.

Matrix QC Sample
Matrix spike sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) set of MS/MSD was analyzed and the following were noted: MSSS-01M/MSSS-01S - Percent recoveries for Nickel (13X) and Zinc (10X) was not within MSD QC limit. The enclosed value (#X) is the ratio of parent sample result and spike amount. Presence of matrix interference was suspected. The rest of the analytes were in control. Refer to Matrix QC summary forms for details.

Sample Analysis
The sample was analyzed according to prescribed analytical procedures. Results were evaluated in accordance to project requirements. For this SDG, all quality control requirements were met with the exception of those that were discussed within the associated QC parameter.

Appendix 1: SUMMARY OF QUALITY CONTROL PROCEDURES

QC PROCEDURES	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	1st Rvw	2nd Rvw
Tune Check (Mass calibration and resolution check)	Daily before initial calibration.	±0.10 AMU (Mass of Isotope) ≈ 0.75 AMU w/ 5% peak width RSD of 5 replicates : ≤ 5%	Correct problem and repeat tune check.		
Initial Calibration (multi-point)	Daily prior to sample analysis.	r ≥ 0.998	Correct the problem and repeat the initial calibration.		
Initial Calibration Verifications (ICV) – *also known as Quality Control Sample (QCS)*	Daily after the initial calibration.	All analytes within ± 10% of expected value RSD of replicate integrations: < 5%	Correct the problem and repeat the initial calibration.		
Calibration Verifications (CCV) – *also known as Instrument Performance Check (IPC)*	Daily immediately after calibration, after every 10 samples and at the end of the analysis sequence.	All analytes within ± 10% of expected value.	Repeat calibration and reanalyze all samples since last successful calibration.		
Calibration Blanks (ICB/CCB)	After every calibration verification	All target analytes < LOQ.	Correct problem then reanalyze calibration blank and previous samples.		
Internal Standard (IS)	ICV, CCV, CCBs, MB, LCS, MS/MSD and every sample	IS Intensities between 60-125% from Initial Calibration Blank IS Intensity	Correct problem then re-analyze		
Method Blank (MB)	One per preparation batch	All target analytes must be less than 10% of analyte level or 2.2 X MDL, whichever is greater	Re-digest and reanalyze method blank and all samples processed with the contaminated blank.		
Laboratory Control Sample (LCS)	One per preparation batch	% Recovery: 85% - 115%	Re-digest and reanalyze LFB and all associated samples		
Matrix Spike (MS/MSD)	One MS/MSD every 10 project samples per matrix	% Recovery: 70% - 130% RPD ≤ 20%	If LCS is in control and apparent for MS to be outside the QC limits, it is indicative of matrix interference. Discuss in the case narrative. Otherwise check possible sources of error and re-analyze the parent sample & MS		
Instrument Detection Limit (IDL)	Every three months		Correct the problem and repeat the IDL determination.		
Comments: Refer to PSR for flagging criteria.			Reviewed By:		
			Date:		

Appendix 2: DEMONSTRATION OF CAPABILITY

Conc Unit: mg/L
Sample Amt(ml): 50

Instrument ID: F6
Digestion date: 1/23/2018 and 1/31/18
Extracted by: S. Para
Analysis date: 1/25/2018 and 2/1/18
Analyzed by: L. Victorino

PARAMETER	F6A18025	F6A18026	F6B01022	F6B01023	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	Accuracy Acceptance Limits (%	RSD (%) Criteria	COMMENTS
	IMA020WL	IMA020WC	IMA030WL	IMA030WC								
Aluminum	3129	2979	3169	3153	3000	3108	104	87	3.0	80 - 120	≤ 20	Passed
Antimony	31.0	29.6	31.7	31.4	30	30.9	103	0.9	3.0	80 - 120	≤ 20	Passed
Arsenic	31.0	29.9	31.3	31.3	30	30.9	103	0.7	2.0	80 - 120	≤ 20	Passed
Barium	30.5	29.0	31.1	30.7	30	30.3	101	0.9	3.0	80 - 120	≤ 20	Passed
Beryllium	30.6	29.2	30.3	30.6	30	30.2	101	0.7	2.0	80 - 120	≤ 20	Passed
Boron	29.4	28.3	30.2	30.4	30	29.6	99	1.0	3.0	80 - 120	≤ 20	Passed
Cadmium	30.7	29.7	30.6	30.5	30	30.4	101	0.5	2.0	80 - 120	≤ 20	Passed
Calcium	3095	3006	3154	3126	3000	3095	103	64	2.0	80 - 120	≤ 20	Passed
Chromium	31.5	30.6	31.8	32.0	30	31.5	105	0.6	2.0	80 - 120	≤ 20	Passed
Cobalt	31.9	30.1	31.8	31.8	30	31.4	105	0.8	3.0	80 - 120	≤ 20	Passed
Copper	33.0	32.1	32.9	32.7	30	32.7	109	0.4	1.0	80 - 120	≤ 20	Passed
Iron	3144	3053	3131	3121	3000	3112	104	41	1.0	80 - 120	≤ 20	Passed
Lead	32.2	31.1	30.5	30.6	30	31.1	104	0.8	3.0	80 - 120	≤ 20	Passed
Lithium	31.4	30.3	31.2	31.5	30	31.1	104	0.6	2.0	80 - 120	≤ 20	Passed
Magnesium	3114	2938	3217	3228	3000	3124	104	134	4.0	80 - 120	≤ 20	Passed
Manganese	32.6	32.0	32.1	32.3	30	32.2	107	0.3	0.8	80 - 120	≤ 20	Passed
Molybdenum	31.0	29.4	30.4	30.4	30	30.3	101	0.7	2.0	80 - 120	≤ 20	Passed
Nickel	32.5	31.7	31.5	31.4	30	31.8	106	0.5	2.0	80 - 120	≤ 20	Passed
Potassium	3224	3137	3349	3336	3000	3262	109	100	3.0	80 - 120	≤ 20	Passed
Selenium	31.2	29.9	30.8	30.9	30	30.7	102	0.6	2.0	80 - 120	≤ 20	Passed
Silver	31.3	30.0	32.1	32.0	30	31.4	105	1.0	3.0	80 - 120	≤ 20	Passed
Sodium	3067	2960	3158	3084	3000	3067	102	82	3.0	80 - 120	≤ 20	Passed
Strontium	31.5	30.4	31.2	31.4	30	31.1	104	0.5	2.0	80 - 120	≤ 20	Passed
Thallium	32.1	31.3	30.6	31.1	30	31.3	104	0.6	2.0	80 - 120	≤ 20	Passed
Tin	30.8	29.6	31.3	31.2	30	30.7	102	0.8	3.0	80 - 120	≤ 20	Passed
Titanium	31.4	30.6	32.1	31.8	30	31.5	105	0.7	2.0	80 - 120	≤ 20	Passed
Uranium	30.3	29.3	30.1	30.4	30	30.0	100	0.5	2.0	80 - 120	≤ 20	Passed
Vanadium	30.4	29.7	31.1	31.2	30	30.6	102	0.7	2.0	80 - 120	≤ 20	Passed
Zinc	64.2	61.0	64.0	63.8	60	63.3	105	1.5	2.0	80 - 120	≤ 20	Passed

200.8FS: SAMPLE PREPARATION LOG (Page 1)

EMAX LABORATORIES, INC.

DIGESTION LOG
for
ICP-MS METALS

Page 1

Note: For samples, relevant QCs/Standards digested, refer to attached digestion sequence.

Comments:

Digestion Vessel Lot #

Book #: EIM-072
Batch:
Matrix:
Digestor ID:

SOP #	Rev. #
☐ EMAX-200.8	6
☐ EMAX-6020	9
☐ EMAX-	

Start	Temp °C	End	Temp °C

Standards	ID	Amount Added (ml/g)
LCS-1		
LCS-2		
MS		
Blank Soil (Bead)		
Reagent	**Lot# / ID**	**Amount Added (ml)**
HNO_3		
HCl		
H_2O_2		
HNO_3(1:1)		
pH Strip (0-14)		
Digestate Location		
Extract Location		

☐ Reagent Water ID:
☐ Thermometer ID:
☐ Pipette ID:
☐ Pipette ID:
☐ Pipette ID:
☐ HNO_3 dispenser checked @ 5.0 ml with Class A volumetric flask
☐ HCl dispenser checked @ 5.0 ml with Class A volumetric flask

Prepared By:
Standard Added By: Witnessed By:
Extract Rcvd By: Checked By:

200.8FS: SAMPLE PREPARATION LOG (Page 2)

PrepBatchID	LabSampleID	Aliquot	Unit	DateTime	Vd(ml)	ExpAmt	ExpVd(ml)	PrepFctr	Comments

200.8FA: ANALYSIS RUN LOG

EMAX LABORATORIES, INC.

ANALYSIS RUN LOG
for
ICP-MS

Page 1

Note: For samples and relevant QCs/Standards analyzed, refer to attached analytical sequence.

Start Date:

End Date:

Comments:

All soil/solid samples are diluted at 10x dilution prior to analysis.

Filter Lot #:

Book #:	AF6-024
Instrument No.:	F6
Analytical Batch:	
Analytical Sequence:	
Method File:	
Micropipette ID:	☐ 142781004
Micropipette ID:	☐ ICP-06
Micropipette ID:	☐ 339362028
Micropipette ID:	☐ GFAA-07
Micropipette ID:	☐ 339342032
Micropipette ID:	☐ 542780515
Micropipette ID:	☐ 542761827
Micropipette ID:	☐

SOP #	Rev. #
☐ EMAX-6020	9
☐ EMAX-200.8	6
☐ EMAX-	
☐ EMAX-	
☐ EMAX-	

STANDARDS ID		STANDARDS ID	
S0		MRL1	
S1		MRL2	
S2		MRL3	
S3		MRL4	
S4		MRL5	
S5		MRL6	
S6		Internal Standard	
S7		Post-Spike 1	
ICV		Post-Spike 2	
CCV		Post-Spike 3	
ICSA		Post-Spike 4	
ICSAB			
6020 TUNE SOLN.			
200.8 TUNE SOLN.			

Analyzed By:

Date:

200.8FM: INSTRUMENT MAINTENANCE LOG

EMAX LABORATORIES, INC.

Page 1

INSTRUMENT MAINTENANCE LOG

Instrument No: F6 Month: Year: 201_ Book #: MF6-005

Date							
Argon, Hydrogen, Helium							
Instrument Discharge							
Pump Tubings							
Rinse Bottle							
Printer Paper							
Autosampler							
Cooling Water							
Peri Pump Rate (0.08-0.12 RPS)							
Nebulizer Gas (0.8-1.30 L/min)							
Makeup Gas (0.1-0.3 L/min)							
ICP-MS TUNE							
Li - 7 (≥ 6400 Counts)							
Y - 89 (≥ 16000 Counts)							
Tl - 205 (≥ 9600 Counts)							
Oxides (MO^+) ≤ 2%							
Double Charge (M^{++}) ≤ 2%							
Analyst Initials							
ICP-MS TUNE							
Problem(s) Encountered							
Corrective Action							
Return To Specs (Analyst Initials)							

Code	Problems Encountered	Code	Corrective Action

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889

ADDENDUM TO	
Document	ALL ANALYTICAL SOPS
Revision Number	CURRENT REVISIONS
Section	10.2 Instrument Parameters
Date	11 September 2019
Reference Number	AA.7

This applies to all GC/MS, GC, HPLC-MS, HPLC, ICP-MS, ICP and IC Method SOPs

Section 10.2 shall include:

10.2. **Instrument Parameters**

10.2.1. Instrument parameters setup stipulated in the SOPs, are instrument suggested parameters. Fine tune the instrument to obtain optimum instrument condition.

10.2.2. Print and staple a copy of the current instrument parameter on the instrument log for easy access when performing daily instrument routine check.

10.2.3. In the event that instrument parameters necessitate a change, replace the instrument parameter printout with the new parameter setup. Archive the previous instrument parameters at the back of the instrument maintenance log.

PREPARED BY: _____ Date: 9/11/19

Name Farina Madamba

Title QA / QC Coordinator

APPROVED BY: _____ Date: 09.11.19

Name Kenette Pimentel

Title QA Manager

APPROVED BY: _____ Date: 09-11-19

Name Caspar Pang

Title Laboratory Director

ANNUAL REVIEW FORM

TRACE METALS BY ICP-MS

SOP#: EMAX-200.8 **Rev** 6 **Effective Date:** 30-Oct-18

COMMENTS	Reviewed By	Review Date
No update needed per LVictorino 11/22/2019		11/22/2019
No update needed per DRF by T. Huang 7/8/2020		7/8/2020

STANDARD OPERATING PROCEDURES

MERCURY (MANUAL COLD VAPOR)

SOP No.:	EMAX-245.1	Revision No.	4	Effective Date:	15-Jul-16
Prepared By:	Mary Jane Mendoza			Date:	07.14.16
Approved By:	Kenette Pimentel QA Manager			Date:	07.14.16
Approved By:	Caspar Pang Laboratory Director			Date:	07-14-16

Control Number: 245.1-04-

1.0 SCOPE AND APPLICATION

1.1. This procedure applies to the measurement of Mercury in drinking and saline waters, domestic and industrial waste samples by Cold Vapor Absorption Technique.

1.2. This SOP is an adaptation of EPA Method 245.1.

2.0 SUMMARY OF METHOD

2.1. A representative amount of sample is digested in nitric and sulfuric acids, followed by oxidation with potassium permanganate and potassium persulfate.

2.2. Organic mercurial are broken down and converted into mercuric ions in order to respond to the cold vapor atomic absorption technique. Persulfate oxidation step, followed by addition of permanganate ensures that organo-mercury compounds are oxidized.

2.3. Absorption of radiation by mercury vapor at 253.7 nm is then measured in the digested samples.

2.4. **Interferences**

2.4.1. Sulfides, as sodium sulfide, Copper and Chloride at high concentrations are known to interfere with the recovery of mercury. Samples containing such interference may require additional permanganate (about 12.5 ml).

2.4.2. Care must be taken to ensure that free chlorine is absent before the mercury is swept into the cell. This may be accomplished by using an excess of hydroxylamine hydrochloride reagent.

2.4.3. Certain volatile organic materials that absorb at this wavelength may also cause interference. A preliminary run without reagents should determine if this type of interference is present.

3.0 DETECTION LIMITS

3.1. **Detection Limit (DL), Limit of Detection (LOD) and Limit of Quantitation (LOQ)**

3.1.1. Refer to EMAX-QA04 for generation, validation and verification of DL, LOD and LOQ.

3.2. **Established DL, LOD & LOQ**

PARAMETER	DL	LOD	LOQ	Unit
Water	0.054	0.1	0.50	µg/L

4.0 DYNAMIC RANGE

4.1. The highest quantifiable range requiring no dilution is equal to the concentration of the highest calibration point (see Section 9.6). All samples analyzed above this range are considered "over-range" and requires dilution to properly quantitate.

4.2. The lowest quantifiable range of diluted samples is equal to the concentration of the lowest calibration point. All diluted samples analyzed below this range are considered as "under-range" and requires lower dilution factor to properly quantitate.

5.0 SAMPLE HOLDING TIME AND PRESERVATION

5.1. **Sample Preservation**

5.1.1. Samples are expected to be contained in HDPE pre-cleaned containers and preserved with HNO3 to pH < 2.

5.2. **Holding Time**

5.2.1. Samples must be analyzed within 28 days from date of collection.

6.0 ASSOCIATED SOPs

6.1. EMAX-DM01 Data Flow and Review

6.2. EMAX-QA04 Detection Limit (DL)

6.3. EMAX-QA05 Training

6.4. EMAX-QA08 Corrective Action

6.5. EMAX-QC01 Quality Control of Chemicals

6.6. EMAX-QC02 Analytical Standard Preparation

6.7. EMAX-QC06 Volumetric Labware and Micropipette Verification

6.8. EMAX-QC07 Glassware Cleaning

6.9. EMAX-SM03 Waste Disposal

6.10. EMAX-SM04 Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS of chemicals listed in this SOP.

7.2. Treat reagents, standards, and samples as potential hazards. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, and gloves at all times when performing this procedure. Perform preparation and analysis of mercury in a fume hood equipped with an exhaust fan or blower.

7.3. If for any reason, sample and/or other reagents get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amounts of water. If irritations persist inform your supervisor immediately so that proper action can be taken.

7.4. Do not look directly at the Mercury Lamp while lit. The radiation may cause damage to your eyes.

7.5. Perform all reagent additions under a fume hood.

7.6. Mercury Analyzers are to be used by trained personnel only.

8.0 INSTRUMENTS, CHEMICALS AND REAGENTS

8.1. **Instruments and Supplies**

8.1.1. Mercury Analyzers

8.1.1.1. Leeman PS-200 Automated Mercury Analyzer with Autosampler, Computer, Printer and PS 200 Software, Win Hg Runner 1.3

8.1.1.2. Leeman Hydra AA Automated Analyzer with Autosampler, Computer, Printer and PS200 Software, Win Hg Runner 1.3

8.1.2. 100 ml Digestion vessel

8.1.3. Digestate containers

8.1.4. Digestion block or equivalent

8.1.5. Micropipettes and tips

8.1.6. Thermometer

8.2. **Chemicals and Reagents**

8.2.1. Where available, purchase reagent grade chemicals and reagents

8.2.2. Sulfuric Acid, concentrated

8.2.3. Nitric Acid, concentrated

8.2.4. Sodium chloride - hydroxylamine hydrochloride solution: Dissolve 120 g of sodium chloride and 120 g of hydroxylamine hydrochloride in reagent water and dilute to 1 L. *(Note: Hydroxylamine sulfate may be used in place of hydroxylamine hydrochloride.)*

8.2.5. Potassium Permanganate, 5% solution: Dissolve 50 g of potassium permanganate in 1 L reagent water.

8.2.6. Potassium Persulfate, 5% solution: Dissolve 50 g of potassium persulfate in 1L reagent water.

8.2.7. Stannous Chloride – 10% solution: Dissolve 200 g of $SnCl_2$ in reagent water, add 200 ml HCl and volume to 2 L.

8.2.8. Reagent water – Mercury-free water

9.0 STANDARDS

9.1. Refer to EMAX-QC02 for proper analytical standard preparations.

9.2. Other concentration levels may be prepared to meet the data quality objective of a project.

9.3. **Stock Standard**

9.3.1. Purchase stock standards as certified solutions from two different vendors. Use one as primary standard and the other as secondary standard.

Stock Std	Name	Source	Conc.	Used for
Primary	Mercury	ERA or equivalent	1000 mg/L	ICAL, CCV
Secondary	Mercury	AccuStandard or equivalent	1000 mg/L	ICV/LCS/MS

9.3.2. Transfer standards on a properly labeled inert vial with minimal headspace and store it at -10°C to -20°C.

9.4. **Intermediate Standard Solution**

9.4.1. Primary Intermediate Standard, 10.0 mg/L: Dilute 1.0 mL of 1000 mg/L Hg primary stock standard to 100 mL using reagent water. Transfer the standard in a clean and properly labeled container.

9.4.2. Secondary Intermediate Standard, 10.0 mg/L: Dilute 1.0 mL of 1000 mg/L Hg secondary stock standard to 100 mL using reagent water. Transfer the standard in a clean and properly labeled container.

9.4.3. Post Spike Standard, 100 µg/L: Dilute 1.0 mL of 10 mg/L Hg primary intermediate standard to 100 mL using reagent water. Digest prior to use.

9.5. **Working Standard**

9.5.1. Primary Working Standard, 50 µg/L: Dilute 0.50 mL of 10 mg/L primary intermediate standard to 100 mL using reagent water. Transfer the standard in a clean and properly labeled container.

9.5.2. Secondary Working Standard, 50 µg/L: Dilute 0.50 mL of 10 mg/L secondary intermediate standard to 100 mL using reagent water. Transfer the standard in a clean and properly labeled container.

9.6. **Initial Calibration Standards**

9.6.1. Initial calibration consists of five standards and a reagent water blank. Using the primary working standard, prepare the ICAL points as follows:.

Level	Primary Working Standard, 100 µg/L Aliquot (ml)	Final Digestion Volume (ml)	Concentration (µg/L)
S0	0	100	0
S1	0.2	100	0.2
S2	0.5	100	0.5
S3	1.0	100	1.0
S4	2.0	100	2.0
S5	5.0	100	5.0

Note: Other concentration levels may be prepared as appropriate to meet project quality objectives.

9.7. **Initial Calibration Verification (ICV)**

9.7.1. Prepare ICV at 2 µg/L by diluting 2mL of secondary working standard (50 µg/L) to final digestion volume of 50 mL using reagent water

9.8. **Continuing Calibration Verification (CCV)**

9.8.1. Prepare IPC at 2 µg/L by diluting 2 mL of primary working standard (50 µg/L) to final digestion volume of 50 mL using reagent water.

9.9. **Lab Control Standard (LCS) and Matrix Spike (MS)**

9.9.1. Spike 2.5mL of secondary working standard (50 µg/L) to 50 mL reagent water (for LCS) or designated sample (for MS).

10.0 PROCEDURES

10.1. **Sample Preparation**

10.1.1. Transfer 50 mL of sample into 100 ml digestion vessel. Use reagent water for method blank (MB), LCS, and calibration standards.

10.1.2. Prepare the LCS and MS/MSD (Sec. 9.9.1). Prepare ICAL (Sec. 9.6.1), ICV (Sec. 9.7.1) and CCV (Sec. 9.8.1).

10.1.2.1. **Spike Addition**. Call a witness. Have the witness verify the setting of the micropipette and the expiration date of the spike standard.

10.1.3. Add 2.5 mL of concentrated H_2SO_4 and 1.25 mL concentrated HNO_3 with mixing after each addition.

10.1.4. Add 7.5 mL of 5% $KMnO_4$ solution to each vessel.

10.1.5. Swirl each vessel to mix and let it stand by for 15 min. Check each vessel if purple color persist. If not, add permanganate solution at 2.5 mL increments (maximum total amount of 12.5 mL) swirling the Digestion vessel at every addition, until purple color persists.

Add the same amount of permanganate solution added to a sample, to the method blank, LCS, calibration standards, ICV and CCV standards.

10.1.6. Add 4 mL of 5% potassium persulfate. Heat for 2 hours in hot block maintained at 95°C.

10.1.7. Allow the samples to cool.

10.1.8. Add 3 mL NaCl-hydroxylamine hydrochloride solution and wait for the sample to decolorize. Additional NaCl-hydroxylamine hydrochloride solution may be added to reduce excess permanganate in 1 mL increments up to a maximum total amount of 5 mL.

Add the same amount of NaCl-hydroxylamine hypochloride solution added to the method blank, LCS, calibration standards, ICV and CCV standards.

10.1.9. Upon decolorization, dilute to 80 mL final volume using reagent water.

10.1.10. Properly fill up the sample preparation log.

10.2. **Instrument Parameters**

10.2.1. PROTOCOL

10.2.1.1. Set Values

Instrument ID:	PS200	HYDRA AA
Number of Integration	1	
Uptake time	20 sec.	18 sec.
Weight	N	N
Dilution	N	N
On/Off, times, gains		
On	Y	Y
Time	10	10
Gas	0.35 LPM	0.15 LPM
Pump Rate	5 ml/min	7 ml/min
AUTOSAMPLER – Setup		
Station 1 (rack1)	From cup 1 to cup 44	From cup 1 to cup 44
Station 2 (rack 2)	From cup 1 to cup 44	From cup 1 to cup 44
Rinse time	50 sec.	60 sec.

CALIBRATION	Concentration, µg/L	Concentration, µg/L
S0, S1, S2, S3, S4, S5	0 0,.20, 0.50, 1.0, 2.0, 5.0	0 0,.20, 0.50, 1.0, 2.0, 5.0

10.2.2. DATA OUTPUT – Specify Report

Data Output	Real Time	Post Run
Samples	Y	Y
Standards	Y	Y
Updates	Y	Y
Peaks	N	N
IEC Stds.	N	N
Check Stds.	Y	Y
Dups and % Diff.	Y	Y
Wavelength	N	N
Rel. Absorbances	N	N
% RSD	Y	Y
Scans to PRN		N
Detail		Y

Summary		N
Post Run Copies		1
Post Run Report Order [1-sorted; 2- sequential]	2	

10.3. **Calibration**

10.3.1. Instrument Set-up

10.3.1.1. Set up PS200 or Hydra AA to proper operating parameters. Refer to Section 10.2.1.

New pump tubing, must be ran with rinse for 45 minutes to break in the tubing.

10.3.1.2. Turn on the lamp and allow to warm up for at least 5 minutes.

10.3.1.3. Check the peristaltic pump to deliver a steady flow.

10.3.1.4. Check that the reductant solution, 10% $SnCl_2$, is sufficient. If not, prepare solution as described in Sec. 8.2.7.

10.3.2. Initial Calibration (ICAL)

10.3.2.1. Prepare initial calibration solution as described in Sec. 9.6.1.

10.3.2.2. Digest the ICAL standards as described in Sec. 10.1.

10.3.2.3. Analyze them as described in Sec. 10.4.

10.3.2.4. Refer to Sec. 10.5 for calculation.

10.3.2.5. Initiate initial calibration as described in the instrument operations manual. After calibration is completed, acquire the calibration data and review.

10.3.2.6. Refer to Appendix 1 for acceptance criteria.

10.3.2.7. Verify the initial calibration by a secondary source standard QCS .

10.3.3. Initial Calibration Verification (ICV)

10.3.3.1. Prepare ICV as described in Sec. 9.7.1. Prepare Initial Calibration Blank (ICB) using reagent water.

10.3.3.2. Digest ICV and ICB as described in Sec. 10.1.

10.3.3.3. Analyze the ICV sample to verify the concentration of the ICAL. Analyze the ICB after the ICV.

10.3.3.4. Refer to Appendix 1 for acceptance criteria.

10.3.4. Continuing Calibration Verification (CCV)

10.3.4.1. Prepare CCV as described in Sec. 9.8.1. Prepare Continuing Calibration Blank (CCB) using reagent water.

10.3.4.2. Digest the CCV and CCB as described in Sec. 10.1.

10.3.4.3. Analyze CCV sample to verify the validity of ICAL. Analyze the CCB after the IPC.

10.3.4.4. Refer to Appendix 1 for acceptance criteria.

10.4. **Analysis**

10.4.1. Calibration

10.4.1.1. Refer to the instrument operations manual for proper calibration and analytical sequence setup (autosampler setup).

10.4.1.2. Analytical batch ID naming convention: MIIMSSS

where:

"M" – is for Mercury and is always the first character

II – is the instrument number

M – is the month code (A for January, B for February, and so on)

SSS – is a sequential number (resets to 001 for the first folder created each month)

10.4.1.3. **Typical Calibration Sequence**

S0	0.00000
S1	0.20000
S2	0.50000
S3	1.00000
S4	2.00000
S5	5.00000
S6	10.0000

10.4.2. Analytical Sequence

10.4.2.1. ICV

10.4.2.2. ICB

10.4.2.3. CCV1

10.4.2.4. CCB1

10.4.2.5. Method Blank (MB)

10.4.2.6. Lab Control Sample (LCS)

10.4.2.7. Lab Control Sample Duplicate (LCSD)

10.4.2.8. Parent Sample

10.4.2.9. Matrix Spike (MS)

10.4.2.10. Matrix Spike Duplicate (MSD)

10.4.2.11. Maximum of 2 samples

10.4.2.12. CCV2

10.4.2.13. CCB2

10.4.2.14. Maximum of 10 samples

10.4.2.15. CCV3

10.4.2.16. CCB3

10.4.3. Using the analytical sequence, arrange the digested standards and samples to be analyzed chronologically.

10.4.4. Transfer about 6 ml of the digestates into the autosampler tubes placing them on the autosampler rack in the same order as the analytical sequence.

10.4.5. Set the prepared samples into the autosampler and start the analytical run.

10.4.6. Sample Result Evaluation

10.4.6.1. Check the QC data as soon as available.

- ✓ Check the ICAL and ICV prior to sample analysis.
- ✓ Check the method blank and LCS/LCSD against project specific requirements.
- ✓ Check the MS / MSD that it meets the acceptance criteria or note possible matrix interference in the run log.
- ✓ Check that all samples are analyzed within the calibration range. Dilute the samples that measured over the absorbance of the highest calibration point.
- ✓ Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.
- ✓ Check the calibration checks to make sure that the instrument is functioning properly.

10.4.6.2. Refer to Sec. 11 for quality control and Sec. 12 for corrective action.

10.4.6.3. Refer to Appendix 1 for acceptance criteria. If any of the acceptance criteria is not met, perform the necessary corrective action. If problem persists, inform the Supervisor for further action.

10.4.6.4. Properly fill up the analytical run log.

10.4.6.5. Upload the electronic data to the network.

10.4.7. Dealing with Carryover

10.4.7.1. Check the sample analyzed preceded by another sample found to have target analyte concentrations exceeding the calibration range.

10.4.7.2. If there is no target analyte detected as found in the preceding high concentration sample, proceed with data reduction.

10.4.7.3. If there is any target analyte detected as found in the preceding high concentration sample, re-analyze the sample to rule-out carryover. If carryover is confirmed, proceed with data reduction and report the data from re-analysis.

10.4.8. Method of Standard Addition (MSA)

10.4.8.1. Perform MSA for all EP extracts, samples for de-listing petition, whenever a new matrix is encountered and/or as indicated above.

10.4.8.2. Prepare three sample solutions (Ms1, Ms2, Ms3) to objectively produce equal increments of concentration in the final solution without diluting the sample more than 50% of its original volume and expected concentrations falls within the linear range.

Example: Sample concentration is tentatively determined at 2 µg/L.

Ms1 – take 10 ml of digestate and add 0.2 ml of 100 µg/L spike standard (≈ 6 µg/L)

Ms2 – take 10 ml of digestate and add 0.4 ml of 100 µg/L spike standard (≈ 7 µg/L)

Ms 3 – take 10 ml of digestate and add 0.6 ml of 100 µg/L spike standard (≈ 8 µg/L)

10.4.8.3. Analyze Ms1, Ms2 and Ms3 and calculate the results using Eq.-10.5.5.

10.5. **Calculations**

10.5.1. Calibration Factor

Plot the absorbance (y-axis) versus the known concentration of the calibration standards (x-axis) using Excel spreadsheet or equivalent. The reciprocal of the slope shall be the calibration factor.

10.5.2. Calculate for Mercury Concentration

$$C = [(A + CF) - Y] * DF \qquad \text{Eq.-10.5.2}$$

where:

C – Concentration of Mercury, µg/L

A – Absorbance

CF – Calibration Factor = 1/slope

Y – Y-intercept / slope

DF – Dilution Factor

10.5.3. Calculate for Percent Recovery

$$\%\,\mathrm{Recovery} = \frac{(C_f - C)}{C_s} \times 100 \qquad \text{Eq.-10.5.3}$$

where:

C_f – Concentration found

C – Concentration of the sample (use 0 for LCS)

C_s – Concentration of spike

10.5.4. Calculate for Relative Percent Difference

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)} \times 100 \qquad \text{Eq.-10.5.4}$$

where:

RPD – Relative Percent Difference

C_1 – Measured concentration of the first sample aliquot

C_2 – Measured concentration of the second sample aliquot

10.5.5. Calculation for MSA

$$C_x = \frac{(S_2)(V_s)(C_s)}{(S_2 - S_1)V_x} \qquad \text{Eq.-10.5.5}$$

where:

C_x – Concentration of the sample

C_s – Concentration of spike

S_1 – Analytical signal of MS1

S_2 – Analytical signal of MS2

V_x – Volume of sample aliquot

V_s – Volume of spike or reagent water

10.6. **Data Reduction**

10.6.1. Make a copy of the analytical run and sample preparation log.

10.6.2. Print a copy of raw data and the QC report.

10.6.3. Highlight the data to be reported.

10.6.4. Collate the reportable data separating the QC results from the sample results.

10.6.5. Keep all other data generated with the analytical folder marked with “For record only”.

10.7. **Report Generation**

10.7.1. Generate the method.txt file and sample results using HGF1.exe.

10.7.2. Generate the QC summaries using HGF3.exe.

10.7.3. Generate the case narrative using CN00.exe.

10.7.4. Arrange the analysis package in sequence as detailed below.

10.7.4.1. Case Narrative

10.7.4.2. Lab Chronicle

10.7.4.3. Sample Results

10.7.4.4. LCS/LCSD Summary

10.7.4.5. MS/MSD Summary

10.7.4.6. Analytical Run Log

10.7.4.7. Raw Data

10.7.4.8. Sample Preparation Log

10.7.4.9. Non-Conformance Report (if any)

10.8. **Data Review**

10.8.1. Perform a 100% data review in accordance to EMAX-DM01 and the PSR.

- ✓ Check that method blank is compliant to Project Specific Requirements (PSR) criteria.
- ✓ Check LCS/LCSD and MS/MSD against QC limits.
- ✓ Check for possible carry-over and if confirmation is performed.
- ✓ Review the attached logs that they are properly filled.
- ✓ Check the generated reports against the raw data, analytical run log and sample preparation log. Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.
- ✓ Review the case narrative and check that it accurately describes what transpired in the analytical process. Edit as necessary to reflect essential issues not captured by the case narrative generator program.

10.8.2. Submit the analytical folder for secondary review

10.9. **Preventive Maintenance**

10.9.1. Daily routine maintenance must be observed religiously. Observe manufacturer's notes regarding DOs and DON'Ts:

- System preparation is a ***MUST*** before instrument startup.
- Make certain that drying tube has been packed loosely. If drying tube is blocked, liquid may backflow into the optical cell; this will require disassembly and leaning.
- Do not shutdown the instrument when operational, abort the run first if interruption is needed.

10.9.2. Daily routine maintenance including checking of reductant solution, 10% $SnCl_2$, trouble shooting and major repairs must be recorded in the maintenance log. Refer to Form 245.1FM.

10.9.3. Maintain the instrument clean at all times.

10.9.4. For troubleshooting, consult the Operations Manual, Section 4.

11.0 QUALITY CONTROL

11.1. **Sample Preparation QC**

11.1.1. Pipettes must be calibrated prior to its use. Refer to EMAX-QC06.

11.1.2. Reagents are subjected to QC check prior to its use. Refer to EMAX-QC01.

11.1.3. Properly treat all lab wares used in the sample preparations as specified in EMAX-QC07.

11.1.4. A preparative batch consists of 20 or fewer samples of the same matrix, that are prepared for analysis simultaneously or sequentially, using the same lots of all reagents.

11.1.5. Every preparative batch must have at least one method blank, one LCS and a set of MS/MSD unless otherwise specified by the project. Digest QC samples together with the field samples.

11.2. **Sample Analysis QC**

11.2.1. Every analytical run is preceded by an Initial Calibration (ICAL) and ICV. The ICV standard should be obtained from a different source from that of the initial calibration. Analyze an instrument calibration blank (ICB) after the ICV. No further analysis is valid unless acceptance criteria are met.

11.2.2. Verify calibration with CCV standard and Continuing Calibration Blank (CCB) after every ten samples and at the end of the analytical run.

11.2.3. Evaluate MS/MSD to document matrix interference.

11.2.4. Use Method of Standard Addition (MSA) technique for analysis of all EP extracts and whenever a new sample matrix is being analyzed.

11.2.5. Refer to Appendix 1 for acceptance criteria.

11.3. **Method QC**

11.3.1. Detection Limit study must be established before the analytical procedure can be used. Quarterly verification must be performed. Refer to EMAX-QA04.

11.3.2. All analysts conducting this analysis must have an established Demonstration of Capability (DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTION

12.1. Corrective actions for each Quality Control Procedure is summarized in Appendix 1.

12.2. **Calibration**

12.2.1. Initial Calibration (ICAL) - if ICAL is non-compliant, consider the following suggestions to correct the problem:

- Replace the sample tubing, prepare fresh rinsate and re-prepare fresh $SnCl_2$. Rinse the system for at least 15 minutes prior to calibration.
- If problem persist, run the latest calibration standard that passed to check for possible instrumentation problem. If it passes, this is an indication that no instrumentation problem exist, re-digest the calibration standards. If it failed, clean the lamp, prior to re-calibration.
- If problem persist, inform the supervisor for further action

12.2.2. Initial Calibration Verification (ICV) - if the ICV is non-compliant, consider the following suggestions to correct the problem:

- Run the latest ICV standard that passed to check for possible standards preparation error. If it passes, this is an indication of standards preparation error. Re-digest the ICV and re-analyze. If it fails, refer to Sec. 12.1.1 prior to re-calibration.

12.2.3. Continuing Calibration Verification (CCV) - If CCV is non-compliant, consider the following suggestion to correct the problem:

- Run the latest CCV standard that passed to check for possible standards preparation error. If it passes, this is an indication of standards preparation error. Re-digest the IPC and re-analyze. If it fails, refer to Sec. 12.1.1 prior to re-calibration.

12.3. **Sample Prep QC**

12.3.1. For insufficient amount of sample(s), inform the supervisor immediately for further action.

12.3.2. Method Blank (MB) - if MB is non-compliant, consider the following suggestion to correct the problem:

- Check the sample results. If sample results are non-detected, you may report the result upon concurring with the PM, otherwise perform the corrective action as specified in the PSR.

12.4. **Sample Analysis QC**

12.4.1. Lab Control Sample (LCS) - If LCS is non-compliant, consider the following suggestions to correct the problem:

- Check for errors in calculation and concentration of the spike standard.
- Check instrument performance to determine if it is within acceptable guidelines.
- Re-calculate the data and/or re-analyze the extract if any of the above checks reveals a problem.
- If re-analysis results are the same as the initial result, consult the Supervisor for further action. Re-digest the LCS and all associated samples.

12.4.2. Matrix Spike/ Matrix Spike Duplicate (MS/MSD) - If MSD/MSD is non-compliant, consider the following suggestions to correct the problem:

- Check for errors in calculation and concentration of the analyte solution.
- Check instrument performance to determine if it is within acceptable guidelines.
- Re-calculate the data and/or re-analyze the extract if any of the above checks reveals a problem.
- If re-analysis results are the same as the initial result, consult the Supervisor for further action. If LCS was compliant, re-digest the parent sample and MS/MSD and re-analyze.
- Otherwise, discuss in the case narrative.

12.5. A Non-Conformance Report (NCR) is required when the following circumstances occur.

- Anomalies other than specified in Appendix 1 is observed.
- Sample is out of technical holding time.

12.5.1. Refer to EMAX-QA08.

13.0 POLLUTION PREVENTION

13.1. Mercury is a very volatile element, dangerous levels are readily attained in air. Mercury vapour should not exceed 0.1 mg/m^{-3} in air. Air saturated with the vapor at 20°C contains mercury in a concentration far greater than that limit. The danger increases at higher temperatures. It is therefore important that mercury be handled with care. Containers of mercury must be securely covered and spillage must be avoided. Mercury must only be handled under in a well-ventilated area. Prepare all standards in the fume hoods.

13.2. Because of the toxic nature of mercury vapor, precaution must be taken to avoid its inhalation. A bypass must be included on the system to vent the mercury vapor into an exhaust hood.

13.3. Small amounts of mercury spillage can be cleaned up by addition of sulphur powder. The resulting mixture must be properly labeled and turned over to the waste disposal unit for proper disposal.

13.4. Observe all necessary precautions to avoid spillage of solvent that may go to wastewater drains.

13.5. To prevent internal pollution, the entire sample preparation process and analytical standard preparation must be conducted in a properly functioning fume hood.

14.0 WASTE MANAGEMENT

14.1. No samples may be dumped on the laboratory sink.

14.2. Separate and properly identify all unused and expired analytical standards for proper disposal.

14.3. Place all wastes generated during analytical process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, expired analytical standards and other waste generated during the analytical process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. **Definition of Terms**

15.1.1. Mercury – is also known as quicksilver, is a chemical (element) that occurs naturally in the environment in several forms. One form of mercury is used in thermometers. This form is called "metallic mercury". Mercury is also used in barometers and other common consumer products. Mercury can also be combined with other chemicals, such as chlorine, carbon or oxygen to form either "inorganic" or "organic" mercury compounds.

15.1.2. Analyte – The specific chemicals or components for which a sample is analyzed; may be a group of chemicals that belong to the same chemical family, and which are analyzed together.

15.1.3. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.1.3.1. **Preparation Batch** – is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.1.3.2. **Analytical Batch** – is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices, preparation batches, and can exceed 20 samples.

15.1.4. Detection Limit (DL) – is defined as the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

15.1.5. Limit of Detection (LOD) – is defined as the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

15.1.6. Limit of Quantitation (LOQ) – is at the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

15.1.7. Safety Data Sheet (SDS) – is a written information concerning a chemical physical properties, toxicity, health standards, fire hazard and reactivity data including storage, spill and handling precautions.

15.1.8. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.1.9. Calibration Blank – is a target-analyte-free solvent subjected to the entire analytical process to establish zero baseline or background value.

15.1.10. Instrument Method – is a file generated to contain the instrument calibration and instrument parameter settings for a particular analysis.

15.1.11. Initial Calibration Verification (ICV) – also called ***Quality Control Standard (QCS)***, is a calibration standard used to verify the initial calibration with a standard obtained or prepared from a source independent of the source of the initial calibration standards to avoid bias of the initial calibration.

15.1.12. Continuing Calibration Verification (CCV) – also called ***Instrument Performance Check (IPC)***, is a calibration standard used to verify continuing calibration and evaluate the performance of the instrument system by ensuring calibration accuracy during the analysis run.

15.1.13. Method Blank (MB) – also called ***Lab Reagent Blank (LRB)***, is a target-analyte-free sample subjected to the entire sample preparation and/or analytical to monitor contamination.

15.1.14. Lab Control Sample (LCS) – also called ***Lab Fortified Blank (LFB)***, is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.1.15. Lab Control Sample Duplicate (LCSD) – also called ***Lab Fortified Blank Duplicate (LFB Dup)***, is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.1.16. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.1.17. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.1.18. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.1.19. Matrix – is a component or form of sample.

15.1.20. Matrix Spike (MS) – also called ***Lab Fortified Matrix (LFM)***, is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyzed to monitor matrix effect on a method's recovery efficiency.

15.1.21. Matrix Spike Duplicate (MSD) – also called ***Lab Fortified Matrix Duplicate (LFM Dup)***, is a replicate of MS analyzed to monitor precision or recovery.

15.1.22. Reagent Water – Purified water free from any target analyte or any other substances that may interfere with the analytical process.

15.2. **Application of EMAX QC Procedures**

15.2.1. The procedures and QC criteria summarized in this SOP applies to all projects when performing Mercury analysis by Cold Vapor Absorption Technique. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.3. **Department of Defense (DoD) and Department of Energy (DOE) Projects**

15.3.1. Samples from DoD sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD ELAP Quality Systems Manual (QSM), latest update, is applied.

16.0 REFERENCES

16.1. EPA Method 245.1, Methods for Chemical Analysis of Water and Wastes, (EPA /600/R-94/111), .

16.2. EMAX Quality Systems Manual, as updated.

17.0 APPENDICES

17.1. **Figures**

17.1.1. Figure 1 Autosampler Layout

17.1.2. Figure 2 Typical Calibration Curve

17.1.3. Figure 3 Typical Sample Result Summary

17.1.4. Figure 4 Typical LCS/LCSD Dup Summary

17.1.5. Figure 5 Typical MS/MSD Summary

17.1.6. Figure 6 Typical Case Narrative

17.2. **Appendices**

17.2.1. Appendix 1 Summary of Quality Control Procedures

17.2.2. Appendix 2 Demonstration of Capability

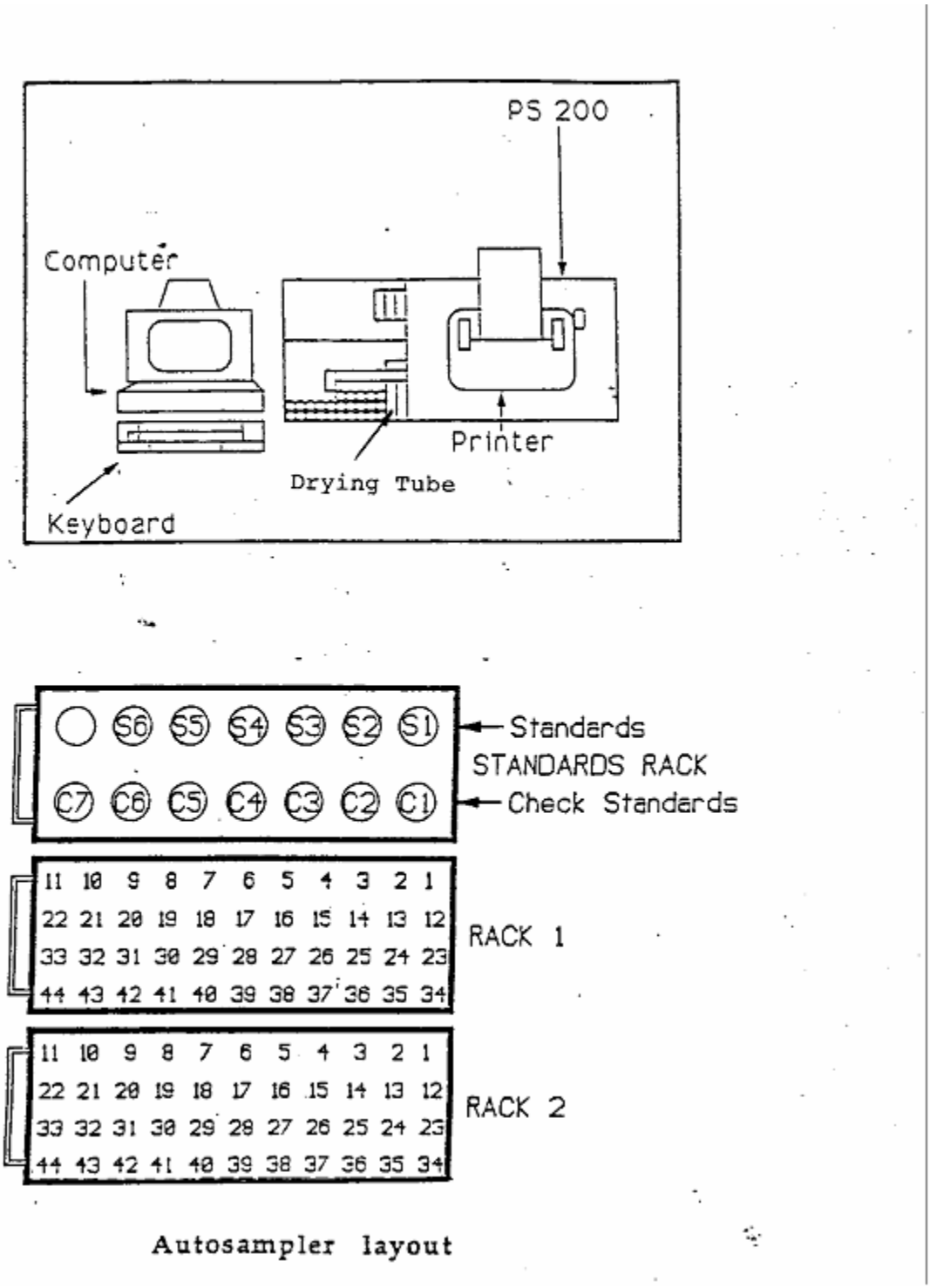
17.3. **Forms**

17.3.1. 245.1FS Sample Preparation Log

17.3.2. 245.1FA Analytical Run Log

17.3.3. 245.1FM Instrument Maintenance Log

Figure 1: AUTOSAMPLER LAYOUT



Autosampler layout

Figure 2: TYPICAL CALIBRATION CURVE

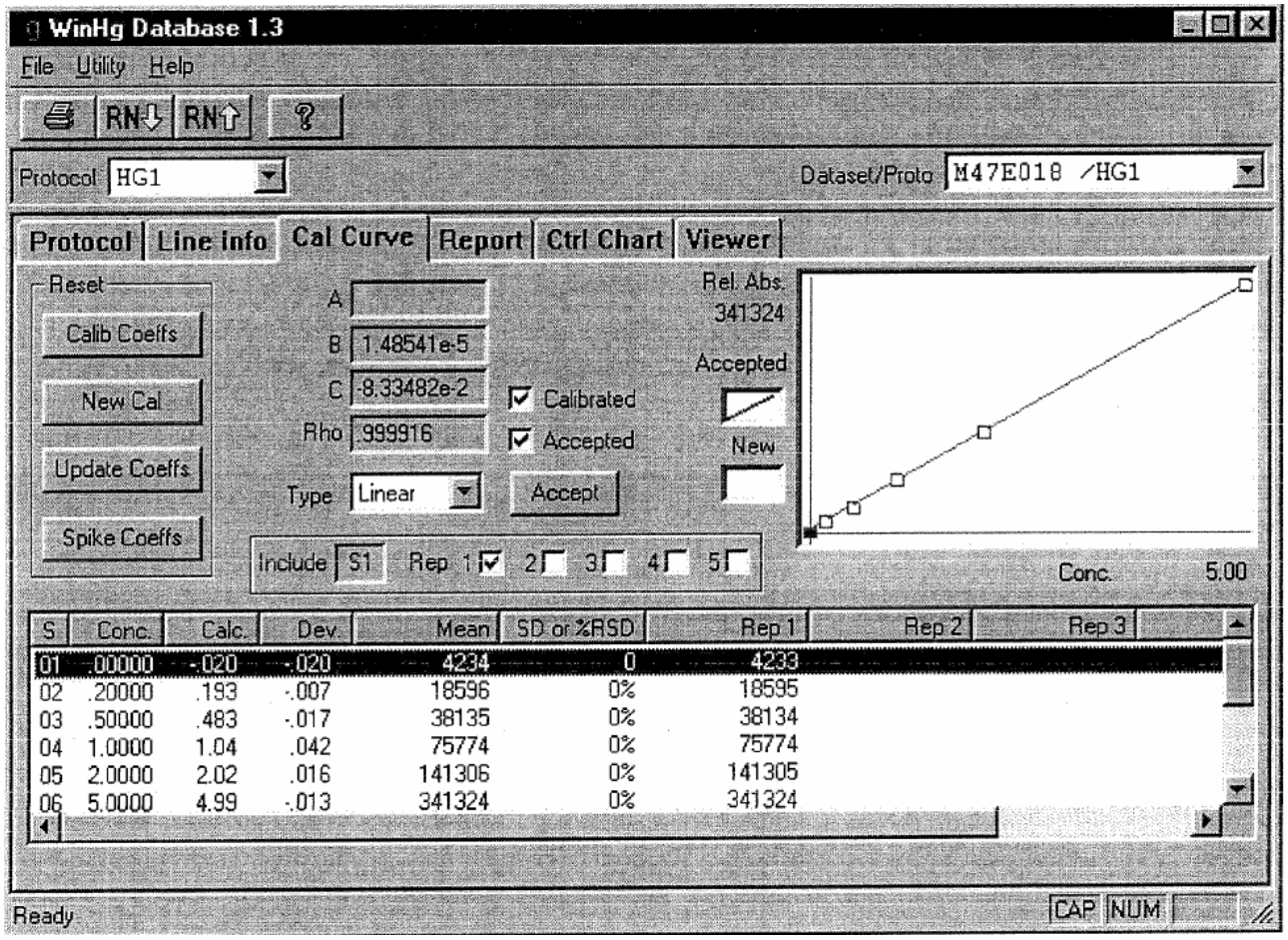


Figure 3: TYPICAL SAMPLE RESULT SUMMARY

METHOD E245.1
MERCURY BY COLD VAPOR

Client : XYZ, INC.
Project : CLEAN WATER
Batch No. : 16E175
Matrix : WATER
InstrumentID : 47

CLIENT SAMPLE ID	EMAX SAMPLE ID	RESULTS (ug/L)	DIL'N FACTOR	MOIST (%)	LOQ (ug/L)	DL (ug/L)	LOD (ug/L)	ANALYSIS DATETIME	PREPARATION DATETIME	DATA FILE ID	CAL REF	PREP BATCH	COLLECTION DATETIME	RECEIVED DATETIME
MBLK1W	HGE027WB	ND	1	NA	0.50	0.054	0.10	05/31/1620:45	05/31/1614:00	M47E018043	M47E018	HGE027W	NA	NA
LCS1W	HGE027WL	2.48	1	NA	0.50	0.054	0.10	05/31/1620:47	05/31/1614:00	M47E018044	M47E018	HGE027W	NA	NA
LCD1W	HGE027WC	2.46	1	NA	0.50	0.054	0.10	05/31/1620:54	05/31/1614:00	M47E018047	M47E018	HGE027W	NA	NA
03M08-2016S	E175-08	ND	1	NA	0.50	0.054	0.10	05/31/1620:58	05/31/1614:00	M47E018049	M47E018	HGE027W	05/18/1614:28	05/20/16
03M08-2016SMS	E175-08M	2.59	1	NA	0.50	0.054	0.10	05/31/1621:03	05/31/1614:00	M47E018051	M47E018	HGE027W	05/18/1614:28	05/20/16
03M08-2016SMSD	E175-08S	2.59	1	NA	0.50	0.054	0.10	05/31/1621:05	05/31/1614:00	M47E018052	M47E018	HGE027W	05/18/1614:28	05/20/16
03M12B-2016S	E175-01	ND	1	NA	0.50	0.054	0.10	05/31/1621:07	05/31/1614:00	M47E018053	M47E018	HGE027W	05/18/1611:16	05/20/16
03M12B-2016S-9	E175-02	ND	1	NA	0.50	0.054	0.10	05/31/1621:10	05/31/1614:00	M47E018054	M47E018	HGE027W	05/18/1611:16	05/20/16
03M04B-2016S	E175-03	ND	1	NA	0.50	0.054	0.10	05/31/1621:12	05/31/1614:00	M47E018055	M47E018	HGE027W	05/18/1612:56	05/20/16
03M11B-2016S	E175-04	ND	1	NA	0.50	0.054	0.10	05/31/1621:14	05/31/1614:00	M47E018056	M47E018	HGE027W	05/18/1614:42	05/20/16
03M10-2016S	E175-05	ND	1	NA	0.50	0.054	0.10	05/31/1621:21	05/31/1614:00	M47E018059	M47E018	HGE027W	05/18/1616:22	05/20/16
03MW20-2016S	E175-06	ND	1	NA	0.50	0.054	0.10	05/31/1621:23	05/31/1614:00	M47E018060	M47E018	HGE027W	05/18/1611:28	05/20/16
03M18-2016S	E175-07	ND	1	NA	0.50	0.054	0.10	05/31/1621:25	05/31/1614:00	M47E018061	M47E018	HGE027W	05/18/1611:35	05/20/16
03M19-2016S	E175-09	ND	1	NA	0.50	0.054	0.10	05/31/1621:27	05/31/1614:00	M47E018062	M47E018	HGE027W	05/19/1611:17	05/20/16

Figure 4: **TYPICAL LCS/LCSD SUMMARY**

EMAX QUALITY CONTROL DATA
LAB CONTROL SAMPLE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN WATER
BATCH NO. : 16E175
METHOD : E245.1

MATRIX	: WATER		% MOISTURE: N/A
DILUTION FACTOR	: 1	1	1
SAMPLE ID	: MBLK1W	LCS1W	LCD1W
LAB SAMPLE ID	: HGE027WB	HGE027WL	HGE027WC
LAB FILE ID	: M47E018043	M47E018044	M47E018047
DATE PREPARED	: 05/31/1614:00	05/31/1614:00	05/31/1614:00
DATE ANALYZED	: 05/31/1620:45	05/31/1620:47	05/31/1620:54
PREP BATCH	: HGE027W	HGE027W	HGE027W
CALIBRATION REF	: M47E018	M47E018	M47E018

ACCESSION:

PARAMETER	MB RESULT (ug/L)	SPIKE AMT (ug/L)	BS RESULT (ug/L)	BS REC (%)	SPIKE AMT (ug/L)	BSD RESULT (ug/L)	BSD REC (%)	RPD (%)	QC LIMIT (%)	MAX RPD (%)
Mercury	ND	2.50	2.48	99	2.50	2.46	98	1	80-120	20

Figure 5: **TYPICAL MS/MSD SUMMARY**

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN WATER
BATCH NO. : 16E175
METHOD : E245.1

MATRIX	: WATER		% MOISTURE: NA
DILUTION FACTOR	: 1	1	1
SAMPLE ID	: 03M08-2016S	03M08-2016SMS	03M08-2016SMSD
LAB SAMPLE ID	: E175-08	E175-08M	E175-08S
LAB FILE ID	: M47E018049	M47E018051	M47E018052
DATE PREPARED	: 05/31/1614:00	05/31/1614:00	05/31/1614:00
DATE ANALYZED	: 05/31/1620:58	05/31/1621:03	05/31/1621:05
PREP BATCH	: HGE027W	HGE027W	HGE027W
CALIBRATION REF	: M47E018	M47E018	M47E018

ACCESSION:

PARAMETER	PARENT RESULT (ug/L)	SPIKE AMT (ug/L)	MS RESULT (ug/L)	MS REC (%)	SPIKE AMT (ug/L)	MSD RESULT (ug/L)	MSD REC (%)	RPD (%)	QC LIMIT (%)	MAX RPD (%)
Mercury	ND	2.50	2.59	104	2.50	2.59	104	0	80-120	20

Figure 6: TYPICAL CASE NARRATIVE

CASE NARRATIVE

Client : XYZ,INC.

Project: CLEAN WATER

SDG : 16E175

METHOD E245.1
MERCURY BY COLD VAPOR

A total of nine (9) water samples were received on 05/20/16 for Mercury analysis, Method E245.1 in accordance with Methods for the Determination of Metals in Environmental Samples, Supplement I (EPA/600/R-94/111).

Holding Time
Samples were digested and analyzed within the prescribed holding time.

Calibration
Multi-calibration points were generated to establish initial calibration (ICAL). ICAL was verified using a secondary source (ICV). Continuing calibration (CCV) verifications were carried on a frequency specified by the project. All calibration requirements were within acceptance criteria.

Method Blank
Method blank was prepared and analyzed at the frequency required by the project. For this SDG, one (1) method blank was analyzed. Mercury was not detected in HGE027WB. Refer to sample result summary form for details.

Lab Control Sample
Lab control sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) set of LCS/LCD was analyzed. HGE027WL/HGE027WC was within LCS limits. Refer to LCS summary form for details.

Matrix QC Sample
Matrix spike sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) set of MS/MSD was analyzed. Mercury was within MS QC limits in E175-08M/S. Refer to Matrix QC summary form for details.

Sample Analysis
Samples were analyzed according to prescribed analytical procedures. Results were evaluated in accordance to project requirements. For this SDG, all quality control requirements were met.

Appendix 1: SUMMARY OF QUALITY CONTROL PROCEDURES

PARAMETER	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	1st Rvw	2nd Rvw
Initial multipoint calibration	Daily initial calibration prior to sample analysis	Correlation coefficient r≥ 0.995 for linear regression	Correct the problem then repeat initial calibration		
Initial Calibration Verification (ICV) – Second Source	Daily after initial calibration	Analyte within ± 5% of expected value	Correct the problem then repeat initial calibration		
Continuing Calibration Verification (CCV)	Daily, immediately after calibration, before sample analysis, every 10 samples and at the end of analysis sequence	Immediately after calibration: All analytes within ± 5% of expected value and RSD < 5% Subsequent analysis: within 10% of expected value and RSD of replicate integrations < 5%	Repeat calibration and re-analyze all samples since last successful calibration		
Calibration blanks (ICB / CCB)	After every calibration verification	No analytes detected ≥ 2.2x LOD or 10% of the concentration of target analytes detected in the sample.	Correct the problem then re-analyze calibration blank and previous samples		
Method Blank(MB)	One per preparation batch	No analytes detected ≥ 2.2x LOD or 10% of the concentration of target analytes detected in the sample.	Re-prep and re-analyze method blank and all samples processed with the contaminated blank		
Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS/LCSD)	One LCS per preparation batch	%Rec.: 85-115%	Re-prep and re-analyze the LCS and all associated samples		
Matrix Spike / Matrix Spike Duplicate (MS/MSD)	One MS/MSD for every 10% project samples per matrix	% Recovery: 70-130%, RPD ≤ 20%	Discuss in case narrative		
Comments: Refer to PSR for flagging criteria LOQ = lowest calibration point			Reviewed By:		
			Date:		

Appendix 2: DEMONSTRATION OF CAPABILITY

DEMONSTRATION OF CAPABILITY
MERCURY
EPA 245.1

SOP: EMAX-245.1 Rev. 3
Conc Unit: mg/L
Sample Amount(mL): 50

Extraction dates: 1/11/2016
Analysis dates: 1/11/2016
Extracted and Analyzed by: N. Tan

PARAMETER	HGA006WL	HGA006WC	HGA007WL	HGA007WC	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	QC Criteria	COMMENTS
	M47A004012	M47A004013	M47A004043	M47A004044							
Mercury	2.56	2.56	2.47	2.51	2.5	2.53	101	0.044	2	80 - 120	PASSED

245.1FS: SAMPLE PREPARATION LOG

EMAX LABORATORIES, INC.

DIGESTION LOG
for
MERCURY

Page 1

Note: For samples, relevant QCs/Standards digested, refer to attached digestion sequence.

Comments:

Digestion Vessel Lot #:

Book #: E47-102
Batch No.:
Matrix:

SOP #	Rev. #
☐ EMAX-7470	8
☐ EMAX-7471	9
☐ EMAX-245.1	4
☐ EMAX-	

Standards	ID	Conc. (µg/L)	Amount Added (ml)
ICAL			
CCV			
ICV			
LCS/MS			

Reagent	ID / Lot #
HNO_3	
HCl	
H_2SO_4	
$KMnO_4$	
$K_2S_2O_8$	
$NH_2OH•HCl•NaCl$	
$SnCl_2$	
Silica Sand	
Reagent Water	
pH strip 0-14	

Digestor ID/ Temp (°C)

Thermometer ID/LOC:

Thermometer ID/LOC:

Pipette ID:

☐ H_2SO_4 dispenser checked @ 2.5 ml with Class A graduated cylinder

☐ HCl dispenser checked @ ___ ml with Class A graduated cylinder

☐ HNO_3 dispenser checked @ ___ ml with Class A graduated cylinder

Prepared By:

Standard Added By: Witnessed By:

245.1FA: ANALYTICAL RUN LOG

EMAX LABORATORIES, INC.

ANALYSIS RUN LOG
for
MERCURY

Page 1

Note: For samples and relevant QCs/Standards analyzed, refer to attached analytical sequence.

Start Date: **Start Time:**

End Date: **End Time:**

Comments:

Book #: A47-085

Instrument No.: 47

Analytical Sequence/Batch:

Method File:

Micropipette ID: ☐ ICP DOE-1

Micropipette ID: ☐ HG-03

Micropipette ID: ☐ HG-04

Micropipette ID: ☐

SOP #	Rev. #
☐ EMAX-7470	
☐ EMAX-7471	
☐ EMAX-245.1	
☐ EMAX-	

STANDARDS ID
S1
S2
S3
S4
S5
S6
CCV
ICV
LCS
Analytical Spike

Analyzed By:

Date:

245.1FM: INSTRUMENT MAINTENANCE LOG

EMAX LABORATORIES, INC.

Page 1

INSTRUMENT MAINTENANCE LOG

Instrument No: 47 Month: Year: 201_ Book #: M47-010

DAQ TEST							
Sample: 700,000 - 1,720,000							
Hg Lamp Volt: 8.0-9.5							
GAS CONTROL TEST							
Argon Input Pressure: 75-90 psi							
Power Supply Voltage: 5V+/-0.25, +12V+/-0.5, -12V+/-0.5							
Gas: 0-1.0 LPM							
Pump Rate: 2-15 ml/min							
Instrument Warm-up: Minimum 5 mins							
Peristaltic Pump							
Tubings Pump/Capillary							
Fume Hood							
Reductant Bottle							
Rinse Solution							
Computer Date/Time							
Printer Paper							
Analyst Initial							
Trouble Shooting							
Problem(s) Encountered							
Return to Specs (Analyst Initial)							

Code	Problems Encountered	Code	Corrective Action

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889

ADDENDUM TO	
Document	ALL ANALYTICAL SOPS
Revision Number	CURRENT REVISIONS
Section	10.2 Instrument Parameters
Date	11 September 2019
Reference Number	AA.7

This applies to all GC/MS, GC, HPLC-MS, HPLC, ICP-MS, ICP and IC Method SOPs

Section 10.2 shall include:

10.2. **Instrument Parameters**

10.2.1. Instrument parameters setup stipulated in the SOPs, are instrument suggested parameters. Fine tune the instrument to obtain optimum instrument condition.

10.2.2. Print and staple a copy of the current instrument parameter on the instrument log for easy access when performing daily instrument routine check.

10.2.3. In the event that instrument parameters necessitate a change, replace the instrument parameter printout with the new parameter setup. Archive the previous instrument parameters at the back of the instrument maintenance log.

PREPARED BY: _____ Date: 9/11/19

Name Farina Madamba

Title QA / QC Coordinator

APPROVED BY: _____ Date: 09.11.19

Name Kenette Pimentel

Title QA Manager

APPROVED BY: _____ Date: 09-11-19

Name Caspar Pang

Title Laboratory Director

ANNUAL REVIEW FORM

MERCURY (MANUAL COLD VAPOR)

SOP#: EMAX-245.1 **Rev** 4 **Effective Date:** 15-Jul-16

COMMENTS	Reviewed By	Review Date
No update needed	AB	06/2017
None	IP	06/15/18
NO update needed.	FM	7/15/19
No update needed per DRF by T Huang dtd 6/24/20.		6/24/20

STANDARD OPERATING PROCEDURES

ION CHROMATOGRAPHY ANALYSIS

SOP No.:	EMAX-300.0	Revision No.	13	Effective Date:	10-Oct-19
Prepared By:	Tyler Kosaka			Date:	10/10/19
Approved By:	Kenette Pimentel QA Manager			Date:	10.10.19
Approved By:	Caspar Pang Laboratory Director			Date:	10-10-19

Control Number: 300.0-13

1.0 SCOPE AND APPLICATION

1.1. This method is applicable for determination of inorganic anions in surface water, mixed domestic and industrial waste waters, ground waters and reagent waters, solids and leachates by Ion Chromatography.

1.2. List of analytes determined and established in this SOP are:

1.2.1. Part A - fluoride, chloride, bromide, nitrite-N, nitrate-N, ortho-phosphate-P and sulfate.

1.2.2. Part B - bromate and chlorate.

1.2.3. Total Nitrate-Nitrite by calculation.

1.2.4. Other inorganic anions may be analyzed provided that qualitative identification and quantitative determination is established through demonstration of capability.

1.3. This SOP is an adaptation of EPA Method 300.0.

2.0 SUMMARY OF METHOD

2.1. A small amount of sample (20 µl) is injected into an ion chromatograph. The sample is passed through a guard column, anion exchange column, suppressor device and the anions are detected by a conductivity detector.

2.2. **Interferences**

2.2.1. Direct Chromatographic Coelution – occurs when a non-target analyte elutes very close to the retention time of target analytes. This interference may be solved by changing the column, eluent strength, modifying the eluent with organic solvents (if compatible with IC columns), changing the detection systems or selective removal of the interference.

2.2.2. Concentration Dependant Coelution – occurs when the response of the neighboring peak overlaps into the retention time window of the target anion. Sample dilution or eluent dilution may resolve this interference.

2.2.3. Ionic Character Displacement – occurs when the retention times may significantly shift due to the influence of high ionic strength matrices (high mineral content or hardness) overloading the exchange sites in the column and significantly shortening the target analytes' retention times. Sample dilution or eluent dilution may resolve this interference.

2.2.4. Method Interferences – may be caused by reagents, glassware and other substance that the sample may get in contact during the analytical process. It is imperative that reagent water production is monitored. Only reagent grade or better reagents are use. Eluate must be passed through 0.2 µm filter. Columns must be sufficiently flushed.

2.2.5. Anion Retention in the Column – anion may temporarily adhere into the column and may elute in the retention time window of fluoride and potentially interfere. Fluoride concentration above 1.5 mg/L may not be significant but the analyst must be sure that the number reported is not a false positive.

2.2.6. Carry Over Peaks – may be caused by a preceding sample with high concentration or a late eluting compound. Ozonated and chlorine dioxide matrices were observed to have unknown analytes that elutes at approximately 23 minutes. Extending the runtime to 24 minutes to allow elution of any interfering peaks may eliminate potential carry over of late eluting peaks.

3.0 DETECTION LIMITS

3.1. Detection Limits (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ)

3.1.1. Refer to EMAX-QA04 for generation, validation and verification of DL, LOD and LOQ.

3.1.2. Refer to Table 1 for established limits.

4.0 DYNAMIC RANGE

4.1. The highest quantifiable range requiring no dilution is equal to the concentration of the highest calibration point (see Section 9.3). All samples analyzed above this range are considered "over range" and requires dilution to properly quantitate.

4.2. The lowest quantifiable range of diluted samples is equal to the concentration of the lowest calibration point. All diluted samples analyzed below this range are considered as "under range" and requires lower dilution factor to properly quantitate.

5.0 SAMPLE HOLDING TIME & PRESERVATION

5.1. Preservation

5.1.1. Water samples received in the lab are expected to be contained in either HDPE or glass bottles and cooled at ≤ 6°C without freezing.

5.1.1.1. Water samples to be analyzed for Ortho-phosphate are expected to be filtered in the field within 15 minutes from collection[1].

5.1.2. Soil samples received in the lab are expected to be contained in either glass jars or Shelby tubes and cooled at ≤ 6°C without freezing.

5.1.3. Store samples and extracts to ≤ 6°C without freezing until analysis is completed.

[1] Table II Required containers, preservation techniques and holding times, CWA Methods Update Rule, August 2017

5.2. **Holding Time**

5.2.1. Water Samples

Analyte	Chemical Preservative	Holding Time	
		Unpreserved	Preserved
Fluoride	None	28 days	N/A
Chloride	None	28 days	N/A
Nitrite-N	None	48 hours	N/A
Bromide	None	28 days	N/A
Nitrate-N	None	48 hours	N/A
Ortho-Phosphate-P	None	48 hours	N/A
Sulfate	None	28 days	N/A
Nitrate/Nitrite-N	pH ≤ 2 with H_2SO_4	48 hours	28 days
Bromate	None	28 days	N/A
Chlorate	None	28 days	N/A

5.2.2. Soil Samples

5.2.2.1. Extract samples within 28 days from sampling date.

5.2.2.2. Holding time of extracts are the same as water samples.

6.0 ASSOCIATED SOPs

6.1. EMAX-DM01 Data Flow and Review

6.2. EMAX-QA04 Detection Limit (DL)

6.3. EMAX-QA05 Training

6.4. EMAX-QA08 Corrective Action

6.5. EMAX-QC01 Quality Control for Chemicals

6.6. EMAX-QC02 Analytical Standard Preparation

6.7. EMAX-QC04 Balance Calibration

6.8. EMAX-QC06 Volumetric Labware and Micropipette Verification

6.9. EMAX-QC07 Glassware Cleaning

6.10. EMAX-SM03 Waste Disposal

6.11. EMAX-SM04 Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS for chemicals listed in this SOP.

7.2. Treat reagents, standards and samples as potential hazards. Observe the standard laboratory safety procedures. Wear protective gear, i.e. lab coat safety glasses, gloves at all times when performing this procedure. Perform all samples and standard handling in the fume hood.

7.3. If for any reason, solvent and/or other reagents get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amounts of tap water. If irritations persist inform your supervisor immediately so proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS AND REAGENTS

8.1. **Instrument**

	Instrument D0	**Instrument D7**	**Instrument E3**
IC	Metrohm 761 Compact IC	Metrohm IC 800 Series	Methrohm 881 Compact IC Pro
Guard Column	Metrosep RP Guard		
Column	Metrosep A Supp 5 (100/4.0 mm)	Metrosep A Supp 5 (150/4.0mm)	Metrosep A Supp 7 (250x4 mm) 5µm
Detector	Detector Block		
Autosampler	788 IC Filtration Sample Processor	838 Advanced Sample Processor	858 Professional Sample Processor
Data Acquisition	IC Net 2.3 SR6		Magic Net 1.1 Ver. 2.3
Balance	Toploading, sensitive to ± 0.0001 g		

8.2. **Supplies**

Autosampler vials	11 mL PP sample tubes
Filters	0.022 µm Gelman IC acrodisc 4485 or equivalent
Syringes	Plastic, 5 mL
Volumetric Flasks	100, 200, 1000, 2000 mL
Containers	50 mL, 125 mLl plastic snap seal
Micropipettes	1 and 5 mL; 200 µL

8.3. **Chemicals and Reagents** – Where available, purchase reagent-grade or better chemicals and reagents.

Reagent water	Anion-free and interference-free water
Reagent soil	Anion-free and interference-free solid matrix
$NaHCO_3$	Bicarbonate Eluent Stock Solution 100 mM $NaHCO_3$, Reagent grade available commercially or

	Dissolve 8.4g $NaHCO_3$ to 1 L of reagent water, assign 1-year expiration.
Na_2CO_3/ $NaHCO_3$	Carbonate and Bicarbonate Eluent Stock Solution Instrument: D0 320/100 mM, Reagent grade available commercially or Dissolve 33.92 g of sodium carbonate (Na_2CO_3) and 8.40 g of sodium bicarbonate ($NaHCO_3$) using reagent water into 1 L solution, assign 1-year expiration. Instrument: D7 350/100 mM, Reagent grade available commercially or Dissolve 37.10 g of sodium carbonate (Na_2CO_3) and 8.40 g of sodium bicarbonate ($NaHCO_3$) using reagent water into 1 L solution, assign 1-year expiration Instrument: E3 360 mM, Reagent grade available commercially or Dissolve 38.156 g of sodium carbonate (Na_2CO_3) using reagent water into 1 L solution, assign 1-year expiration.
Sulfuric Acid (IC Regenerant)	100 mM Reagent Grade
Working Eluent Solution	Instrument: D0 3.2 Na_2CO_3/1.6 $NaHCO_3$mM Add 20.0 ml of 320 mM Na_2CO_3 / 100 mM combined $NaHCO_3$ into a 2 L volumetric flask and dilute to the mark with reagent water, assign 1-month expiration. Intrument : D7 3.5 Na_2CO_3/2.0 $NaHCO_3$mM Add 20.0 mL of 350 mM Na_2CO_3 / 100 mM combined $NaHCO_3$ and 20 ml of 100 mM $NaHCO_3$ solution into a 2 L volumetric flask and dilute to the mark with reagent water, assign 1-month expiration. *(Note: Degas both solutions with high purity N_2 gas for a minimum of 2 hours prior use)* Instrument: E3 3.6 mM Na_2CO_3 Add 20.0 mL of 360 mM Na_2CO_3 into a 2 L volumetric flask and dilute to the mark with reagent water, assign 1-month expiration.

9.0 STANDARDS

9.1. Standard Preparation

9.1.1. Refer to EMAX-QC02 for proper preparation of analytical standards.

9.1.2. Store all standard solutions at ≤ 6°C without freezing.

9.1.3. Standard concentrations stipulated in this SOP are recommended concentration levels. In the event that concentrations are changed, perform all quality control procedures, apply related acceptance criteria and obtain Supervisor approval prior to use.

9.2. **Stock Standards Solution (SSS)**

9.2.1. Primary Stock Standards – are purchased commercially as certified solutions. These standards are primarily used for calibration.

Stock Standard	Source	Conc. (mg/L)
Fluoride(F^-)	ERA or equivalent	1,000
Chloride(Cl^-)	ERA or equivalent	1,000
Nitrite-N(NO^-_2-N)	ERA or equivalent	1,000
Bromide(Br^-)	ERA or equivalent	1,000
Nitrate-N(NO^-_3-N)	ERA or equivalent	1,000
Phosphate-P(o-$PO_4^=$-P)	ERA or equivalent	1,000
Sulfate($SO_4^=$)	ERA or equivalent	1,000
Bromate(BrO_3^-)	ERA or equivalent	1,000
Chlorate (ClO_3^-)	ERA or equivalent	1,000

9.2.2. Secondary Stock Standards - are purchased commercially as certified solutions from a different source. This standard is used to prepare for ICV, and LCS.

Stock Standard	Source	Conc. (mg/L)
Fluoride(F^-)	SCP Science or equivalent	1,000
Chloride(Cl^-)	SCP Science or equivalent	1,000
Nitrite-N(NO_2^--N)	SCP Science or equivalent	1,000
Bromide(Br^-)	SCP Science or equivalent	1,000
Nitrate-N(NO_3^--N)	SCP Science or equivalent	1,000
Phosphate-P(o-$PO_4^=$-P)	SCP Science or equivalent	1,000
Sulfate($SO_4^=$)	SCP Science or equivalent	1,000
Bromate(BrO_3^-)	SCP Science or equivalent	1,000
Chlorate (ClO_3^-)	SCP Science or equivalent	1,000

9.2.3. Preparation of Intermediate Standards

9.2.3.1. Primary Intermediate Standards. Using the primary stock standards in Section 9.2.1, prepare the following:

9.2.3.1.1. For Part A analytes (F^-, Cl^-, NO_2^- - N, Br^-, NO_3^- - N, o-$PO4^{2-}$, $SO4^{2-}$): Prepare intermediate standard at 100 mg/L by diluting 10 mL of stock standard (at 1000 mg/L) to a final volume of 100 mL with reagent water.

- Nitrate, Nitrite and Phosphate are prepared fresh on the day they are used. All other analytes are prepared weekly.

9.2.3.1.2. For Part B analytes (BrO_3^-, ClO_3^-): Prepare intermediate standards at 500 µg/L by diluting 0.05 mL of stock standard (at 1000 mg/L) to final volume of 100 mL with reagent water.

- Prepare the standards fresh on the day they are used.

9.2.3.2. Secondary Intermediate Standards. Using the secondary stock standards in Section 9.2.2, prepare the intermediate standards at the same concentrations as the primary intermediate standards shown in Section 9.2.3.1.

9.2.3.3. Store all standards at ≤ 6°C without freezing.

9.3. **Initial Calibration Standard (ICAL)**

9.3.1. Prepare a minimum of three Initial Calibration Standards and a calibration blank (S0) in 100 ml volumetric flask. Additional calibration points may be added and/or other concentrations may be used to meet project specific requirements.

9.3.2. Suggested initial calibration standards are shown in Table 2.

9.4. **Initial Calibration Verification (ICV)**

9.4.1. Using the secondary intermediate standards, prepare the ICV standard as shown in Table 2.

9.5. **Daily Continuing Calibration (DCC) – *also called Instrument Performance Check (IPC)***

9.5.1. Prepare DCC standard from the primary intermediate standards as shown in Table 2. Use this standard for continuing calibration verification (CCV).

9.6. **Laboratory Control Standard and Matrix Spike Standard (LCS/MS)**

9.6.1. Use the secondary intermediate standards to prepare the LCS/MS Spike Standard as shown in Table 2.

10.0 PROCEDURES

10.1. **Sample Preparation**

10.1.1. Water Samples

10.1.1.1. Identify the samples for the batch (not to exceed 20 field samples) and input them in the sequence table.

10.1.1.2. Withdraw the samples from the sample control room and allow to equilibrate to room temperature.

10.1.1.3. Using a 5 mL plastic syringe, withdraw an aliquot of the sample and attach the 0.22 µm filter. Discard the first 2 mL and collect the rest in the properly labeled snap-seal container. Repeat this until sufficient amount of aliquot is collected.

10.1.1.4. Do this for all samples. Use reagent water for MB and LCS.

10.1.1.5. Take clean autosampler vials equal to the number of samples to be analyzed. Add vials for MB, LCS, MS and MSD, CCVs and CCBs.

10.1.1.6. Transfer approximately 10 mL of aliquot sample into the autosampler vials.

10.1.1.7. Spike LCS and MS designated vials with LCS/MS spike standard.

10.1.2. Soil Samples

10.1.2.1. Allow sample to equilibrate to room temperature.

10.1.2.2. Mix sample thoroughly discarding artifacts, e.g. vegetation, rocks, etc.

10.1.2.3. Tare a 125 ml polyethylene bottle to nearest 0.1 g.

10.1.2.4. Weigh 10 g of homogenized soil sample to the nearest 0.1 g. For MB and LCS, use reagent soil.

10.1.2.5. Spike LCS and MS designated bottles with LCS/MS spike standard.

10.1.2.6. Using a graduated cylinder, add 100 ml of reagent water to the bottle. Place the bottle in a shaker and mix the solution for 10 minutes.

10.1.2.7. Remove bottles from the shaker and centrifuge the slurry for 15-30 minutes or allow the particles to settle.

10.1.2.8. Treat the liquid phase like an aqueous sample and follow Sections 10.1.1.3 to 10.1.1.6.

10.2. **Instrument Parameters**

	Inst. D0	Inst. D7	Inst. E3
Instrument	Metrohm	Metrohm	Metrohm
Detector	Conductivity	Conductivity	Conductivity
Column	Metrosep A Supp 5 (100/4.0 mm)	Metrosep A Supp 5 (150/4.0 mm)	Metrosep A Supp 7 250x4.0 mm
Sample Flow Rate	0.70 mL/min	0.70 mL/min	0.8 mL/min
Recommended Pump Pressure (Mpa)	4.5-6.5	6.5-8.5	10.0-13.0
Sample Loop	20 µL	20 µL	20 µL
Oven Temp	-	-	45°C

Note: Sample flow rate is based on the column manufacturer's recommendation.

10.2.1. Instrument parameters stipulated in this SOP are instrument suggested parameters. Fine tune the instrument to obtain optimum instrument condition.

10.2.2. Print and staple a copy of the current instrument parameter on the instrument log for easy access when performing daily instrument routine check.

10.2.3. In the event that the instrument parameters necessitate a change, replace the instrument parameter printout with the new parameter setup. Archive the previous instrument parameters at the back of the instrument maintenance log.

10.3. **Calibration**

10.3.1. Instrument Set Up

10.3.1.1. Set up the Metrohm IC to the proper operation parameter established in Section 10.2.

10.3.1.2. Prime the pump to eliminate air bubbles in the system.

10.3.1.3. Step the suppressor thrice and equilibrate the column for 30 minutes or until a stable baseline is obtained.

10.3.2. Initial Calibration (ICAL)

10.4.3.1 Prepare initial calibration standards as suggested in Table 2. Additional calibration standards may be analyzed when deemed necessary.

10.3.2.1. Analyze the ICAL standards. Establish the individual analyte calibration curve by plotting the peak area against the known concentration.

10.3.2.2. Calculate the slope and intercept of the linear curve.

10.3.2.3. Refer to Appendix 1 for acceptance criteria.

10.3.2.3.1. If the correlation coefficient (r) is out of acceptance criteria, check the results again and identify which calibration point is off.

10.3.2.3.2. If the highest ICAL point appears to be bias high, exclude the highest point.

10.3.3. Initial Calibration Verification (ICV)

10.3.3.1. Analyze ICV from second source after the initial calibration to verify the validity of the initial calibration.

10.3.3.2. Refer to Appendix 1 for acceptance criteria.

10.3.4. Retention Time Window (RTW)

10.3.4.1. After initial calibration, establish a tentative retention time window based from the calibration points.

10.3.4.2. Tabulate the retention time for each analyte and calculate their standard deviations. Retention time window is determined by ± 3 X standard deviation.

10.3.4.3. Determine actual retention time window from the continuing calibrations within the course of a day. RTW is determined by 3X standard deviation of retention time for each analyte.

10.3.5. Daily Continuing Calibration (DCC)

10.3.5.1. Analyze opening continuing calibration verification standard and continuing calibration blank (CCV/CCB) at the beginning of analytical sequence.

10.3.5.2. Analyze continuing calibration verification standard (CCV) after every 10 samples or whenever the anion eluent is changed or as per project requirements.

10.3.5.3. Analyze a continuing calibration blank (CCB) after every continuing calibration verification standard (CCV).

10.3.5.4. Analyze closing continuing calibration verification standard (CCV) at the end of each analytical sequence.

10.3.5.5. Refer to Appendix 1 for acceptance criteria and corrective action.

10.4. **Analysis**

10.4.1. Analytical Sequence

10.4.1.1. ICV/DCC – initial calibration verification (immediately after ICAL) or daily continuing calibration

10.4.1.2. ICB/CCB – initial calibration blank or continuing calibration blank (reagent water)

10.4.1.3. MB – method blank

10.4.1.4. LCS – lab control sample

10.4.1.5. Samples – maximum of 10 field samples

10.4.1.6. MS – matrix spike sample

10.4.1.7. MSD – matrix spike sample duplicate

10.4.1.8. CCV – continuing calibration verification

10.4.1.9. CCB – continuing calibration blank

10.4.1.10. Samples – maximum of 10 field samples

10.4.1.11. CCV – closing continuing calibration verification

10.4.1.12. CCB – closing continuing calibration blank

10.4.2. Sample Result Evaluation

10.4.2.1. Check that the ICV, MB and LCS are within control limits. Refer to Appendix 1 for acceptance criteria and corrective action.

- Check the MB for absence or presence of contamination.
- Check the LCS for method performance.
- Check the MS for absence or presence of matrix interference.
- Check MSD to establish the precision of the method.

10.4.2.2. Qualitatively identify detected analytes using the actual retention time window. Check that the retention time for all positive results fall within the actual RTW as described in Section 10.3.4.

10.4.2.3. Check the peaks for all positive results. Refer to Figure 1 for typical peak evaluation.

- The same peak integration technique applied in the initial calibration must be applied during the analysis of field samples.
- Peaks must be well-resolved and properly integrated.
- If manual integration is necessary, retain the original chromatogram and the corrected chromatogram must be initialed and dated by the analyst and the supervisor.

- If a peak appears to be cryptic / anomalous, consult the supervisor.

10.4.2.4. Check that results exceeding calibration range are appropriately diluted and re-analyzed at a concentration within the calibration range.

10.4.2.5. Rule-out any suspicion of carry-over. Re-analyze any sample with trace amount of analyte(s) seen in a previous sample that exceeds the calibration range.

10.4.2.6. Properly fill out the analytical run log.

10.5. **Calculations**

10.5.1. Calculate for Concentration

10.5.1.1. Water Samples

$$Cw = (mA + b) * DF$$ Eq.-10.5.1.1.

where:

Cw – Concentration of analyte in sample, in mg/L

m – Slope of the linear calibration curve

A – Peak area of the analyte in sample

b – Intercept of the linear calibration curve

DF – Dilution Factor = V_f / V_i

where V_f – final volume of diluted sample, ml

V_i – initial volume of diluted sample, ml

10.5.1.2. Soil Samples

$$Cs = \frac{(mA + b) * PF * DF}{\%S}$$

where:

Cs – Concentration of analyte in sample, in mg/Kg

m – Slope of the linear calibration curve

A – Peak area of the analyte in sample

b – Intercept of the linear calibration curve

PF – Preparation Factor = *Ve / W*

Where *Ve* – final extract volume, ml

W – sample amount, g

DF – Dilution Factor = V_f / V_i

where V_f – final volume of diluted extract, ml

V_i – initial volume of extract, ml

$\%S$ – Percent Solids = 1- (%Moisture/100)

10.5.2. Calculate Total Nitrate/Nitrite – N

$$Total\ Nitrate/Nitrite\text{-}N = Nitrate\text{-}N + Nitrite\text{-}N \quad \text{Eq.-10.5.2}$$

where: *Nitrate-N and Nitrite-N* are derived separately from Eq. 10.5.1.1.

10.5.3. Calculate for Total Nitrate/Nitrite

$$Total\ Nitrate/Nitrite = Nitrate\text{-}N \times (MW_{NO3} / MW_N) + Nitrite\text{-}N \times (MW_{NO2} / MW_N) \quad \text{Eq.-10.5.3}$$

where:

MW_{NO3} – molecular weight of Nitrate = 62

MW_{NO2} – molecular weight of Nitrite = 46

MW_N – molecular weight of Nitrogen = 14

10.5.4. Calculate for Percent Recovery

$$\%Recovery = \frac{C_f - C}{C_s} \times 100 \quad \text{Eq.-10.5.2}$$

where:

C_f – Concentration Found

C – Concentration of Sample (use 0 for LCS)

C_s – Concentration of spike

10.5.5. Calculate for Precision

$$RPD = \frac{|C_1 - C_2|}{\frac{C_1 + C_2}{2}} \times 100 \quad \text{Eq.-10.5.3}$$

where:

RPD – Relative Percent Difference

C_1 – Measured concentration of the first sample aliquot

C_2 – Measured concentration of the second sample aliquot

10.6. **Data Reduction**

10.6.1. Make a copy of the analytical run log.

10.6.2. Make a copy of the sample preparation log (if any), refer to Form 300.0FS page 1.

10.6.3. Print a copy of the sample preparation log (if any), refer to sample preparation log page 2.

10.6.4. Print a copy of the raw data and the QC report.

10.6.5. Highlight the data to be reported.

10.6.6. Collate the reportable raw data separating the QC results from the sample results.

10.6.7. Keep all other data generated with the analytical folder marked with "For record only".

10.7. **Report Generation**

10.7.1. Generate the method.txt file and sample results using ANIONSF1.exe.

10.7.2. Generate the LCS and MS summaries using ANIONSF3.exe.

10.7.3. Generate the case narrative using CN00.exe.

10.8. **Data Review**

10.8.1. Arrange the analysis package in sequence as detailed below using section separators. Attach all raw data to every form generated, to include manual integration(s) and re-analyses.

10.8.1.1. Case Narrative

10.8.1.2. Sample Results

10.8.1.3. LCS Summary

10.8.1.4. MS/MSD Summary

10.8.1.5. Sample Duplicate Result Summary (if any)

10.8.1.6. ICAL Summary

10.8.1.7. ICV Summary

10.8.1.8. CCV Summary

10.8.1.9. Analytical Run Log

10.8.1.10. Sample Preparation Log (if any)

10.8.1.11. Retention Time Summary

10.8.1.12. Non-Conformance Report (if any)

10.8.2. Perform a 100% data review in accordance to EMAX-DM01 and the PSR.

- ✓ Check that identifications are done properly.
- ✓ Check that sample results are integrated properly and results over calibration range are diluted and re-analyzed within calibration range.
- ✓ Check that presence of saturated peak(s) are diluted, and quantitated properly.
- ✓ Check that suspected carry-overs are confirmed.
- ✓ Review the attached logs that they are properly filled out.
- ✓ Check the generated reports against the raw data. Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.
- ✓ Review the case narrative and check that it accurately describes what transpired in the analytical process. Edit as necessary to reflect essential issues not captured by the case narrative generator program.

10.8.3. Submit the analytical folder for secondary review.

10.9. **Preventive Maintenance**

10.9.1. Perform daily routine check and record it in the instrument maintenance log. Refer to Form 300.0FM for daily routine maintenance check points. This practice ensures optimum operating condition of the equipment thus reducing the possibility of frequent instrument malfunction.

10.9.2. The table below is a list of preventive maintenance activities that are essential in performing this SOP.

Maintenance Activity	Description	Frequency
Verification	Prime system and run test injection Clean and inspect sampler and perform pressure test	Daily prior to analysis
Detector Maintenance	Inspect flow cell for leaks and verify performance	Daily prior to analysis
Documentation	Record all instrument maintenance performed in the instrument maintenance log.	Daily prior to analysis
IC Pump Maintenance	Replace pump head seal and filter. Perform wear-in procedure and leak test	Every six months or as necessary
Column Maintenance	Replace column or flush column as necessary. Perform pressure test.	As necessary
Valve Maintenance	Replace rotor seal. Inspect valve fittings and capillaries for leaks	As necessary
System Cleaning	Remove dust from fans and vent covers	Every 6 months or as necessary
Sampler Maintenance	Replace tubing. Lubricate moving parts.	Once a year or as necessary
Inspection	Perform general inspection of the complete system	Once a year

10.9.3. Maintain an inventory of instrument parts and supplies for routinely maintenance.

11.0 QUALITY CONTROL

11.1. Reagents are subjected to QC check prior to use. Refer to EMAX-QC01 for details.

11.2. Pipettes must have a valid calibration prior to use. Refer to EMAX-QC06 for details.

11.3. Properly treat all lab wares used in the sample preparation as specified in EMAX-QC07.

11.4. Acceptance criteria are summarized in Appendix 1.

11.5. Assessing Analytical QC. Every analytical batch is expected to consist of the following to comply with the requirement:

- Daily Continuing Calibration (DCC and CCV)
- Method Blank (MB)
- Lab Control Sample (LCS)

11.6. Assessing Analyte Recovery Data Quality on a given matrix is demonstrated for each group of sample with similar matrix and is expected to consist of the following to comply with the requirement:

- Matrix Spike (MS) and Matrix Spike Duplicate (MSD)
- MS spike level must be high enough to be detected above the original sample and not less than 4 times the LOD.
- If the concentration of fortification is less than 25% of the background concentrations measured in the unfortified sample, the matrix recovery is not calculated.
- If recovery for MS falls outside the recovery range and the LCS is within control, the recovery problem for MS is judged to be matrix related, and not system related.

11.7. Perform MDL study every 6 months. Quarterly verification of LOD and LOQ must be performed. Refer to EMAX-QA04 for details.

11.8. Perform quarterly verification of calibration standards and instrument performance with the analysis of a Quality Control Sample (QCS). Since the QCS is equivalent to the LCS, this verification is done in every batch.

11.9. All analysts conducting this analysis must have an established Demonstration of Capability (DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTION

12.1. Corrective action for each Quality Control Procedure is summarized in Appendix 1.

12.2. **Sample Preparation QC**

12.2.1. For insufficient amount of sample(s), inform the supervisor immediately for further action.

12.2.2. When method blank is non-compliant, investigate the source of the problem and institute resolution to correct, minimize or eliminate the problem.

- If the analyte found in the method blank is not detected in any of the field samples, consult with the Supervisor and the PM if the result can be reported. Otherwise, re-analyze the method blank with the associated samples.

12.3. **Sample Analysis QC**

12.3.1. When Continuing Calibration Verification (CCV) is non-compliant and all measures (e.g. flushing the column and/or changing the column, etc.) had been undertaken to correct the problem, consult the Supervisor for further advice prior to performing a new ICAL.

12.3.2. When flushing does not get rid of carry-over, consider changing the column.

12.3.3. If the reagent water shows contamination in the instrument or in the method blank consider changing the filters of the reagent water source.

12.3.4. If the QC'd blank soil shows contamination in the method blank, consider baking the soil at 400°C overnight then repeat QC prior to its use. If problem persists, discontinue the use of the lot and use a new QC'd lot.

12.4. **Method QC**

12.4.1. When LOQ verification is non-compliant, consider instrument maintenance and/or repeating the MDL study.

12.4.2. When retention time significantly shifts, check for any bubbles or leaks.

12.5. Non-Conformance Report (NCR) is required when the following circumstances occur:

- Anomalies other than specified in Appendix 1, is observed.
- Sample is out of technical holding time.

12.5.1. Refer to EMAX-QA08 for NCR details.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of reagents that may go to the wastewater drains.

13.2. Prepare all standards in fume hoods.

14.0 WASTE MANAGEMENT

14.1. No samples maybe dumped on the laboratory sink.

14.2. Separate and properly identify all unused and expired analytical standards for proper disposal.

14.3. Place all waste generated during analytical process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, expired analytical standards and other waste generated during the analytical process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. **Definition of Terms**

15.1.1. Analyte – The specific chemicals or components for which a sample is analyzed; may be a group of chemicals that belong to the same chemical family, and which are analyzed together.

15.1.2. Reagent Water – is purified water free from any target analyte or any other substance that may interfere with the analytical process.

15.1.3. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.1.3.1. **Analytical batch** - is composed of a complete analysis for a batch of no more than 20 field samples. Every 10 field samples or a fraction thereof shall be bracketed with continuing calibration and one MS is analyzed. For every analytical batch at least one MB and one LCS is analyzed.

15.1.3.2. **Preparation batch** - is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.1.4. Detection Limit (DL) – is defined as the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

15.1.5. Limit of Detection (LOD) – is defined as the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

15.1.6. Limit of Quantitation (LOQ) – is at the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

15.1.7. Safety Data Sheet (SDS) – is where the physical data, toxicology and safety precaution of a certain substance is listed.

15.1.8. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.1.9. Initial Calibration Verification (ICV) – A solution obtained from a secondary source different from the source of calibration standard with known concentration of method analytes. It is also used to fortify an aliquot of MB or sample matrix.

15.1.10. Instrument Blank – is a target-analyte-free solvent subjected to the entire analytical process to establish zero baseline or background value.

15.1.11. Instrument Performance Check (IPC) – *also called Continuing Calibration Verification (CCV).* It is a mid-range check standard containing the target analytes that is analyzed to verify the instrument calibration at the given criteria.

15.1.12. Method Blank (MB) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LFB is analyzed to monitor the accuracy of the analytical system.

15.1.13. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.1.14. Lab Control Sample Duplicate (LCSD) – is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.1.15. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.1.16. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.1.17. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.1.18. Matrix – is a component or form of a sample.

15.1.19. Matrix Spike (MS) – is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyzed to monitor matrix effect on a method's recovery efficiency.

15.1.20. Matrix Spike Duplicate (MSD) – is a replicate of MS analyzed to monitor precision or recovery.

15.1.21. Raw Data - Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted.

15.2. **Application of EMAX QC Procedures**

15.2.1. The procedures and QC criteria summarized in this SOP applies to all projects when performing Ion Chromatography analysis unless. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.3. **Department of Defense (DoD) and Department of Energy (DOE) Projects**

15.3.1. Samples from DoD and/or DOE sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD and DOE Consolidated Quality Systems Manual (QSM), latest update, is applied.

16.0 REFERENCES

16.1. EPA Method 300.0, Methods for Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100)

16.2. EMAX Quality Systems Manual, as updated

16.3. Title 40 Code of Federal Regulations Part 136, Guidelines Establishing Test Performance for Analysis of Pollutants, Method Update Rule, July 30, 2019.

17.0 APPENDICES

17.1. **Tables**

17.1.1. Table 1 Established DL, LOD and LOQ Limits

17.1.2. Table 2 Calibration Standard Preparation

17.2. **Figures**

17.2.1. Figure 1 Typical Peak Evaluation

17.2.2. Figure 2A Typical Chromatogram

17.2.3. Figure 2B Typical Bromate and Chlorate Chromatograms

17.2.4. Figure 3 Typical Sample Result Summary

17.2.5. Figure 4 Typical LCS Summary

17.2.6. Figure 5 Typical MS/MSD Summary

17.2.7. Figure 6 Typical Case Narrative

17.3. **Appendices**

17.3.1. Appendix 1 Summary of Quality Control Procedures

17.3.2. Appendix 2 Demonstration of Capability

17.4. **Forms**

17.4.1. 300.0FS Sample Preparation Log

17.4.2. 300.0FA Analytical Run Log

17.4.3. 300.0FM Instrument Maintenance Log

Table 1: ESTABLISHED DL, LOD AND LOQ LIMITS

PARAMETER	WATER (mg/L)			SOIL (mg/Kg)		
	DL	LOD	LOQ	DL	LOD	LOQ
Bromide	0.125	0.25	0.5	1.25	2.5	5
Chloride	0.05	0.1	0.2	0.5	1	2
Fluoride	0.025	0.05	0.1	0.25	0.5	1
Nitrate	0.025	0.05	0.1	0.25	0.5	1
Nitrite	0.025	0.05	0.1	0.25	0.5	1
Phosphate	0.125	0.25	0.5	1.25	2.5	5
Sulfate	0.125	0.25	0.5	1.25	2.5	5

PARAMETER	WATER (µg/L)		
	DL	LOD	LOQ
Bromate	2.5	5	10
Chlorate	2.5	5	10

Table 2: CALIBRATION STANDARD PREPARATION

Analyte	Inter-mediate Standard Conc.	S0	S1		S2		S3		S4		S5		ICV / DCC		LCS / MS	
		Conc.	Int. Std. Aliquot (mL)	Conc.	Int. Std. Aliquot (mL)	Conc.	Int. Std. Aliquot (mL)	Conc.	Int. Std. Aliquot (mL)	Conc.	Int. Std. Aliquot (mL)	Conc.	Int. Std. Aliquot (mL)	Conc.	Int. Std. Aliquot (mL)	Conc.
Fluoride (F^-)	100mg/L	0	0.1	0.1mg/L	0.5	0.5mg/L	1	1mg/L	5	5mg/L	10	10mg/L	2.5	2.5 mg/L	2	2 mg/L
Chloride (Cl^-)	100mg/L	0	0.2	0.2mg/L	0.5	0.5mg/L	1	1mg/L	5	5mg/L	10	10mg/L	2	2 mg/L	2	2 mg/L
Nitrite-N (NO^-_2-N)	100mg/L	0	0.1	0.1mg/L	0.5	0.5mg/L	1	1mg/L	5	5mg/L	10	10mg/L	2.5	2.5 mg/L	2	2 mg/L
Bromide (Br^-)	100mg/L	0	0.5	0.5mg/L	1	1mg/L	5	5mg/L	10	10mg/L	20	20mg/L	5	5mg/L	2	2 mg/L
Nitrate-N (NO^-_3-N)	100mg/L	0	0.1	0.1mg/L	0.5	0.5mg/L	1	1mg/L	5	5mg/L	10	10mg/L	2.5	2.5 mg/L	1	1mg/L
Phosphate-P (o-$PO_4^=$-P)	100mg/L	0	0.5	0.5mg/L	1	1mg/L	5	5mg/L	10	10mg/L	20	20mg/L	5	5mg/L	2	2 mg/L
Sulfate ($SO_4^=$)	100mg/L	0	0.5	0.5mg/L	1	1mg/L	5	5mg/L	10	10mg/L	20	20mg/L	5	5mg/L	5	5mg/L
Bromate (BrO_3^-)	500µg/L	0	2	10µg/L	10	50µg/L	20	100µg/L	50	250µg/L	100	500µg/L	20	100µg/L	20	100µg/L
Chlorate (ClO_3^-)	500 µg/L	0	2	10µg/L	10	50µg/L	20	100µg/L	50	250µg/L	100	500µg/L	20	100µg/L	20	100µg/L

***** Use Primary Intermediate Standard for ICAL and DCC Standards. Use Secondary Intermediate Standard for ICV and LCS/MS Standards. All standards are prepared to a ***final volume of 100 mL*** using reagent water.

Figure 1: TYPICAL PEAK EVALUATION

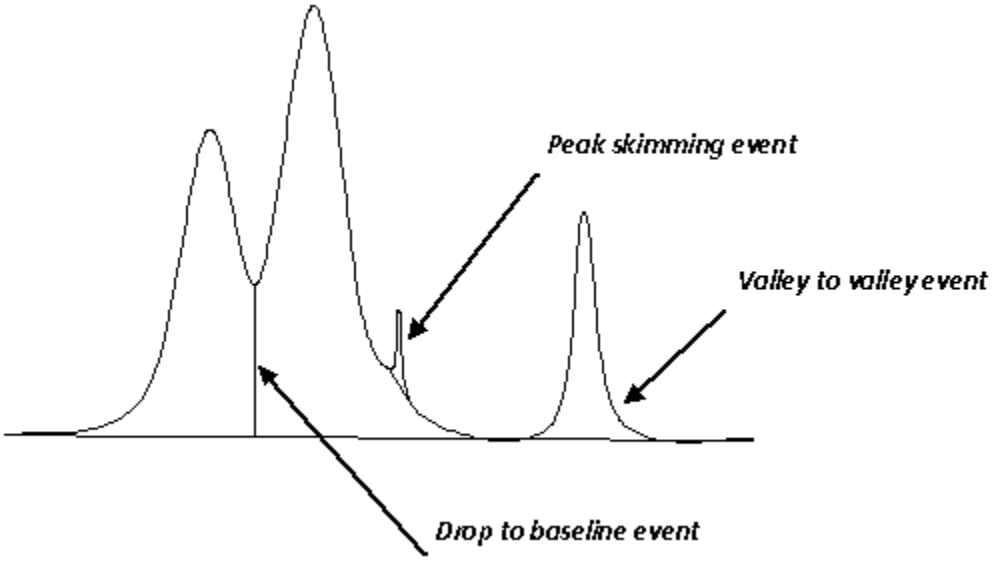


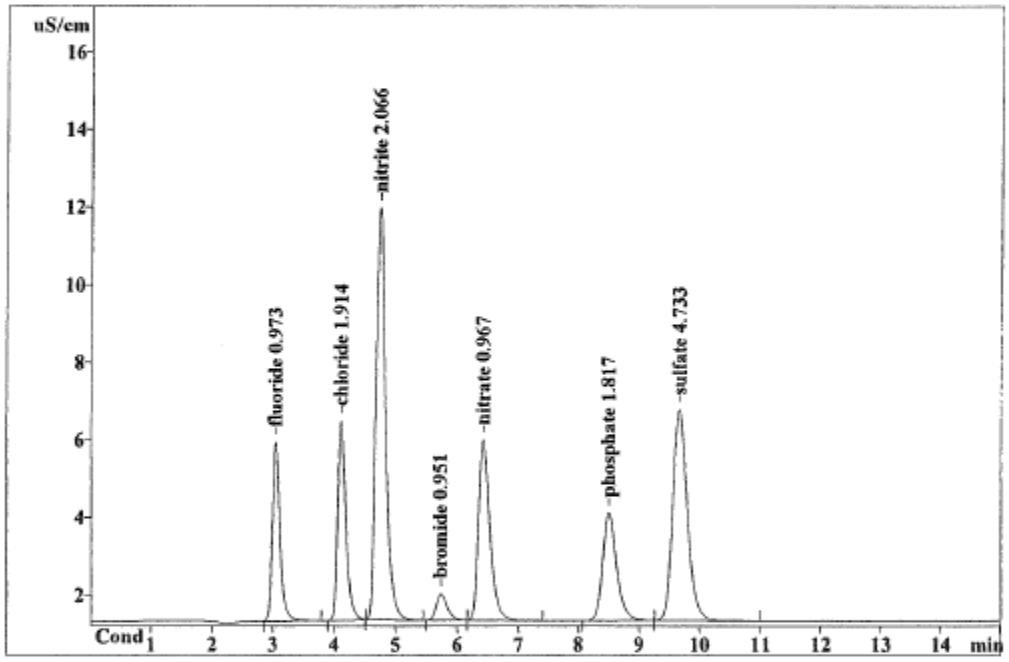
Figure 2A: TYPICAL CHROMATOGRAM

Report date: MM/DD/YYYY HH:MM:SS
Printed by: LDip

Ident: AM07-04 ICM007WL
Analysis from: MM/DD/YYYY HH:MM:SS
File: _YYYY-MM-DD_HH-MM.chw Last save: MM/DD/YYYY HH:MM:SS

Method: ICD0-H26.mtw Last save: MM/DD/YYYY HH:MM:SS
Run operator: LDip
Analysis number: 151215

SAMPLE: METHOD 300
:
Vial number: 4
Volume: 1.0 µL
Dilution: 1.00
Amount: 1.0000



Quantitation method: Custom

No	Retention min	Height uS/cm	Area uS/cm*sec	Conc. mg/L	Name
1	3.05	4.61	40.907	0.973	fluoride
2	4.11	5.13	47.646	1.914	chloride
3	4.73	10.61	118.097	2.066	nitrite
4	5.73	0.68	8.483	0.951	bromide
5	6.42	4.63	59.929	0.967	nitrate
6	8.50	2.78	44.823	1.817	phosphate
7	9.66	5.42	91.406	4.733	sulfate
7	15.00	33.86	411.292	13.422	

This report has been created by IC Net
METROHM LTD

Figure 2B: TYPICAL BROMATE & CHLORATE CHROMATOGRAMS

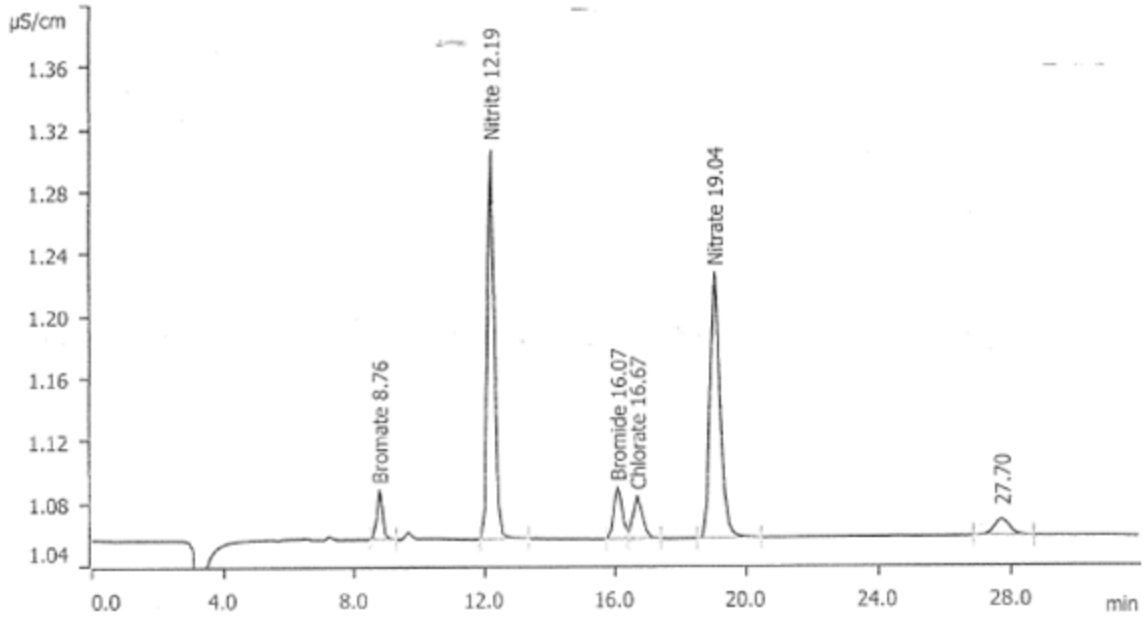
Mag Net

YYYY-MM-DD HH:MM:SS

Sample data

Sequence	E3MXX-XX
Ident	ICV
Determination start	YYYY-MM-DD HH:MM:SS UTC-7
Method	E3MXX-XX METHOD
Sample type	Check standard 1
Dilution Factor	1
Operator	ASitu

Anions



Peak number	Retention time min	Area (µS/cm) x min	Height µS/cm	Component name	Concentration ppb
1	8.763	0.005941 ✓	0.032	Bromate	100.749 ✓
2	12.185	0.056397 ✓	0.249	Nitrite	98.459 ✓
3	16.070	0.009834 ✓	0.033	Bromide	97.921 ✓
4	16.670	0.009361 ✓	0.027	Chlorate	97.254 ✓
5	19.042	0.060018 ✓	0.171	Nitrate	100.328 ✓
6	27.698	0.005386	0.011		invalid

Page 1 of 1

Metrohm

Figure 3: TYPICAL SAMPLE RESULT SUMMARY

METHOD 300.0
NITRATE-N

Client : XYZ, INC.
Project : CLEAN PROJECT
Batch No. : YYMXXX
Matrix : WATER
InstrumentID : D0

CLIENT SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DFxPREP FACTOR	MOIST (%)	LOQ (mg/L)	DL (mg/L)	LOD (mg/L)	ANALYSIS DATETIME	PREPARATION DATETIME	DATA FILE ID	CAL REF	PREP BATCH	COLLECTION DATETIME	RECEIVED DATE
MBLK1W	ICM007WB	ND	1	NA	0.1	0.025	0.05	MM/DD/YYHH:MM	NA	AM07-03	AM07-01	ICM007W	NA	NA
LCS1W	ICM007WL	0.967	1	NA	0.1	0.025	0.05	MM/DD/YYHH:MM	NA	AM07-04	AM07-01	ICM007W	NA	NA
LCD1W	ICM007WC	0.967	1	NA	0.1	0.025	0.05	MM/DD/YYHH:MM	NA	AM07-05	AM07-01	ICM007W	NA	NA
ABCDEF-01	MXXX-01	0.110	1	NA	0.1	0.025	0.05	MM/DD/YYHH:MM	NA	AM07-06	AM07-01	ICM007W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-02	MXXX-02I	2.07	2	NA	0.2	0.05	0.1	MM/DD/YYHH:MM	NA	AM07-11	AM07-01	ICM007W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-01MS	MXXX-01M	1.08	1	NA	0.1	0.025	0.05	MM/DD/YYHH:MM	NA	AM07-15	AM07-13	ICM007W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-01MSD	MXXX-01S	1.08	1	NA	0.1	0.025	0.05	MM/DD/YYHH:MM	NA	AM07-16	AM07-13	ICM007W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-01DUP	MXXX-01D	0.110	1	NA	0.1	0.025	0.05	MM/DD/YYHH:MM	NA	AM07-17	AM07-13	ICM007W	MM/DD/YYHH:MM	MM/DD/YY

Figure 4: **TYPICAL LCS SUMMARY**

EMAX QUALITY CONTROL DATA
LAB CONTROL SAMPLE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : 300.0

MATRIX : WATER % MOISTURE: NA

DILUTION FACTOR:	1	1	1
SAMPLE ID :	MBLK1W	LCS1W	LCD1W
LAB SAMPLE ID :	ICM007WB	ICM007WL	ICM007WC
LAB FILE ID :	AM07-03	AM07-04	AM07-05
DATE PREPARED :	NA	NA	NA
DATE ANALYZED :	MM/DD/YYHH:MM	MM/DD/YYHH:MM	MM/DD/YYHH:MM
PREP BATCH :	ICM007W	ICM007W	ICM007W
CALIBRATION REF:	AM07-01	AM07-01	AM07-01

ACCESSION:

PARAMETER	MB RESULT (mg/L)	SPIKE AMT (mg/L)	BS RESULT (mg/L)	BS REC (%)	SPIKE AMT (mg/L)	BSD RESULT (mg/L)	BSD REC (%)	RPD (%)	QC LIMIT (%)	MAX RPD (%)
NITRATE-N	ND	1	0.967	97	1	0.967	97	0	88-111	15

Figure 5: TYPICAL MS/MSD SUMMARY

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : 300.0

MATRIX : WATER % MOISTURE: NA
DILUTION FACTOR: 1 1 1
SAMPLE ID : ABCDEF-01 ABCDEF-01MS ABCDEF-01MSD
LAB SAMPLE ID : MXXX-01 MXXX-01M MXXX-01S
LAB FILE ID : AM07-06 AM07-15 AM07-16
DATE PREPARED : NA NA NA
DATE ANALYZED : MM/DD/YYHH:MM MM/DD/YYHH:MM MM/DD/YYHH:MM
PREP BATCH : ICM007W ICM007W ICM007W
CALIBRATION REF: AM07-01 AM07-13 AM07-13

ACCESSION:

PARAMETER	PARENT RESULT (mg/L)	SPIKE AMT (mg/L)	MS RESULT (mg/L)	MS REC (%)	SPIKE AMT (mg/L)	MSD RESULT (mg/L)	MSD REC (%)	RPD (%)	QC LIMIT (%)	MAX RPD (%)
NITRATE-N	0.110	1	1.08	97	1	1.08	97	0	80-120	20

Figure 6: TYPICAL CASE NARRATIVE

CASE NARRATIVE

Client : XYZ, INC.

Project: CLEAN PROJECT

SDG : YYMXXX

METHOD 300.0
NITRATE-N

A total of two (2) water samples were received on MM/DD/YY to be analyzed for Nitrate-N in accordance with Method 300.0 and project specific requirements.

Holding Time
Samples were analyzed within the prescribed holding time.

Calibration
Calibration was performed as prescribed by the method and was verified using a secondary source (ICV). All calibration requirements were within acceptance criteria.

Method Blank
Method blank was prepared and analyzed at the frequency required by the project. For this SDG, one (1) method blank was analyzed. Nitrate-N was not detected in ICM007WB. Refer to sample result summary form for details.

Lab Control Sample
Lab control sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) set of LCS/LCD was analyzed. ICM007WL/ICM007WC were within LCS limits. Refer to LCS summary form for details.

Matrix QC Sample
Matrix spike sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) set of MS/MSD was analyzed. Nitrate-N was within MS QC limits in MXXX-01M/MXXX-01S. Sample duplicate was analyzed and RPD was within expected value. Refer to Matrix QC summary forms for details.

Sample Analysis
Samples were analyzed according to prescribed analytical procedures. Results were evaluated in accordance to project requirements. For this SDG, all quality control requirements were met.

Appendix 1: SUMMARY OF QUALITY CONTROL PROCEDURES

QC PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	1st Rvw	2nd Rvw
Initial Calibration Min. 3 pts + CB	Every 6 months or when CCV fails to meet the acceptance criteria.	Correlation coefficient ≥ 0.995 for linear regression	Correct the problem then repeat initial calibration		
Initial Calibration Verification (ICV)	After every initial calibration and every 3 months.	All analytes within ± 10% of expected value	Correct the problem then repeat initial calibration		
Continuing Calibration Verification (CCV) *also known as Instrument Performance Check (IPC)*	At the beginning of analytical batch and every 10 samples thereafter and at the end of the sequence.	All analytes within ± 10% of expected value.	Re-analyze DCC. If re-analysis is still outside acceptance limits, discontinue the analysis. Resolve the cause of failure and re-calibrate prior to resuming analysis.		
Method Blank (MB)	One per preparation batch	No analytes detected > ½ LOQ. Blank result must not affect sample results.	Re-prep and re-analyze MB and all samples processed with MB.		
Lab Control Sample (LCS)	One LCS per preparation batch	All analytes within ± 10% of expected value.	Re-prep and re-analyze the LCS and all associated samples		
Matrix Spike (MS) and Matrix Spike Duplicate (MSD)	One MS/MSD for every 10 or fewer samples.	All analytes within project QC Limits or within ± 20% of expected value.	If LCS passed, no action.		
MDL Study	Every 6 months	Refer to EMAX-QA04.	None.		
Comments: For flagging criteria refer to PSR.			Reviewed By		
			Date		

Appendix 2: DEMONSTRATION OF CAPABILITY

MATRIX: WATER

SOP: EMAX-300.0 Rev. 13

Conc Unit: mg/L

PARAMETER	AM15-04	AM15-05	AM15-06	AM15-07	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	Accuracy Acceptance Limits (% Rec)	RSD (%) Criteria	COMMENTS
	ICM019WL	ICM019WC	ICM019WX	ICM019WY								
Nitrate	0.974	0.974	0.973	0.975	1	0.979	98	0.001	0.1	90 - 110	≤ 20	Passed
Chloride	1.91	1.91	1.91	1.91	2	1.91	95	0.001	0.1	90 - 110	≤ 20	Passed
Fluoride	0.977	0.978	0.978	0.978	1	0.978	98	0.001	0.1	90 - 110	≤ 20	Passed
Nitrite	2.06	2.06	2.06	2.06	2	2.06	103	0.003	0.1	90 - 110	≤ 20	Passed
Bromide	1.83	1.83	1.83	1.83	2	1.83	91	0.001	0.1	90 - 110	≤ 20	Passed
Phosphate	1.82	1.83	1.82	1.83	2	1.82	91	0.001	0.1	90 - 110	≤ 20	Passed
Sulfate	4.63	4.63	4.63	4.62	5	4.63	93	0.002	0.0	90 - 110	≤ 20	Passed

MATRIX: WATER

SOP: EMAX-300.0 Rev. 13 Instrument: E3

Conc Unit: µg/L

PARAMETER	E3M08-15	E3M08-16	E3M08-17	E3M08-18	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	Accuracy Acceptance Limits (% Rec)	RSD (%) Criteria	COMMENTS
	ILM001WL	ILM001WC	ILM002WL	ILM002WC								
Bromate	99.5	99.1	98.8	98.6	100	99.2	99	0.391	0.4	90 - 110	≤ 20	Passed
Chlorate	98.8	99.1	99.4	98.6	100	99.0	99	0.358	0.4	90 - 110	≤ 20	Passed

MATRIX: SOIL

SOP: EMAX-300.0 Rev. 13

Conc Unit: mg/Kg

PARAMETER	AM24-04	AM24-05	AM24-06	AM24-07	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	Accuracy Acceptance Limits (% Rec)	RSD (%) Criteria	COMMENTS
	ICM003WL	ICM003WC	ICM003WX	ICM003WY								
Nitrate	10.21	10.24	10.21	10.26	10	10.18	102	0.024	0.2	90 - 110	≤ 20	Passed
Chloride	19.4	19.5	19.5	19.5	20	19.5	97	0.047	0.2	90 - 110	≤ 20	Passed
Fluoride	10.28	10.09	10.00	10.13	10	10.13	101	0.119	1.2	90 - 110	≤ 20	Passed
Nitrite	20.5	20.5	20.4	20.6	20	20.5	102	0.058	0.3	90 - 110	≤ 20	Passed
Bromide	18.4	18.5	18.4	18.5	20	18.4	92	0.057	0.3	90 - 110	≤ 20	Passed
Phosphate	19.4	19.5	19.4	19.6	20	19.5	97	0.106	0.5	90 - 110	≤ 20	Passed
Sulfate	49.1	49.2	49.1	49.3	50	49.2	98	0.113	0.2	90 - 110	≤ 20	Passed

300.0FS: SAMPLE PREPARATION LOG (Page 1)

EMAX LABORATORIES, INC.

SAMPLE PREPARATION LOG
for
ION CHROMATOGRAPHY

Page 1

Note: For samples and relevant QCs/Standards extracted, refer to attached extraction sequence.

Comments:

Book #: EIC-009

Preparation Batch:

Matrix:

Balance ID:

Pipette ID:

Filter:

SOP	Rev. #
☐ EMAX-300.0	13
☐ EMAX-4110B	6
☐ EMAX-9056	9

Standards	ID	Amount Added (ml)
Fluoride		
NO_2-N		
NO_3-N		
Chloride		
Br^-		
PO_4P		
SO_4^{2-}		

Reagent	Lot # / ID
Sand	
Reagent Water	

Prepared By:

Standard Added By:

Checked By:

300.0FS: SAMPLE PREPARATION LOG (Page 2)

PrepBatchID	LabSampleID	Aliquot	Unit	DateTime	FinalVol(ml)	ExpAmt	ExpVf(ml)	PrepFctr	Comments

PrepFctr=(ExpAmt/Aliquot)*(Vf/ExpVf)

☐ Extraction Started @ Comments: Prepared By:

☐ Extraction Ended @ Checked By:

Date

 ExpAmt 10

ExpVf(ml) 10

300.0FA: **ANALYTICAL RUN LOG**

EMAX LABORATORIES, INC.

ANALYSIS RUN LOG
for
ION CHROMATOGRAPHY

Page 1

Note: For samples and relevant QCs/Standards analyzed, refer to attached analytical sequence.

Comments:

Book #:	AD0-066
Instrument No.:	D0
Pipette ID's:	039380124
	SW3-02-02-02
	439350100
Analytical Sequence:	
Method File:	
Analytical Batch:	

SOP #	Rev. #
☐ EMAX-300.0	13
☐ EMAX-4110B	6
☐ EMAX-9056	9
☐ EMAX-	
STANDARDS ID	
ICAL	
ICV	
CCV	
LCS	
MS	

Filters Lot #:	Snap Seal Containers Lot #:
0.45 µm:	4 oz:
0.2 µm:	1.5 oz:

Column: Metrosep A Supp 5-100

Flow Rate: 0.70 ml/min

IC ELUENT PREPARATION Expiration Date:

Std ID	Aliquot	Final Vol*
	20 mL	2 L

IC REGENERANT PREPARATION Expiration Date:

Std ID	Aliquot	Final Vol*
	100 mL	1 L

* Reagent Water ID:

ELECTRONIC DATA ARCHIVAL	
Location	Date
☐ IC-METROHM	
☐ External Hard Drive	

Analyzed By:

Date:

300.0FM: INSTRUMENT MAINTENANCE LOG

EMAX LABORATORIES, INC.

Page 1

INSTRUMENT MAINTENANCE LOG

Instrument No: D0 Month: Year: 20___ Book #: MD0-009

Date							
Background Noise (<0.01)							
Check Eluent bottle level							
Check DI bottle level							
Check H_2SO_4 bottle level							
Check autosampler rinse beakers							
Pump Setting at 0.7 ml/min							
Pump Pressure (4.5-6.5mpa)							
µS Reading							
Autosampler Filter							
Printer Paper							
Computer Clock							
Analyst Initial							
Troubleshooting							
Problem(s) Encountered							
Return To Specs (Analyst Initial)							

Code	Problems Encountered	Code	Corrective Action

ANNUAL REVIEW FORM

ION CHROMATOGRAPHY ANALYSIS

SOP#: EMAX-300.0 **Rev** 13 **Effective Date:** 10-Oct-19

COMMENTS	Reviewed By	Review Date
No update needed per DRF by LDip dtd (10/13/20)		10/13/20

STANDARD OPERATING PROCEDURES

TOTAL DISSOLVED SOLIDS

SOP No.:	EMAX-2540C	Revision No.	9	Effective Date:	30-Apr-18
Prepared By:	Tyler Kosaka			Date:	04/27/18
Approved By:	Kenette Pimentel QA Manager			Date:	04.30.18
Approved By:	Caspar Pang Laboratory Director			Date:	4/30/18

Control Number: 2540C-09-

1.0 SCOPE AND APPLICATION

1.1. This method describes the determination of total dissolved solids (TDS) in drinking water, groundwater samples and other aqueous samples of similar matrix.

1.2. This SOP is an adaptation of Methods 2540C-1997 and 2540C-2011, Standard Methods for the Examination of Water and Wastewater, 21st and 22nd Editions.

2.0 SUMMARY OF METHOD

2.1. A well-mixed required amount of sample is filtered through a glass fiber filter. The filtrates are collected into a pre-weighed evaporating dish, pre-heated at 90°C and continue drying to a constant weight at 180°C. The increase of weight in the dish represents the total dissolved solids.

2.2. **Interferences**

2.2.1. Highly mineralized waters containing significant concentrations of calcium, magnesium, chloride and/or sulfate may be hygroscopic and will require prolonged drying, desiccation and rapid weighing.

2.2.2. Samples containing high concentrations of bicarbonate will require careful and possibly prolonged drying at 180°C to insure that all the bicarbonate is converted to carbonate.

2.2.3. Too much residue in the evaporating dish will crust over and entrap water that will not be driven off during drying. Total residue must be limited to about 200 mg.

3.0 DETECTION LIMITS

3.1. **Detection Limit (DL) & Limit of Detection (LOD)**

3.1.1. DL and LOD are not applicable for this method.

3.2. **Limit of Quantitation (LOQ)**

3.2.1. Refer to EMAX-QA04 for validation, verification and generation of LOQ.

3.2.2. Established LOQ for this method is 10 mg/L.

4.0 DYNAMIC RANGE

4.1. 2.5 mg – 200 mg dried residue

5.0 SAMPLE HOLDING TIME AND PRESERVATION

5.1. Sample Collection

5.1.1. Samples received in the laboratory are expected to be contained in HDPE bottles and cooled to ≤ 6°C without freezing.

5.2. Holding Time

5.2.1. Analyze samples within seven days from collection date.

5.3. Preservation

5.3.1. Store the samples at ≤ 6°C without freezing.

6.0 ASSOCIATED SOPs

6.1.	EMAX-160.1	Total Dissolved Solids
6.2.	EMAX-DM01	Data Flow and Review
6.3.	EMAX-QA04	Detection Limit (DL)
6.4.	EMAX-QA05	Training
6.5.	EMAX-QA08	Corrective Action
6.6.	EMAX-QC01	Quality Control for Chemicals
6.7.	EMAX-QC04	Balance Calibration
6.8.	EMAX-QC06	Volumetric Labware and Micropipette Verification
6.9.	EMAX-QC07	Glassware Cleaning
6.10.	EMAX-SM03	Waste Disposal
6.11.	EMAX-SM04	Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS of chemicals listed in this SOP.

7.2. Treat reagents, standards and samples as potential hazard. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, gloves, at all times when performing this procedure.

7.3. If for any reason, reagents and/or samples get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amount of tap water. If irritations or any other discomfort related to the incident persist, inform your supervisor immediately, so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS AND REAGENTS

8.1. **Instruments and Supplies**

Filtration assembly	SCP Science DigiFilter Manifold, 12 position or equivalent
Filters	SCP Science DigiFilter 0.45 micron filters or equivalent
Graduation cylinder	Class A 100 ml, 25 ml, 10 ml
Evaporating Vessel	20, 40 ml scintillation vial, 150 ml beaker
Micropipette	Variable
Wash bottles	Plastic
Oven	Fisher Isotemp oven, temperature range: 20°C – 200°C or equivalent
Balance	Sartorius H-51 accurate to 0.0001 g, or equivalent
Weights	Class "S"; ASTM1 certified; 0.1g, 5g, 100g
Desiccator	With color indicator dessicant
DigiTubes	50 ml or equivalent

8.2. **Chemicals and Reagents**

8.2.1. Reagent Water – Type II

9.0 STANDARDS

9.1. Sodium Chloride Standard (LCS) 1000 mg/L – Weigh 1 g of sodium chloride (previously dried for at least 1 hour). Dissolve in reagent water and dilute to 1000 mL.

10.0 PROCEDURES

10.1. **Sample Preparation**

10.1.1. Preparation for Filtration

10.1.1.1. Connect the Digifilter to a Digitube and attach to the DigiFilter Manifold.

10.1.1.2. Apply vacuum and rinse the filter with three successive portions of 10 ml reagent water.

10.1.1.3. Continue to suction until no trace of water is evident.

10.1.2. Prepare Evaporating Vessel

10.1.2.1. Heat clean the vials at 180°C (±2°C) for 1 hour.

10.1.2.2. Cool it in the dessicator until needed.

10.1.2.3. Weigh before use.

10.1.3. Preparative Batch

10.1.3.1. Bring sample to room temperature.

10.1.3.2. Estimate the amount of sample to be used in the analysis by checking the conductivity of the samples.

- If conductivity is below 800 µmho/cm, use 100 ml of sample.
- If conductivity is about 800 – 10000 µmho/cm, use 50 ml of sample.
- If conductivity is about 1000 – 5000 µmho/cm, use 20 ml of sample.
- If conductivity is about 5000 – 10000 µmho/cm, use 10 ml of sample.
- If conductivity is about 10000 – 25000 µmho/cm, use 5 ml of sample.
- If conductivity is about 25000 – 70000 µmho/cm, use 2 ml of sample.
- If conductivity is greater than 70000 µmho/cm, please check with supervisor.

Historical information of samples and appearance can also help in estimating the amount of sample to be used.

10.1.3.3. For a maximum of 20 field samples, prepare one method blank using reagent water, one LCS (refer to Section 9.0) and a sample duplicate for every 10 samples.

10.2. **Instrument Parameters**

10.2.1. Set the oven to deliver 90°C (± 5°C) for preheating and 180°C (± 2°C) for drying. Record the thermometer ID in the analytical log.

10.3. **Calibration**

10.3.1. Open the TDS template (TD.xls) and click on the "**Save As**" button, input your electronic signature.

10.3.2. Calibrate the analytical balance at 0.1 g, 5 g and 100 g using class "S" weights. Record the balance and weight ID.

10.3.3. Calibration must be within ± 0.1% or 0.5mg, whichever is higher.[1]

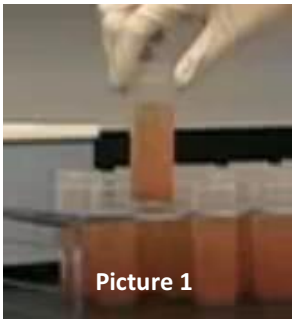
10.3.4. Verify calibration of the balance before and after each analytical batch. If calibration is not verified after the measurements, re-calibrate the balance and re-weigh the batch.

10.4. **Analysis**

10.4.1. TDS Determination

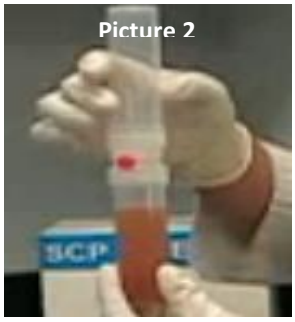
10.4.1.1. Shake the sample thoroughly and volumetrically measure the amount of sample for analysis as determined in Section 10.1.3.2. If historical information are available suggesting that sample is of known high TDS concentration or if sample appears to be turbid or cloudy, consider lesser amount of sample for analysis.

10.4.1.2. Pour the sample into a graduated cylinder and transfer into a labeled DigiTube. Rinse the graduated cylinder with reagent water and transfer the rinsate to the DigiTube (see picture 1).



Picture 1

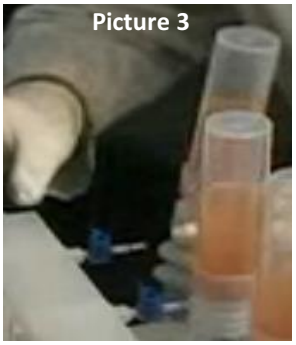
[1] DoD and DoE Consolidated QSM for Environmental Laboratories, version 5.1, Mod. 2, Sec. 5.5.13.1, Table 5.1


Picture 2

10.4.1.3. Connect the DigiTube to the pre-washed DigiFilter connected to another DigiTube which serves as receiver for the filtrate (see Picture 2). Record DigiFilter Lot Number in the Run Log.

10.4.1.4. Invert the DigiTube assembly so that your sample is on top and connect it to the vacuum manifold (see Picture 3). Turn the vacuum pump on and open the Luer lock dial to the open position to allow the sample to be pulled through the digiFilter (see Picture 4).

10.4.1.5. Unscrew the emptied DigiTube and rinse it with two portions of 5 ml reagent water using a reagent water wash bottle. Transfer each washing to the DigiFilter. Give the filter a final rinse of approximately 5 ml using a reagent water wash bottle.


Picture 3

10.4.1.6. Continue suction until no trace of water is evident.

10.4.1.7. Turn off the vacuum to release excess pressure.

10.4.1.8. Transfer the filtrate with the rinsate into a weighed evaporating vessel.

10.4.1.9. Place the sample vessel in the oven (set at 90°C) and evaporate until sample is at most dry. If evaporating vessel can not contain the entire sample at one time, add the successive portions on the same dish used for evaporation.

Picture 4

10.4.1.10. Dry evaporated sample for at least one hour in an oven at 180°C (± 2°C).

10.4.1.11. After the sample has been completely dried, cool the sample in a desiccator and weigh. Check if dried residue is between 2.5 mg to 200 mg.

- If dried residue is < 2.5 mg and sample aliquot volume used satisfies LOQ requirement, report result. Otherwise, repeat sample analysis using higher sample aliquot volume up to 1 liter to ensure that representative sub-sample is taken.
- If residue is > 200 mg, repeat analysis using lesser volume of sample estimated from the result.

10.4.1.12. Repeat drying process at 180°C (± 2°C) until weight is constant or until weight loss is less than 0.0005 g.

10.4.2. Sample Result Evaluation

10.4.2.1. Check the QC data as soon as available.

- ✓ Check the method blank and make sure that it meets the project requirement.
- ✓ Check the LCS and make sure it meets the recovery limit.

- ✓ Check the sample duplicate(s) that it meets the acceptance criteria or note possible matrix interference on the run log.
- ✓ Check that all samples are analyzed within the dynamic range.

10.4.2.2. Report only samples that are properly quantitated. (Samples between 2.5 – 200 mg per sample aliquot volume that satisfies LOQ requirement).

10.5. **Calculations**

10.5.1. Calculate for Total Dissolved Solids (TDS)

$$TDS, mg/L = \frac{(R-D)\times 1000}{S} \qquad \text{Eq-10.5.1}$$

where:

R – Weight of residue + dish, mg

D – Weight of dish, mg

S – Volume of sample analyzed, ml

10.5.2. Calculate for Percent Recovery

$$\%Recovery = \frac{(C_f - C)}{C_s}\times 100 \qquad \text{Eq-10.5.2}$$

where:

C_f – Concentration found

C – Concentration of the sample (use 0 for LCS)

C_s – Concentration of spike

10.5.3. Calculate for Precision

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C1+C2}{2}\right)} x100 \qquad \text{Eq-10.5.3}$$

where:

RPD – Relative Percent Difference

C_1 – Measured concentration of the first sample aliquot

C_2 – Measured concentration of the second sample aliquot

10.6. **Data Reduction**

10.6.1. Print a copy of the analytical run log.

10.6.2. Highlight the data to be reported.

10.6.3. Keep all other data generated with the analytical folder marked with “For record only”.

10.7. **Report Generation**

10.7.1. Generate the method .txt file, sample results and QC summaries using GRAV.exe.

10.7.2. Generate the case narrative using CN00.exe.

10.7.3. Arrange the analysis package in sequence as detailed below.

10.7.3.1. Case Narrative

10.7.3.2. Sample Results

10.7.3.3. LCS/LCSD Summary

10.7.3.4. Sample Duplicate Result Summary

10.7.3.5. Run Log

10.7.3.6. Non-Conformance Report (if any)

10.8. **Data Review**

10.8.1. Perform a 100% data review in accordance to EMAX-DM01and the PSR.

10.8.1.1. If any of the checkpoints below is non-compliant, re-analysis is required.

- ✓ Check that MB is compliant to PSR.
- ✓ Check LCS/LCSD recoveries against project specific criteria (PSR). In the absence of the PSR, default to in-house QC limits.
- ✓ Check that all sample results are within dynamic range.

10.8.1.2. Review the generated reports against the analytical run log. Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.

10.8.1.3. Review the case narrative and check that it accurately describes what transpired in the analytical process. Edit as necessary to reflect essential issues not captured by the case narrative generator program.

10.8.2. Submit the analytical folder for secondary review.

10.9. **Preventive Maintenance**

10.9.1. Check the vacuum pump oil level prior to use.

10.9.2. Clean filter assembly thoroughly after each use.

11.0 QUALITY CONTROL

11.1. Acceptance criteria for each quality control procedure are summarized in Appendix 1.

11.2. **Analytical Batch QC**

11.2.1. Glass-fiber filters must be properly treated prior to use.

11.2.2. Filter assembly must be thoroughly cleaned prior to use.

11.2.3. Balance must be calibrated before and after each weighing.

11.2.4. Pipettes must be calibrated prior to its use. Refer to EMAX-QC06 for details.

11.2.5. Reagents are subjected to QC check prior to its use. Refer to EMAX-QC01 for details.

11.3. **Preparation Batch QC**

11.3.1. The maximum number of original field samples in a prep batch is 20 unless otherwise specified by the project.

11.3.2. Prepare method blank, LCS, and sample duplicate(s) in every prep batch, unless otherwise specified by the project. They are subjected to the same process that the field samples undergo as described in Section 10.

11.3.3. Properly treat all lab wares used in the sample preparation as specified in EMAX-QC07.

11.4. **Method QC**

11.4.1. A valid LOQ must exist prior to sample analysis. Refer to EMAX-QA04 for details.

11.4.2. All analysts conducting this analysis must have an established Demonstration of Capability (DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTION

12.1. Corrective action for each quality control procedure is summarized in Appendix 1.

12.2. **Preparation Batch QC**

12.2.1. For insufficient amount of sample(s), inform the supervisor immediately for further action.

12.2.2. When method blank is non-compliant, investigate the source of the problem and institute resolution to correct, minimize or eliminate the problem.

12.2.3. If LCS is non-compliant, investigate the source of the problem to institute resolution to correct, minimize or eliminate the problem.

12.2.4. If sample duplicate is non-compliant, discuss in case narrative.

12.3. A Non-Conformance Report (NCR) is required when the following circumstances occur:

- Anomalies other than specified in Appendix 1, is observed.
- Sample is out of technical holding time.

12.3.1. Refer to EMAX-QA08 for NCR details.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of standards and reagents that may go to the wastewater drains.

13.2. Prepare all standards in the fume hood.

14.0 WASTE MANAGEMENT

14.1. No samples shall be dumped on the laboratory sink.

14.2. Separate and properly identify all unused and expired analytical standards for proper disposal.

14.3. Place all wastes generated during analytical process in properly labeled satellite waste containers for proper disposal

14.4. Dispose all unused samples, expired analytical standards and other wastes generated during the analytical process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. According to the Method Update Rule (MUR) and Title 40 Code of Federal Regulation, Part 136, EPA Method 160.1 is not an approved method. If a client requires Method 160.1, EMAX shall perform analysis using Method 2540C-1997/2011 to comply with the MUR and client shall be duly informed.

15.2. **Definition of Terms**

15.2.1. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.2.1.1. **Preparation Batch** - is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.2.1.2. **Analytical batch -** is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices, preparation batches, and can exceed 20 samples.

15.2.2. Limit of Quantitation (LOQ) – is at the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

15.2.3. Safety Data Sheet (SDS) – is where the physical data, toxicology and safety precaution of a certain substance is listed.

15.2.4. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.2.5. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical to monitor contamination.

15.2.6. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.2.7. Lab Control Sample Duplicate (LCSD) – is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.2.8. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.2.9. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.2.10. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.2.11. Matrix – is a component or form of a sample.

15.2.12. Reagent Water – is purified water free from any target analyte or any other substances that may interfere with the analytical process.

15.3. **Application of QC Procedures**

15.3.1. The procedures and QC criteria summarized in this SOP applies to all projects when performing Total Dissolved Solids. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.4. **Department of Defense (DoD) and Department of Energy (DoE) Projects**

15.4.1. Samples from DoD and DoE sponsored projects follow the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD and DoE Consolidated Quality Systems Manual (QSM), latest update, is applied.

15.5. Note that this SOP was revised on the merit of updating according to 40 CFR Methods Update Rule. There is no significant analytical changes made from that of the previous version.

16.0 REFERENCES

16.1. Standard Methods for the Examination of Water and Waste Water, 21st and 22nd Editions, Method 2540C-1997 and 2540C-2011

16.2. Title 40 Code of Federal Regulations, Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants, latest edition

16.3. Department of Defense (DoD) and Department of Energy (DoE) Consolidated Quality Systems Manual (QSM), as updated

16.4. EMAX Quality Systems Manual, as updated

17.0 APPENDICES

17.1. **Figures**

17.1.1. Figure 1 Typical Sample Result Summary

17.1.2. Figure 2 Typical LCS Summary

17.1.3. Figure 3 Typical Sample Duplicate Result Summary

17.1.4. Figure 4 Typical Case Narrative

17.2. **Appendices**

17.2.1. Appendix 1 Summary of Quality Control Procedures

17.2.2. Appendix 2 Demonstration of Capability

17.3. **Forms**

17.3.1. Form 2540CFA Analytical Run Log

Figure 1: **TYPICAL SAMPLE RESULT SUMMARY**

METHOD SM2540C
TOTAL DISSOLVED SOLIDS

Client : XYZ, INC. Matrix : WATER
Project : CLEAN PROJECT InstrumentID : 402426
Batch No. : YYMXXX

CLIENT SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DFxPREP FACTOR	MOIST (%)	LOQ (mg/L)	DL (mg/L)	LOD (mg/L)	ANALYSIS DATETIME	PREPARATION DATETIME	DATA FILE ID	CAL REF	PREP BATCH	COLLECTION DATETIME	RECEIVED DATE
MBLK1W	TDM001WB	ND	1	NA	10	10	10	MM/DD/YYHH:MM	NA	YYTDM00101	YYTDM001	TDM001W	NA	NA
LCS1W	TDM001WL	1000	1	NA	10	10	10	MM/DD/YYHH:MM	NA	YYTDM00102	YYTDM001	TDM001W	NA	NA
ABCDEF-01	MXXX-01	624	1	NA	10	10	10	MM/DD/YYHH:MM	NA	YYTDM00103	YYTDM001	TDM001W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-01DUP	MXXX-01D	609	1	NA	10	10	10	MM/DD/YYHH:MM	NA	YYTDM00104	YYTDM001	TDM001W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-02	MXXX-02	2750	1	NA	10	10	10	MM/DD/YYHH:MM	NA	YYTDM00105	YYTDM001	TDM001W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-03	MXXX-03	6920	1	NA	10	10	10	MM/DD/YYHH:MM	NA	YYTDM00106	YYTDM001	TDM001W	MM/DD/YYHH:MM	MM/DD/YY

Figure 2: TYPICAL LCS SUMMARY

EMAX QUALITY CONTROL DATA
LCS ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : SM2540C

MATRIX	: WATER	
DILUTION FACTOR	: 1	1
SAMPLE ID	: MBLK1W	LCS1W
LAB SAMPLE ID	: TDM001WB	TDM001WL
LAB FILE ID	: YYTDM00101	YYTDM00102
DATE PREPARED	: NA	NA
DATE ANALYZED	: MM/DD/YYHH:MM	MM/DD/YYHH:MM
PREP BATCH	: TDM001W	TDM001W
CALIBRATION REF	: YYTDM001	YYTDM001

ACCESSION:

PARAMETER	MB RESULT (mg/L)	SPIKE AMT (mg/L)	BS RESULT (mg/L)	BS REC (%)	QC LIMIT (%)
TDS	ND	1000	1000	100	80-120

Figure 3: TYPICAL SAMPLE DUPLICATE RESULT SUMMARY

EMAX QUALITY CONTROL DATA
SAMPLE DUPLICATE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : SM2540C

MATRIX	: WATER	
DILUTION FACTOR	: 1	1
SAMPLE ID	: ABCDEF-01	ABCDEF-01DUP
LAB SAMPLE ID	: MXXX-01	MXXX-01D
LAB FILE ID	: YYTDM00103	YYTDM00104
DATE PREPARED	: NA	NA
DATE ANALYZED	: MM/DD/YYHH:MM	MM/DD/YYHH:MM
PREP BATCH	: TDM001W	TDM001W
CALIBRATION REF	: YYTDM001	YYTDM001

ACCESSION:

PARAMETER	PARENT RESULT (mg/L)	DUP RESULT (mg/L)	RPD (%)	MAX RPD (%)
TDS	624	609	2	5

Figure 4: TYPICAL CASE NARRATIVE

CASE NARRATIVE

Client : XYZ, INC.

Project: CLEAN PROJECT

SDG : YYMXXX

METHOD SM2540C
TOTAL DISSOLVED SOLIDS

A total of three (3) water samples were received on MM/DD/YY to be analyzed for Total Dissolved Solids in accordance with Method SM2540C and project specific requirements.

Holding Time
Samples were analyzed within the prescribed holding time.

Calibration
Balance calibration verifications were carried out on a frequency specified by the method. All calibration requirements were within acceptance criteria.

Method Blank
Method blank was prepared and analyzed at the frequency required by the project. For this SDG, one (1) method blank was analyzed. TDS was not detected in TDM001WB. Refer to sample result summary form for details.

Lab Control Sample
Lab control sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) LCS was analyzed. Percent recovery for TDS was within LCS QC limits in TDM001WL. Refer to LCS summary form for details.

Matrix QC Sample
Sample duplicate was analyzed and RPD was within expected value.

Sample Analysis
Samples were analyzed according to prescribed analytical procedures. Results were evaluated in accordance to project requirements. For this SDG, all quality control requirements were met.

Appendix 1: SUMMARY OF QUALITY CONTROL PROCEDURES

QC PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	1st Rvw	2nd Rvw
Instrument Calibration	Daily, before and after sample analysis	Analytical balance must be within ± 0.1% of the certified weight or 0.5 mg, whichever is greater[2]	Correct the problem and repeat calibration		
Method Blank	One per preparation batch	Result ≤ ½ LOQ	Re-analyze method blank and all samples processed with the contaminated blank.		
LCS	One LCS per preparation batch	% Recovery: 80% - 120%	Re-analyze the LCS and all associated samples.		
Sample Duplicate	One for every 10 field samples	RPD ≤ 5%	Discuss in the case narrative.		
Comments: Refer to PSR for flagging criteria. 21st and/or 22nd Editions			Reviewed By: Date:		

[2] (See page 4 footnote)

Appendix 2: DEMONSTRATION OF CAPABILITY

DEMONSTRATION OF CAPABILITY
TOTAL DISSOLVED SOLIDS
SM 2540C

SOP: EMAX-2540C Rev. 8
Conc Unit: mg/L
Sample Amount(ml): 20

Analysis date: 01/05/18
Analyzed by: Y. Aquino

PARAMETER	TDA002WL TDA00202	TDA002WC TDA00203	TDA002WX TDA00204	TDA002WY TDA00205	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	Accuracy Acceptance Limits (% Rec)	RSD (%) Criteria	COMMENTS
TOTAL DISSOLVED SOLIDS	969	993	946	986	1000	973	97	20.8	2	80 - 120	≤ 20	Passed

2540CFA: ANALYTICAL RUN LOG

Data FileID	Sample ID	Sample Amt(ml)	Dish #	Dish (g)	1stDry Wt+Dish (g)	Date Time	2ndDry Wt+Dish (g)	Date Time	FinalDry Wt+Dish (g)	Date Time	Diff.ofDry Wt. Rdgs (<0.5mg)	Solids (mg)	TDS (mg/L)	Result (mg/L)

Beginning Balance Check

Std. Wt. (g)	Balance Rdg (g)	Date	Comments
0.1			
5			
100			

Ending Balance Check

Std. Wt (g)	Balance Rdg (g)	Date	Comments
0.1			
5			
100			

Beginning Balance Check

Std. Wt (g)	Balance Rdg (g)	Date	Comments
0.1			
5			
100			

Ending Balance Check

Std. Wt (g)	Balance Rdg (g)	Date	Comments
0.1			
5			
100			

Balance ID: 402426 Weight ID: 31116

Acceptance Criteria: +/- 0.1% or +/- 0.5 mg whichever is greate

StandardID	Desc.	Conc. (mg/L)	ExpDate
	MB	ND	
	LCS	1000	
	pH strip		

QC Check

Lab SampleID	Result	Expected Value	QC Result

Oven Drying

Thermometer ID: T4690-17

1st Drying	☐ Start	Temp 180	°C
	☐ End	Temp	°C
2nd Drying	☐ Start	Temp	°C
	☐ End	Temp	°C

Notes:

SOP

☐ EMAX-2540C Rev. 9

LOQ: 10 mg/L

Analyzedby: _____

Checked by: _____

Date: _____

ANNUAL REVIEW FORM

TOTAL DISSOLVED SOLIDS

SOP#: EMAX-2540C Rev 9 Effective Date: 30-Apr-18

COMMENTS	Reviewed By	Review Date
	[signature]	061319
For updating. Correct 10.1.3.2(800-1000 umho/cm) Update filtration requirement (sec. 10.4.1.6)	[signature]	1/23/2020

STANDARD OPERATING PROCEDURES

TOTAL SUSPENDED SOLIDS

SOP No.:	EMAX-2540D	Revision No.	6	Effective Date:	30-Apr-18
Prepared By:	Tyler Kosaka			Date:	04/27/18
Approved By:	Kenette Pimentel QA Manager			Date:	04.30.18
Approved By:	Caspar Pang Laboratory Director			Date:	4 30 18

Control Number: 2540D-06-

1.0 SCOPE AND APPLICATION

1.1. This method describes the determination of total suspended solids (TSS) in drinking and ground water samples and other aqueous samples of similar matrix.

1.2. This SOP is an adaptation of Methods 2540D-1997 and 2540D-2011, Standard Methods for the Examination of Water and Wastewater, 21st and 22nd Editions.

2.0 SUMMARY OF METHOD

2.1. A well-mixed required amount of sample is filtered through a pre-weighed glass fiber filter and the residue retained on the filter is dried to a constant weight at 103-105°C. The increase of the weight of the filter represents the total suspended solids.

2.2. **Interferences**

2.2.1. Samples high in dissolved solids, such as saline waters, brines and some wastes may be subject to a positive interference. Care must be taken in selecting the filtering apparatus so that washing of the filter and any dissolved solids in the filter minimizes the potential interference.

2.2.2. Exclude large floating particles or submerged agglomerates of non-homogeneous from the sample if it is determined that their inclusion is not representative.

3.0 DETECTION LIMITS

3.1. **Detection Limit (DL) and Limit of Determination (LOD)**

3.1.1. DL and LOD are not applicable for this method.

3.2. **Limit of Quantitation (LOQ)**

3.2.1. Refer to EMAX-QA04 for validation, verification and generation of LOQ.

3.2.2. LOQ is verified at 10 mg/L.

4.0 DYNAMIC RANGE

4.1. 2.5 – 200 mg dried residue

5.0 SAMPLE HOLDING TIME AND PRESERVATION

5.1. **Sample Collection**

5.1.1. Samples received in the laboratory are expected to be contained in HDPE bottles and cooled to ≤ 6° C without freezing.

5.2. **Holding Time**

5.2.1. Analyze samples within seven days from collection date.

5.3. **Preservation**

5.3.1. Store the samples at ≤ 6°C without freezing.

6.0 ASSOCIATED SOPs

6.1.	EMAX-DM01	Data Flow and Review
6.2.	EMAX-QA04	Detection Limit (DL)
6.3.	EMAX-QA05	Training
6.4.	EMAX-QA08	Corrective Action
6.5.	EMAX-QC01	Quality Control for Chemicals
6.6.	EMAX-QC04	Balance Calibration
6.7.	EMAX-QC06	Volumetric Labware & Micropipette Verification
6.8.	EMAX-QC07	Glassware Cleaning
6.9.	EMAX-SM03	Waste Disposal
6.10.	EMAX-SM04	Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS for chemicals listed in this SOP.

7.2. Treat reagents, standards and samples as potential hazard. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, gloves, at all times when performing this procedure.

7.3. If for any reason, reagents and/or samples get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amount of tap water. If irritations or any other discomfort related to the incident persist, inform your supervisor immediately, so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS AND REAGENTS

8.1. Instruments and Supplies

Filtration assembly	Kontes 953805 with vacuum pump or equivalent
Filters	Whatman grade 934AH or equivalent 47 mm diameter, 1.5 µm, or equivalent
Graduated cylinder	1000 ml, 500 ml, 100 ml, 25 ml, 10 ml
Evaporating Vessel	Aluminum dish
Micropipette	Variable
Wash bottles	Plastic
Oven	Convection oven to deliver 103-105°C, Fisher or equivalent
Balance	Sartorius H-51 accurate to 0.0001 g. or equivalent
Desiccator	With color indicator desiccant

8.2. Chemicals and Reagents

8.2.1. Reagent Water – Type II

9.0 STANDARDS

9.1. Lab Control Standard (LCS) – ERA or equivalent

10.0 PROCEDURES

10.1. Sample Preparation

10.1.1. Glass-fiber Filter Treatment

10.1.1.1. Assemble filtration system, having the wrinkled side of the filter facing up. Record the filter lot #.

10.1.1.2. Apply vacuum and rinse the filter with three successive 20 ml portions of reagent water.

10.1.1.3. Continue to suction until no trace of water is evident.

10.1.1.4. Turn off the pump and release the excess pressure.

10.1.1.5. Carefully transfer the filter into an evaporating dish and oven-dry at 103-105°C for one hour.

10.1.1.6. Cool in a desiccator for at least 30 minutes. Weigh the dry filter and dish. Record the weight.

10.1.1.7. Repeat steps 10.1.1.5 to 10.1.1.6. Check that the weight is constant or weight change is less than 4% of the previous weighing or 0.5 mg, whichever is less. Otherwise, repeat drying and cooling cycle until this is achieved.

10.1.2. Preparative Batch

10.1.2.1. Bring sample to room temperature.

10.1.2.2. For a maximum of 20 field samples, prepare one method blank using a reagent water, one LCS (refer to Section 9.0) and two sample duplicates.

10.2. **Instrument Parameters**

10.2.1. Set the convection oven to deliver 103-105°C.

10.3. **Calibration**

10.3.1. Open the TSS template (SS.xls) and click on the "**Save As**" button, input your electronic signature.

10.3.2. Using the 0.1 g, 5 g and 100 g standard weights, verify balance calibration prior and after use. Transmit readings by pressing the balance "Print" button into the appropriate allocated cells for balance calibration check.

10.3.3. Record the balance ID into the designated cell for balance ID.

10.3.4. Calibration must be within ± 0.1% or 0.5 mg whichever is higher[1].

10.3.5. Verify the calibration of the balance, before and after each analytical batch. If calibration is not verified after the measurements re-calibrate the balance and re-weigh the batch.

10.4. **Analysis**

10.4.1. Populate the sample IDs under field "Sample ID".

10.4.2. Take a treated glass-fiber filter (refer to Section 10.1) from the desiccator and weigh. Transmit the weight by pressing the balance print button into the appropriate cell ["Wt. of Filter +Dish"].

10.4.3. Using a filter tong, transfer the filter into the filtering apparatus funnel. Wet the filter paper with reagent water wash bottle. Turn the vacuum pump on.

10.4.4. Shake the sample/QCs thoroughly and rapidly transfer into a graduated cylinder an appropriate volume to satisfy project LOQ (e.g. 100 ml sample for 10 mg/L LOQ). Transfer the measured sample into the filtering apparatus.

10.4.5. Rinse the graduated cylinder twice with approximately 10 ml portions of reagent water. Pass the rinsate through the filter. Give the filter a final rinse of approximately 10 ml.

10.4.6. Continue suction until no trace of water is evident. Turn-off the vacuum pump and release the excess pressure.

10.4.7. Carefully return the filter into its evaporating vessel and oven-dry at 103-105°C for at least 1 hour.

10.4.8. Cool the filter and dish in a desiccator and weigh. Check if dried residue is between 2.5 mg to 200 mg.

[1] Department of Defense (DoD) & Department of Energy (DoE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories Version 5.1, Module 2 Section 5.5.13.1, Table 5.1

- If dried residue is < 2.5 mg, repeat sample analysis using higher sample aliquot volume up to 1 liter to ensure that representative sub-sample is taken, unless otherwise specified by the project.
- If residue is greater than 200 mg, repeat the analysis using lesser volume of sample estimated from the result.

10.4.9. Repeat drying process until weight is constant or until weight loss is < 0.0005 g.

10.4.10. Record the first and the last two weight determinations.

10.5. **Calculations**

10.5.1. Calculate for Total Suspended Solids (TSS)

$$TSS, mg/L = \frac{(R-D)\times 1000}{S} \qquad \text{Eq.-10.5.1}$$

where:

R – Weight of filter + residue + dish, mg

D – Weight of filter + dish, mg

S – Volume of sample analyzed, ml

10.5.2. Calculate for Percent Recovery

$$\%Recovery = \frac{(C_f - C)}{C_s}\times 100 \qquad \text{Eq.-10.5.2}$$

where:

C_f – Concentration found

C – Concentration of the sample (use 0 for LCS)

C_s – Concentration of spike

10.5.3. Calculate for Precision

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C1+C2}{2}\right)} x100 \qquad \text{Eq.-10.5.3}$$

where:

RPD – Relative Percent Difference

C_1 – Measured concentration of the first sample aliquot

C_2 – Measured concentration of the second sample aliquot

10.6. **Data Reduction**

10.6.1. Print a copy of the run log.

10.6.2. Highlight the data to be reported.

10.6.3. Keep all other data generated with the analytical folder marked with “For record only”.

10.7. **Report Generation**

10.7.1. Generate the method.txt file, sample results and QC summaries using GRAV.exe.

10.7.2. Generate the case narrative using CN00.exe.

10.7.3. Arrange the analysis package in sequence as detailed below.

10.7.3.1. Case Narrative

10.7.3.2. Sample Results

10.7.3.3. LCS/LCSD Summary

10.7.3.4. Sample Duplicate Result Summary

10.7.3.5. Analytical Run Log

10.7.3.6. Non-Conformance Report (if any)

10.8. **Data Review**

10.8.1. Perform a 100% data review in accordance to EMAX-DM01 and the PSR.

10.8.2. **Check QC Criteria**

10.8.2.1. Check the run log that samples are analyzed in conformance to the QC frequency and all pertinent records are logged.

10.8.2.2. Check that the following conforms to the QC requirement.

- ✓ Holding Time
- ✓ Calibrations
- ✓ Lab Control Sample
- ✓ Sample Duplicate

10.8.3. **Check Qualitative Determination**

10.8.3.1. Check that the samples were analyzed within the holding time.

10.8.3.2. Check the sample reported against the COC for completeness

10.8.4. **Check Quantitation**

10.8.4.1. Check that results are calculated as described in Section 10.5.

10.8.4.2. Check the generated reports against the run log. Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.

10.8.4.3. Check that only reportable values are included in the report. (Samples between 2.5 – 200 mg per sample aliquot volume that satisfies the RL/LOQ requirement.)

10.8.5. Review the case narrative and check that it accurately describes what transpired in the analytical process. Edit as necessary to reflect essential issues not captured by the case narrative generator program.

10.8.6. Submit the analytical folder for secondary review.

10.9. **Preventive Maintenance**

10.9.1. Check the vacuum pump oil level prior to its use.

10.9.2. Clean filter assembly thoroughly after each use.

11.0 QUALITY CONTROL

11.1. Acceptance criteria for each Quality Control procedure, is summarized in Appendix 1.

11.2. **Analytical Batch QC**

11.2.1. Glass-fiber filters must be properly treated prior to their use.

11.2.2. Filter assembly must be thoroughly cleaned prior to its use.

11.2.3. Balance must be calibrated prior to its use. Refer to EMAX-QC04 for details.

11.2.4. Pipettes must be calibrated prior to its use. Refer to EMAX-QC06 for details.

11.2.5. Reagents are subjected to QC check prior to its use. Refer to EMAX-QC01 for details.

11.3. **Preparation Batch QC**

11.3.1. 20 is the maximum number of original field samples in a prep batch unless otherwise specified by the project.

11.3.2. Prepare method blank, LCS, and sample duplicate(s) in every prep batch, unless otherwise specified by the project. They are subjected to the same process that the field samples undergo as described in Section 10.

11.3.3. Properly treat all lab wares used in the sample preparation as specified in EMAX-QC07.

11.4. **Method QC**

11.4.1. A valid LOQ must exist prior to sample analysis. Refer to EMAX-QA04 for details. Where project requires LOQ at < 10 mg/L, verify project LOQ.

11.4.2. All analysts conducting this analysis must have an established Demonstration of Capability (DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTION

12.1. Corrective action for each quality control procedure is summarized in Appendix 1.

12.2. **Preparation Batch QC**

12.2.1. For insufficient amount of sample(s), inform the supervisor immediately for further action.

12.2.2. If balance calibration check is non-compliant, inform the supervisor immediately for further instruction.

12.2.3. When method blank is non-compliant, investigate the source of the problem and institute resolution to correct, minimize or eliminate the problem.

12.2.4. If LCS is non-compliant, investigate the source of the problem to institute resolution to correct, minimize or eliminate the problem.

12.2.5. If sample duplicate is non-compliant, sample matrix is suspected to be heterogeneous. Perform corrective action as directed by the project otherwise, discuss in case narrative.

12.3. A Non-Conformance Report (NCR) is required when the following circumstances occur:

- Anomalies other than specified in Appendix 1, is observed.
- Sample is out of technical holding time.

12.3.1. Refer to EMAX-QA08 for NCR details.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of standards and reagents that may go to the wastewater drains.

14.0 WASTE MANAGEMENT

14.1. No samples may be dumped on the laboratory sink.

14.2. Separate and properly identify all unused and expired analytical standards for proper disposal.

14.3. Place all waste generated during analytical process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, expired analytical standards and other waste generated during the analytical process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. According to the Method Update Rule (MUR) and Title 40 Code of Federal Regulation, Part 136, EPA Method 160.2 is not an approved method. If a client requires Method 160.2, EMAX shall perform analysis using Method 2540D-1997/2011 to comply with the MUR and client shall be duly informed.

15.2. **Definition of Terms**

15.2.1. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagent.

15.2.1.1. **Preparation batch** – is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.2.1.2. **Analytical batch** – is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices, preparation batches, and can exceed 20 samples.

15.2.2. Limit of Quantitation (LOQ) – is at the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial and calibration standard.

15.2.3. Safety Data Sheet (SDS) – is where the physical data, toxicology and safety precaution of a certain substance is listed.

15.2.4. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.2.5. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical to monitor contamination.

15.2.6. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.2.7. Lab Control Sample Duplicate (LCSD) – is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.2.8. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.2.9. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.2.10. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.2.11. Matrix – is a component or form of a sample.

15.2.12. Reagent Water – is purified water free from any target analyte or any other substance that may interfere with the analytical process.

15.3. **Application of EMAX QC Procedures**

15.3.1. The procedures and QC criteria specified in this SOP applies to all projects when performing Total Suspended Solids. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.4. **Department of Defense (DoD) and Department of Energy (DoE) Projects**

15.4.1. Samples from DoD and DoE sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD and DoE Consolidated Quality Systems Manual (QSM), latest update, is applied.

15.5. Note that this SOP was revised on the merit of updating according to 40 CFR Methods Update Rule. There is no significant analytical changes made from that of the previous version.

16.0 REFERENCES

16.1. Standard Methods for the Examination of Water and Waste Water, 21st and 22nd Editions, Methods 2540D-1997 and 2540D-2011

16.2. Title 40 Code of Federal Regulations, Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants, latest edition

16.3. EMAX Quality Systems Manual, as updated

When printed valid only until 5/2/18 EOB.

16.4. Department of Defense (DoD) and Department of Energy (DoE) Consolidated Quality Systems Manual, as updated

17.0 APPENDICES

17.1. **Figures**

17.1.1. Figure 1 Typical Sample Result Summary

17.1.2. Figure 2 Typical LCS/LCSD Summary

17.1.3. Figure 3 Typical Sample Duplicate Result Summary

17.1.4. Figure 4 Typical Case Narrative

17.2. **Appendices**

17.2.1. Appendix 1 Summary of Quality Control Procedures

17.2.2. Appendix 2 Demonstration of Capability

17.3. **Forms**

17.3.1. 2540DFA Analytical Run Log

Figure 1: TYPICAL SAMPLE RESULT SUMMARY

METHOD SM2540D
TOTAL SUSPENDED SOLIDS

Client : XYZ, INC.
Project : CLEAN PROJECT
Batch No. : YYMXXX
Matrix : WATER
InstrumentID : 402426

CLIENT SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DFxPREP FACTOR	MOIST (%)	LOQ (mg/L)	LOD (mg/L)	ANALYSIS DATETIME	PREPARATION DATETIME	DATA FILE ID	CAL REF	PREP BATCH	COLLECTION DATETIME	RECEIVED DATETIME
MBLK1W	SSM001WB	ND	1	NA	10	10	MM/DD/YYHH:MM	NA	YYSSM00101	YYSSM001	SSM001W	NA	NA
LCS1W	SSM001WL	102	1	NA	10	10	MM/DD/YYHH:MM	NA	YYSSM00102	YYSSM001	SSM001W	NA	NA
LCD1W	SSM001WC	106	1	NA	10	10	MM/DD/YYHH:MM	NA	YYSSM00103	YYSSM001	SSM001W	NA	NA
ABCDEF-01	MXXX-01	50.2	1	NA	10	10	MM/DD/YYHH:MM	NA	YYSSM00107	YYSSM001	SSM001W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-01DUP	MXXX-01D	52.2	1	NA	10	10	MM/DD/YYHH:MM	NA	YYSSM00108	YYSSM001	SSM001W	MM/DD/YYHH:MM	MM/DD/YY

Figure 2: TYPICAL LCS/LCSD SUMMARY

EMAX QUALITY CONTROL DATA
LAB CONTROL SAMPLE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : SM2540D

MATRIX : WATER % MOISTURE: NA

DILUTION FACTOR:	1	1	1
SAMPLE ID :	MBLK1W	LCS1W	LCD1W
LAB SAMPLE ID :	SSM001WB	SSM001WL	SSM001WC
LAB FILE ID :	YYSSM00101	YYSSM00102	YYSSM00103
DATE EXTRACTED :	NA	NA	NA
DATE ANALYZED :	MM/DD/YYHH:MM	MM/DD/YYHH:MM	MM/DD/YYHH:MM
PREP BATCH :	SSM001W	SSM001W	SSM001W
CALIBRATION REF:	YYSSM001	YYSSM001	YYSSM001

ACCESSION:

PARAMETER	MB RESULT (mg/L)	SPIKE AMT (mg/L)	BS RESULT (mg/L)	BS REC (%)	SPIKE AMT (mg/L)	BSD RESULT (mg/L)	BSD REC (%)	RPD (%)	QC LIMIT (%)	MAX RPD (%)
TSS	ND	96.4	102	106	96.4	98.8	102	3	80-120	5

Figure 3: TYPICAL SAMPLE DUPLICATE RESULT SUMMARY

EMAX QUALITY CONTROL DATA
SAMPLE DUPLICATE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : SM2540D

MATRIX	WATER	
DILUTION FACTOR	1	1
SAMPLE ID	ABCDEF-01	ABCDEF-01DUP
LAB SAMPLE ID	MXXX-01	MXXX-01D
LAB FILE ID	YYSSM00107	YYSSM00108
DATE PREPARED	NA	NA
DATE ANALYZED	MM/DD/YYHH:MM	MM/DD/YYHH:MM
PREP BATCH	SSM001W	SSM001W
CALIBRATION REF	YYSSM001	YYSSM001

ACCESSION:

PARAMETER	PARENT RESULT (mg/L)	DUP RESULT (mg/L)	RPD (%)	MAX RPD (%)
TSS	50.2	52.2	4	5

Figure 4: TYPICAL CASE NARRATIVE

CASE NARRATIVE

Client : XYZ, INC.

Project: CLEAN PROJECT

SDG : YYMXXX

METHOD SM2540D
TOTAL SUSPENDED SOLIDS

One (1) water sample was received on MM/DD/YY to be analyzed for Total Suspended Solids in accordance with Method SM2540D and project specific requirements.

Holding Time
The sample was analyzed within the prescribed holding time.

Calibration
Balance calibration verifications were carried out on a frequency specified by the method. All calibration requirements were within acceptance criteria.

Method Blank
Method blank was prepared and analyzed at the frequency required by the project. For this SDG, one (1) method blank was analyzed. TSS was not detected in SSM001WB. Refer to sample result summary form for details.

Lab Control Sample
Lab control sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) set of LCS/LCD was analyzed. SSM001WL/SSM001WC were within LCS limits. Refer to LCS summary form for details.

Matrix QC Sample
Sample duplicate was analyzed and RPD was within expected value.

Sample Analysis
The sample was analyzed according to prescribed analytical procedures. Results were evaluated in accordance to project requirements. For this SDG, all quality control requirements were met.

Appendix 1: SUMMARY OF QUALITY CONTROL PROCEDURES

QC PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	1st Rvw	2nd Rvw
Instrument Calibration	Daily, before and after sample analysis	Analytical balance must be within ± 0.1% of the certified weight or 0.5 mg, whichever is greater[2]	Correct the problem and repeat calibration		
Method Blank	One per preparation batch	Result ≤ ½ LOQ	Re-prep and re-analyze method blank and all samples processed with the contaminated blank.		
LCS	One LCS per preparation batch	% Recovery : 80-120%	Re-prep and re-analyze the LCS and all associated samples.		
Sample Duplicate	One per every 10 field samples	RPD ≤ 5%	Discuss in case narrative.		
Comments: Refer to PSR for flagging criteria.			Reviewed By:		
21st and/or 22nd Editions			Date:		

[2] (See page 4)

Appendix 2: DEMONSTRATION OF CAPABILITY

DEMONSTRATION OF CAPABILITY
TOTAL SUSPENDED SOLIDS
SM 2540D

SOP: EMAX-2540D
Conc Unit: mg/L
Sample Amount(ml): 100

Analysis date: 02/02/18
Analyzed by: G. Hernandez

PARAMETER	SSB001WL / SSB00102	SSB001WC / SSB00103	SSB001WX / SSB00104	SSB001WY / SSB00105	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	Accuracy Acceptance Limits (% Rec)	RSD (%) Criteria	COMMENTS
TOTAL SUSPENDED SOLIDS	97.1	98.4	97.2	97.6	96.4	97.6	101	0.6	1	80 - 120	≤ 20	Passed

2540DFA: ANALYTICAL RUN LOG

Data FileID	Sample ID	Sample Amt(ml)	Dish + Filter #	1stWt. Dish+ Filter(g)	2ndWt. Dish+ Filter(g)	1stDry Wt+ Dish(g)	Date Time	2ndDry Wt+ Dish(g)	Date Time	FinalDry Wt+ Dish(g)	Date Time	Diff.of DryWt. Rdgs (<0.5mg)	Solids (mg)	TSS (mg/L)	Result (mg/L)

Beginning Balance Check

Std. Wt. (g)	Balance Rdg (g)	Date	Comments
0.1			
5			
100			

Ending Balance Check

Std. Wt (g)	Balance Rdg (g)	Date	Comments

Balance ID: 402426 Weight ID: 31116

Acceptance Criteria: +/- 0.1% or 0.5 mg whichever is greater

StandardID	Desc.	Conc. (mg/L)	ExpDate
	MB	ND	
	LCS		
	pH Strip		

QC Check

LabSampleID	Result	Expected Value	QC Result

Oven Drying

		Thermometer ID:	
1st Drying	☐ Start	Temp	°C
	☐ End	Temp	°C
2nd Drying	☐ Start	Temp	°C
	☐ End	Temp	°C
3rd Drying	☐ Start	Temp	°C
	☐ End	Temp	°C

Notes:

SOP

☐ EMAX-2540D 6

LOQ: 10 mg/L

Filter Lot#:

Micropipette ID:

Analyzedby:

Checked by:

Date:

ANNUAL REVIEW FORM

TOTAL SUSPENDED SOLIDS

SOP#: EMAX-2540D Rev 6 Effective Date: 30-Apr-18

COMMENTS	Reviewed By	Review Date
	[signature]	06/3/19
Update filtration requirement (Section 10.4.6.).	[signature]	04/20/2020

STANDARD OPERATING PROCEDURES

PURGE AND TRAP

SOP No.:	EMAX-5030	Revision No.	4	Date:	22-Sep-17
Prepared By:	Diem Nguyen			Date:	09.21.17
Approved By:	Kenette Pimentel QA Manager			Date:	09.21.17
Approved By:	Caspar Pang Laboratory Director			Date:	09-21-17

Control Number: **5030-04-**

1.0 SCOPE AND APPLICATION

1.1. This method describes a purge-and-trap procedure for the analysis of volatile organic compounds (VOCs) in aqueous samples and water miscible liquid samples. It also describes the analysis of high concentration sample. This method is applicable for all determinative methods requiring purge and trap for above mentioned matrices.

1.2. This method can be used for volatile organic compounds listed in the volatile determinative SOPs. Other compounds maybe determined upon successful demonstration of capability.

1.3. This SOP is an adaptation of SW846 Method 5030C.

2.0 SUMMARY OF METHOD

2.1. Aqueous Samples. Helium gas is bubbled through an aqueous solution or suspension at a predetermined flow rate, and volatile components are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where volatiles are absorbed. After purging is completed, the sorbent column is heated and back flushed with helium to desorb the components onto a GC column.

2.2. High Concentration samples are extracted with methanol. An aliquot of the methanol extract is combined with organic free reagent water in the purging chamber. It is then analyzed by purge and trap GC or GC/MS following the normal aqueous method.

2.3. **Interferences**

2.3.1. Impurities in the purge gas and from organic compounds out-gassing from the plumbing ahead of the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination by running method blanks. The use of non-polytetrafluoroethylene (non-PTFE) plastic coating, non-PTFE thread sealant, or flow controllers with rubber components in the purging device must be avoided. These compounds will result in interferences or false positives in the determinative step.

2.3.2. Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) during shipment or storage. A trip blank prepared from organic-free reagent water and carried through sampling and handling serves as a check on such contamination.

2.3.3. Contamination by carryover can occur whenever high-concentration and low-concentration samples are analyzed in sequence. Where practical, samples with unusually high concentrations of analytes should be followed by an analysis of organic-free reagent water to check for cross-contamination.

2.3.4. Special pre-cautions must be taken to determine methylene chloride. The volatile area should be isolated from all atmospheric sources of methylene chloride; otherwise random background levels will result.

3.0 DETECTION LIMITS

3.1. Refer to applicable analytical SOP.

4.0 DYNAMIC RANGE

4.1. Refer to applicable analytical SOP.

5.0 SAMPLE HOLDING TIME AND PRESERVATION

5.1. **Holding Time**

5.1.1. Analyze preserved samples within 14 days from sampling date.

5.1.2. Analyze samples with pH > 2 within 7 days from sampling date.

5.2. **Preservation**

5.2.1. Keep both soil and aqueous samples cool at ≤ 6°C without freezing.

5.2.2. Preserve aqueous samples with hydrochloric acid to pH < 2. The acid preservation of the aqueous samples must be done in the field; the laboratory will only confirm the acid preservation at the time of analysis.

6.0 ASSOCIATED SOPs

6.1.	EMAX-8015G	Gasoline Range Organics
6.2.	EMAX-8260	Volatile Organics by GC/MS
6.3.	EMAX-8260C	Volatile Organics by GC/MS
6.4.	EMAX-8260SIM	Volatile Organics by GC/MS SIM
6.5.	EMAX-M8260SIM	1-4,Dioxane by GC/MS SIM
6.6.	EMAX-TCPSIM	1,2,3-Trichloropropane by GC/MS SIM
6.7.	EMAX-QA05	Training
6.8.	EMAX-QA08	Corrective Action
6.9.	EMAX-QC01	Quality Control for Chemicals
6.10.	EMAX-QC07	Glassware Cleaning
6.11.	EMAX-SM03	Waste Disposal
6.12.	EMAX-SM04	Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS for chemicals listed in this SOP.

7.2. Treat reagents, standards, and samples as potential hazards. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, and gloves at all times when performing this procedure. Perform all sample and standard handling in the fume hood.

7.3. If for any reason, solvent and/or other reagents get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amounts of tap water. If irritations or any other discomfort related to the incident persist, inform your supervisor immediately so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS AND REAGENTS

8.1. **Instruments and Supplies**

8.1.1. Automatic Sample Purger: Tekmar ALS 2016 or OI MPM-.6; Archon; DynaSoil

8.1.2. Trap: VOCARB 4000 (Supelco) or equivalent

8.1.3. Concentrator: O.I. 4560, 4460 or Tekmar LCS 2000; DynaSoil or equivalent

8.1.4. Syringe: 5 mL, 25 mL, gas-tight with Luerlok tip

8.1.5. Microsyringe: 2, 10, 25, 50, 100 µl (Hamilton 702N or equivalent)

8.1.6. Sparging Vessel: 40 mL , 20 mL test tubes

8.1.7. Balance: Sartorius, Model LC620, top loading, capable of weighing 100 g ± 0.01 g

8.2. **Chemicals and Reagents**

8.2.1. Reagents: Organic free reagent water, generated from active charcoal column

8.2.2. Ultra-high purity methanol

9.0 STANDARDS

9.1. Preparation of standard is outlined in Section 9.0 of applicable analytical SOP.

9.2. **Spiking Standard Solution**

9.2.1. Refer to applicable analytical SOP.

10.0 PROCEDURES

10.1. **Sample Preparation**

10.1.1. Water Samples

10.1.1.1. Label sample vials to include the following:

- Method Blank (MB)
- Lab Control Sample/Lab Control Sample Duplicate (LCS/LCD)
- Matrix Spike/Matrix Spike Duplicate (MS/MSD)[1]
- Field Samples according to lab sample ID.

[1] Adhere to PSR, some projects requires MS/MSD only on designated matrix QC field sample(s).

10.1.1.2. Pull out samples from the sample control room and record samples withdrawn in the internal chain of custody (ICOC).

10.1.1.3. Line up field samples corresponding to the labeled sample vials.

10.1.1.4. Using a 10 mL or 25 mL syringe, remove the plunger, close the syringe hub and fill the syringe barrel. Insert the syringe plunger back and measure the appropriate sample amount needed for analysis. Use organic free water for MB, LCS and LCD.

10.1.1.5. Add the surrogate and internal standard to all samples. Add LCS standard to LCS and LCD, MS and MSD (if required). Inject spiking solution through the syringe hub.

As a precaution, consider separating LCS, LCD, MS and MSD samples from the rest of the samples to prevent spiking the sample that is not intended for positive QC sample.

10.1.1.6. Transfer the measured sample into the corresponding labeled vial. Careful delivery must be considered to prevent air leak. Invert the sample source vial to indicate that subsampling is completed for that sample.

10.1.1.7. Samples are now ready to be placed on the purge and trap autosampler.

10.1.1.8. When only one vial of sample is available, samples must be analyzed following a passing DCC and associated QC. A 5X and 25X dilutions (or per priori knowledge) shall be prepared simultaneously, in case dilution is needed. These extra steps, is expected to minimize occurrences of un-reportable results.

10.1.1.9. Check sample pH if it is ≤ 2 (when preserved) and presence of residual chlorine if it is ≤ 5 mg/L. Record sample pH and residual chlorine observations on the analysis log.

In the event that sample pH is > 2 and it is beyond the sample holding time (7 days) or residual chlorine is > 5mg/L, inform the supervisor immediately.

10.1.2. High Level

10.1.2.1. Weigh 5 ± 0.1 g of sample into a 20 mL vial. Using a 5 mL syringe, add 5 mL of methanol and mix thoroughly for 5 minutes. Allow the mixture to stand so that the sediment can settle.

10.1.2.2. Prepare 5 mL of organic free water solution with internal standard and surrogate. Withdraw up to 100 µl of methanol extract using an appropriate microsyringe.

10.1.2.3. Add the methanol extract to the 5 mL syringe through the Luerlok tip and pull the plunger slowly to make room for the extract, taking into consideration that no air is introduce into the syringe.

10.1.2.4. Samples are now ready to be placed on the purge and trap autosampler.

10.2. **Instrument Parameters**

10.2.1. Refer to applicable analytical method.

10.3. **Calibration**

10.3.1. Refer to applicable analytical method.

10.4. **Analysis**

10.4.1. Refer to applicable analytical method

10.5. **Calculations**

10.5.1. Dilution factor (DF)

10.5.1.1. **Low Level**

$$DF = \frac{V}{S}$$ Eq.-10.5. 1.1

where:

V – Purge volume

S – Sample amount

10.5.1.2. **High Level**

$$DF = \frac{V}{E} \times \frac{EV}{S}$$ Eq.-10.5.1.2

where:

V – Purge volume

E – Extract amount

EV – Extract volume

S – Sample amount

10.5.2. Refer to applicable analytical SOP.

10.6. **Data Reduction**

10.6.1. Refer to applicable analytical SOP.

10.7. **Report Generation**

10.7.1. Refer to applicable analytical SOP.

10.8. **Data Review**

10.8.1. Refer to applicable analytical SOP.

10.9. **Preventive Maintenance**

10.9.1. Refer to applicable analytical SOP.

11.0 QUALITY CONTROL

11.1. The sequence of runs and quality control acceptance criteria are specified in the individual analytical SOP. They include method blank, calibrations, lab control samples, and matrix spike/matrix spike duplicate.

11.2. Reagents and standards must undergo quality control check prior to use. Refer to EMAX-QC01 for details.

11.3. Properly treat all lab wares used in the sample preparation as specified in EMAX-QC07.

11.4. All analysts conducting this method must demonstrate capability (IDOC/DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTION

12.1. Refer to applicable analytical SOP.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of solvent that may go to wastewater drains.

13.2. Handle solvents and extracts and preparations of standards under the fume hood.

13.3. Keep extraction area clean to prevent contamination of sample.

14.0 WASTE MANAGEMENT

14.1. No samples may be dumped on the laboratory sink.

14.2. Separate and properly identify all unused expired standards for proper disposal.

14.3. Place all wastes generated during the process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, expired standards and other waste generated during the process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. **Definition of Terms**

15.1.1. Analyte – the specific chemicals or components for which a sample is analyzed; may be a group of chemicals that belong to the same chemical family, and which are analyzed together.

15.1.2. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.1.2.1. **Preparation batch** – is composed of one to 20 field samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate (if required).

15.1.2.2. **Analytical batch** – is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices; preparation batches, and may exceed 20 samples.

15.1.3. Safety Data Sheet (SDS) – is a written information concerning a chemical physical properties, toxicity, health hazards, fire hazard and reactivity data including storage, spill and handling pre-cautions.

15.1.4. Calibration - is a determinant measured from a standard to obtain the correct value of an instrument output.

15.1.5. Calibration Blank – is a target-analyte-free solvent subjected to the entire analytical process to establish zero baseline or background value.

15.1.6. Calibration Check Compounds (CCC) - evaluate the integrity of the system. Variability of these compounds may indicate system leak or reactive sites in the column.

15.1.7. Instrument Method - is a file generated to contain the instrument calibration and instrument parameter settings for a particular analysis.

15.1.8. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical to monitor contamination.

15.1.9. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.1.10. Lab Control Sample Duplicate (LCSD) – is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.1.11. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.1.12. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.1.13. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.1.14. Matrix – is a component or form of a sample.

15.1.15. Matrix Spike (MS) – is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyzed to monitor matrix effect on a method's recovery efficiency.

15.1.16. Matrix Spike Duplicate (MSD) – is a replicate of MS analyzed to monitor precision or recovery.

15.1.17. Response Factor - is the ratio of the peak area of the target compound in the sample or sample extract.

15.1.18. Surrogate – are compounds added to every blank, sample, matrix spike, matrix spike duplicate and standard; used to evaluate analytical efficiency by measuring recovery. Compounds not expected to be detected in environmental media.

15.1.19. System Performance Check Compounds (SPCC) - are compounds that are used to check compound stability and to check for degradation caused by contaminated lines or active sites in the system.

15.1.20. Reagent Water – is purified water free from any target analyte or any other substances that may interfere with the analytical process.

15.2. **Application of EMAX QC Procedures**

15.2.1. The procedures and QC criteria summarized in this SOP applies to all projects when performing purgeable volatile analyses. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.3. **Department of Defense (DoD) and Department of Energy (DoE) Projects**

15.3.1. Samples from DoD and DoE sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD Quality System Manual (QSM), latest update, is applied.

16.0 REFERENCES

16.1. U.S. EPA Method 5030C; SW846, Rev. 3, 2003

16.2. EMAX Quality Systems Manual, as updated

17.0 APPENDICES

17.1. **Appendices**

17.1.1. Appendix 1 Demonstration of Capability for 8260

17.1.2. Appendix 2 Demonstration of Capability for 8015

17.2. **Forms**

17.2.1. 5030FAA Analytical Log for 8260

17.2.2. 5030FAB Analytical Run Log for 8015

Appendix 1: DEMONSTRATION OF CAPABILITY FOR 8260

DEMONSTRATION OF CAPABILITY
EPA 8260B / 8260C

MATRIX: WATER

Analytical SOP: EMAX-8260 Rev. 10
Analytical SOP: EMAX-8260C Rev. 1
Extraction SOP: EMAX-5030 Rev.3
Unit: µg/L
Sample Amount(ml): 5
Sample Purge(ml): 5

Analysis date: 01/04/17
Analyzed by: O. Dinh

PARAMETER	RAP020 VW02A04L	RAP021 VW02A04C	RAP022 VW02A05L	RAP023 VW02A05C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
Acetone	244	248	246	246	250	246.0	98	1.633	1	40 - 160	Passed
Acetonitrile	478	483	487	491	500	484.8	97	5.560	1	30 - 160	Passed
Acrolein	207	203	205	210	250	206.3	83	2.986	1	30 - 160	Passed
Acrylonitrile	259	264	262	262	250	261.8	105	2.062	1	30 - 160	Passed
Benzene	52.5	50.7	50.2	50.7	50	51.03	102	1.011	2	70 - 130	Passed
Bromobenzene	49.6	48.0	46.4	45.2	50	47.30	95	1.915	4	70 - 130	Passed
Bromochloromethane	48.7	48.2	47.4	47.3	50	47.90	96	0.668	1	70 - 130	Passed
Bromodichloromethane	49.0	48.6	48.1	48.1	50	48.5	97	0.436	1	70 - 130	Passed
Bromoform	45.6	47.0	44.3	42.9	50	45.0	90	1.756	4	70 - 130	Passed
Bromomethane	41.6	42.1	40.4	40.9	50	41.25	83	0.751	2	60 - 130	Passed
tert-Butyl alcohol	248	263	260	259	250	257.5	103	6.557	3	50 - 150	Passed
2-Butanone (MEK)	250	261	256	259	250	256.5	103	4.796	2	20 - 160	Passed
n-Butylbenzene	58.8	58.5	53.6	57.8	50	57.18	114	2.420	4	60 - 130	Passed
sec-Butylbenzene	57.2	56.6	51.7	54.2	50	54.93	110	2.510	5	70 - 130	Passed
tert-Butylbenzene	53.2	52.9	47.8	49.9	50	50.95	102	2.575	5	70 - 130	Passed
Carbon disulfide	53.7	50.0	53.0	54.1	50	52.7	105	1.857	4	60 - 140	Passed
Carbon tetrachloride	57.0	54.0	51.3	54.5	50	54.2	108	2.337	4	60 - 130	Passed
Chlorobenzene	48.8	48.8	48.4	48.2	50	48.6	97	0.300	1	70 - 130	Passed
2-Chloroethyl vinyl ether	51.2	51.9	51.2	50.8	50	51.28	103	0.457	1	30 - 160	Passed
Chloroethane	45.8	45.3	44.2	44.2	50	44.88	90	0.806	2	70 - 140	Passed
Chloroform	53.3	51.2	50.7	51.1	50	51.6	103	1.170	2	70 - 130	Passed
1-Chlorohexane	55.0	54.3	49.9	53.1	50	53.08	106	2.257	4	30 - 160	Passed
Chloromethane	40.8	42.4	40.7	38.7	50	40.65	81	1.515	4	40 - 140	Passed
2-Chlorotoluene	57.2	57.1	51.6	53.3	50	54.80	110	2.801	5	30 - 160	Passed
4-Chlorotoluene	55.3	53.0	52.5	51.4	50	53.05	106	1.642	3	10 - 160	Passed
Dibromochloromethane	45.6	46.1	44.8	45.1	50	45.4	91	0.572	1	70 - 130	Passed
1,2-Dibromo-3-chloropropane	48.9	49.3	47.5	50.3	50	49.0	98	1.160	2	60 - 140	Passed
1,2-Dibromoethane	44.8	46.3	45.0	44.6	50	45.2	90	0.768	2	70 - 130	Passed
Dibromomethane	46.4	46.8	46.7	46.8	50	46.7	93	0.189	0	70 - 130	Passed
1,1-Dichloroethane	53.4	51.8	51.3	51.6	50	52.03	104	0.939	2	70 - 130	Passed
1,2-Dichloroethane	49.6	48.7	48.4	48.5	50	48.8	98	0.548	1	60 - 130	Passed
1,2-Dichlorobenzene	47.7	47.4	45.4	46.9	50	46.85	94	1.021	2	70 - 130	Passed
1,3-Dichlorobenzene	50.2	49.3	47.6	48.2	50	48.83	98	1.156	2	70 - 130	Passed
trans-1,4-Dichloro-2-Butene	55.2	55.5	52.2	52.2	50	53.78	108	1.823	3	30 - 160	Passed
1,4-Dichlorobenzene	50.2	49.5	47.6	49.4	50	49.18	98	1.109	2	70 - 130	Passed
Dichlorodifluoromethane	39.7	38.8	32.3	36.7	50	36.9	74	3.299	9	50 - 150	Passed
1,1-Dichloroethene	55.4	53.6	50.8	54.1	50	53.48	107	1.938	4	60 - 130	Passed
cis-1,2-Dichloroethene	51.0	49.7	48.8	49.1	50	49.65	99	0.975	2	50 - 140	Passed
trans-1,2-Dichloroethene	56.1	53.9	51.9	53.1	50	53.75	108	1.769	3	10 - 160	Passed
Dichlorofluoromethane	53.3	51.5	51.2	53.6	50	52.4	105	1.225	2	30 - 160	Passed
1,1-Dichloropropene	53.0	50.5	48.4	49.8	50	50.43	101	1.926	4	70 - 130	Passed
1,2-Dichloropropane	49.2	48.9	48.2	48.2	50	48.63	97	0.506	1	70 - 130	Passed
1,3-Dichloropropane	46.8	46.6	46.0	46.9	50	46.6	93	0.403	1	70 - 130	Passed
2,2-Dichloropropane	57.7	54.6	51.4	54.5	50	54.6	109	2.572	5	40 - 150	Passed
cis-1,3-Dichloropropene	49.2	48.2	47.7	48.3	50	48.4	97	0.624	1	70 - 140	Passed

Appendix 1 (Cont.): DEMONSTRATION OF CAPABILITY FOR 8260

DEMONSTRATION OF CAPABILITY
EPA 8260B / 8260C

MATRIX: WATER

Analytical SOP: EMAX-8260 Rev. 10
Analytical SOP: EMAX-8260C Rev. 1
Extraction SOP: EMAX-5030 Rev.3
Unit: µg/L
Sample Amount(ml): 5
Sample Purge(ml): 5

Analysis date: 01/04/17
Analyzed by: O. Dinh

PARAMETER	RAP020 VW02A04L	RAP021 VW02A04C	RAP022 VW02A05L	RAP023 VW02A05C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
trans-1,3-Dichloropropene	48.6	49.5	47.9	48.8	50	48.7	97	0.658	1	70 - 130	Passed
tert-Butyl ethyl ether (ETB	49.1	48.9	48.0	48.1	50	48.5	97	0.556	1	70 - 130	Passed
Ethyl Methacrylate	47.5	49.0	47.0	48.2	50	47.9	96	0.869	2	30 - 160	Passed
Ethylbenzene	52.9	53.3	51.5	53.1	50	52.7	105	0.816	2	70 - 130	Passed
2-Hexanone (MBK)	254	267	262	270	250	263.3	105	6.994	3	40 - 150	Passed
Hexachlorobutadiene	49.3	50.7	45.1	48.4	50	48.4	97	2.380	5	50 - 130	Passed
Iodomethane	47.7	45.9	46.8	48.2	50	47.15	94	1.015	2	30 - 160	Passed
Isopropyl ether (DIPE)	50.9	49.3	48.8	49.1	50	49.53	99	0.939	2	70 - 130	Passed
Isopropylbenzene	53.0	53.4	51.2	52.6	50	52.6	105	0.957	2	70 - 130	Passed
p-Isopropyltoluene	56.3	56.2	51.9	54.2	50	54.65	109	2.073	4	70 - 130	Passed
Methyl acetate	48.1	49.2	48.1	48.0	50	48.35	97	0.569	1	30 - 160	Passed
Methylene Chloride	48.8	47.1	48.2	49.1	50	48.30	97	0.883	2	60 - 130	Passed
4-Methyl-2-pentanone (MIBK)	254	262	262	265	250	260.8	104	4.717	2	10 - 160	Passed
tert-Butyl methyl ether	47.6	46.9	46.3	46.8	50	46.9	94	0.535	1	70 - 130	Passed
Naphthalene	45.3	45.6	43.2	44.1	50	44.55	89	1.109	2	10 - 160	Passed
n-Propylbenzene	59.7	58.0	53.5	54.9	50	56.53	113	2.831	5	70 - 130	Passed
Styrene	49.4	49.9	49.4	50.0	50	49.68	99	0.320	1	20 - 160	Passed
tert-Amyl methyl ether (TAME)	46.7	46.0	45.7	46.0	50	46.1	92	0.424	1	70 - 130	Passed
1,1,1,2-Tetrachloroethane	48.1	48.7	49.0	48.0	50	48.5	97	0.480	1	70 - 130	Passed
1,1,2,2-Tetrachloroethane	50.4	51.9	48.4	48.8	50	49.9	100	1.603	3	40 - 160	Passed
Tetrachloroethene	51.5	50.2	48.1	49.7	50	49.88	100	1.406	3	20 - 160	Passed
Toluene	52.0	50.7	49.3	50.4	50	50.6	101	1.111	2	70 - 130	Passed
1,1,1-Trichloroethane	56.4	54.1	52.3	54.0	50	54.2	108	1.683	3	60 - 140	Passed
1,1,2-Trichloroethane	46.1	46.5	45.9	45.7	50	46.1	92	0.342	1	10 - 160	Passed
1,2,3-Trichlorobenzene	44.8	45.2	41.0	41.9	50	43.23	86	2.089	5	70 - 130	Passed
1,2,4-Trichlorobenzene	45.4	45.6	42.5	44.5	50	44.50	89	1.417	3	70 - 130	Passed
Trichloroethene	49.3	49.1	47.8	48.4	50	48.65	97	0.686	1	10 - 160	Passed
Trichlorofluoromethane	52.0	52.7	46.5	48.5	50	49.9	100	2.931	6	20 - 160	Passed
1,2,3-Trichloropropane	50.6	51.6	49.4	47.0	50	49.7	99	1.982	4	60 - 140	Passed
1,1,2-Trichloro1,2,2-trifluoroethane	49.0	48.8	45.0	50.3	50	48.3	97	2.282	5	60 - 150	Passed
1,2,4-Trimethylbenzene	55.9	55.6	51.5	53.3	50	54.08	108	2.073	4	70 - 130	Passed
1,3,5-Trimethylbenzene	56.9	56.4	52.3	53.9	50	54.88	110	2.161	4	70 - 130	Passed
Vinyl Acetate	47.8	48.1	44.4	46.0	50	46.58	93	1.721	4	40 - 140	Passed
Vinyl Chloride	46.3	47.2	44.1	45.8	50	45.85	92	1.303	3	40 - 150	Passed
m-Xylene & p-xylene	107	107	104	106	100	106.0	106	1.414	1	70 - 130	Passed
o-Xylene	50.8	51.7	50.1	51.5	50	51.0	102	0.727	1	70 - 130	Passed
1,4-Dioxane	906	975	996	959	1000	959.0	96	38.445	4	30 - 160	Passed
2-Butanol	233	259	251	249	250	248.0	99	10.893	4	30 - 160	Passed
Cyclohexane	52.7	50.4	46.4	50.0	50	49.88	100	2.604	5	30 - 160	Passed
Methylcyclohexane	52.6	51.0	46.5	51.3	50	50.4	101	2.659	5	30 - 160	Passed
Tetrahydrofuran	46.3	48.1	47.7	49.1	50	47.80	96	1.160	2	30 - 160	Passed
1,2-Dichloroethane-d4	46.4	43.7	45.3	46.0	50	45.4	91	1.190	3	70 - 130	Passed
Toluene-d8	50.7	46.9	47.6	49.6	50	48.70	97	1.757	3.6	70 - 130	Passed
4-Bromofluorobenzene	54.7	50.0	51.4	51.3	50	51.85	104	2.004	4	70 - 130	Passed
Dibromofluoromethane	48.8	44.0	46.1	47.6	50	46.6	93	2.069	4	70 - 130	Passed

Appendix 2: DEMONSTRATION OF CAPABILITY FOR 8015

DEMONSTRATION OF CAPABILITY
GASOLINE RANGE ORGANICS
METHOD: EPA 8015B

MATRIX: WATER

SOP: EMAX-8015G Rev. 5
Conc Unit: µg/L
Sample Amount(ml): 5

Instrument ID: 39
Analysis date: 1/6/2017
Analyzed by: Cervantes, Sergio

PARAMETER	EA06004A	EA06005A	EA06006A	EA06007A	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	QC Criteria	COMMENTS
	VG39A02L	VG39A02C	VG39A03L	VG39A03C							
Gasoline(TOTAL)	454	431	460	468	500	453	91	15.8	3	60 - 130	PASSED
GRO(C6-C10)	514	495	519	534	500	515	103	16.2	3	60 - 130	PASSED
GRO(2MP-124TMB)	479	462	484	497	500	481	96	14.7	3	60 - 130	PASSED
GRO(C5-C12)	454	432	462	470	500	455	91	16.3	4	60 - 130	PASSED
Bromofluorobenzene	36.7	37.4	36.9	37.7	40	37.1	93	0.46	1	70 - 130	PASSED
1,1,1-Trifluorotoluene	41.0	40.7	42.1	42.8	40	41.6	104	0.99	2	70 - 130	PASSED

5030FAA: **ANALYTICAL LOG FOR 8260**

Page 1

EMAX LABORATORIES, INC.

ANALYSIS LOG FOR VOLATILES

SOP ☐ EMAX-8260 Rev.No. 10 ☐ EMAX-8260C Rev. No. 1 ☐ EMAX-8260SIM Rev.No. 1 ☐ EMAX-M8260SIM Rev.No. 0 ☐ EMAX-TCPSIM Rev.No. 2 ☐ EMAX-624 Rev.No. 4

Start Date: ☐ 5-mL Purge ☐ 10-mL Purge ☐ 25-mL Purge Book #: A03-062

BATCH _____

	Sample Prep ID	Data File Name	Lab Sample ID	Sample Amount	DF	Matrix W pH < 2	Matrix W Cl_2 < 5ppm	Matrix S	Notes
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

Instrument No.	03
INITIAL CALIBRATION REFERENCE	
DATE	
ICAL ID	

STANDARDS

NAME	ID	Amount (µl)	Conc (mg/L)
DCC			
DCC			
DCC			
DCC			
BFB			
IS/SURR.			
ICV/LCS			
ICV/LCS			
ICV/LCS			
ICV/LCS			
Data File Folder			

	LOT #	Syringe Lot #
pH strip		
Chlorine strip		
Methanol		
$NaHSO_4$		
Reagent Water		
Sand		

Electronic Data Archival Location	Date
HPCHEM_VOA/TO03	

Comments: _____

☐ Refer to sample weight log

Analyzed By: _____

Date Disposed: _____ Disposed By: _____

5030FAB: **ANALYTICAL RUN LOG FOR 8015**

EMAX LABORATORIES, INC.

ANALYSIS RUN LOG
for
PURGEABLE TPH

Page 1

Note: For samples and relevant QCs/Standards analyzed, refer to attached analytical sequence.

Comments:

Purge Volume = 5 ml

Book #:	A39-059
Instrument No.:	39
Analytical Sequence:	
Method File:	☐
	☐
	☐
Analytical Batch:	

SOP #	Rev. #
☐ EMAX-5030B	4
☐ EMAX-8015G	5
☐ EMAX-AK101	2
☐ EMAX-	

STANDARDS ID	Amt Added (µL)	Conc. (mg/L)
ICAL		
ICV		
DCC GAS		
DCC		
DCC		
BFB/TFT (Sample)		
BFB/TFT (DCC)		
LCS/LCSD		
MS/MSD		
GRO (HC-Chain)		

Solvent	ID/Lot #
Methanol	
Reagent Water	
	Lot #
pH strip	

SYRINGES	
☐	5 mL - MSF-01-01-12
☐	5 mL - MSF-01-01-13
☐	1 mL - MSF-01-01-20
☐	500 µL - MSF-01-01-21
☐	250 µL - MSF-01-01-22
☐	100 µL - MSF-01-01-19
☐	100 µL - MSF-01-02-16
☐	50 µL - MSF-01-01-17
☐	10 µL - MSF-01-03-03
☐	10 µL - MSF-01-03-04
☐	

ELECTRONIC DATA ARCHIVAL	
Location	Date
☐ EZC-3-BTEX	

Analyzed By: _____

Date: _____

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889

ADDENDUM TO	
Document	ALL SAMPLE PREPARATION SOPs
Revision Number	CURRENT REVISIONS
Section	11.0 Quality Control
Date	18 September 2019
Reference Number	AA.8

This applies to all Sample Preparation SOPs.

Section 11.0 shall include:

Whenever non-volumetric labware is used to measure extract or digestate volume, the non-volumetric labware must be verified by lot before use according to EMAX-QC04 Section 6.4 Non-Volumetric Labware Verification.

PREPARED BY: _____ Date: 09-18-19

Name Ye Myint

Title Operations Manager

APPROVED BY: _____ Date: 09.18.19

Name Kenette Pimentel

Title QA Manager

APPROVED BY: _____ Date: 09-19-19

Name Caspar Pang

Title Laboratory Director

ANNUAL REVIEW FORM

PURGE & TRAP

SOP#: EMAX-5030 **Rev** 4 **Effective Date:** 22-Sep-17

COMMENTS	Reviewed By	Review Date
No update needed per DRF by ODinh dtd 9/4/18		9/4/18
No update needed per DRF by DNguyen dtd 7/2/19		7/2/19
No update needed per DRF by DNguyen dtd 7/1/20		7/1/20

STANDARD OPERATING PROCEDURES

CLOSED SYSTEM PURGE AND TRAP

SOP No.:	EMAX-5035	Revision No.	4	Date:	22-Sep-17
Prepared By:	Diem Nguyen			Date:	09.21.17
Approved By:	Kenette Pimentel QA Manager			Date:	09.21.17
Approved By:	Caspar Pang Laboratory Director			Date:	09-21-17
			Control Number:		**5035-04-**

1.0 SCOPE AND APPLICATION

1.1. This method describes a closed-system purge and trap process for the sample preparation and extraction for the analysis of volatile organics in a solid matrix. It applies to the gas chromatographic determination of volatile organics in sediment, soil, and waste. The low soil method (0.5 to 200 µg/kg) utilize a hermetically-sealed sample vial, the seal of which is never broken from the time of sampling to the time of sample preservation.

1.2. Procedures are also included for preparing high concentration sample for purging by Method 5030C.

1.3. This SOP is an adaptation of SW846 Method 5035.

2.0 SUMMARY OF METHOD

2.1. **Low Concentration Soil Samples (0.5 - 200 µg/Kg)**

2.1.1. Samples collected in EnCore^{R} tube are preserved within 48 hours of sample collection by directly transferring its contents into a 40 ml vial containing sodium bisulfate as preservative, 5 ml of reagent water and a stir bar. Samples are extracted in a purge and trap closed system interfaced to a GC instrument equipped with a detector appropriate for the determinative method.

2.1.2. In the purge and trap closed, is equipped with an autosampler. The vial containing the sample is simultaneously analyzed and heated. A duplicate sample is prepared in case re-analysis is needed.

2.2. High Concentration Soil Sample or Encore tube/Terra Core are extracted with 5 ml methanol in case sample dilution is necessary.

2.3. **Interferences**

2.3.1. Impurities in the purge gas and organic compounds in the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination by running method blanks. The use of non-polytetrafluoroethylene (non-PTFE) plastic coating, non-PTFE thread sealant, or flow controllers with rubber components in the purging device must be avoided. These compounds will result in interferences or false positives in the determinative step.

2.3.2. Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) during shipment or storage. A trip blank prepared from organic-free reagent water and carried through sampling and handling serves as a check on such contamination.

2.3.3. Contamination by carryover can occur whenever high-concentration and low-concentration samples are analyzed in sequence. Where practical, samples with unusually high concentrations

of analytes should be followed by an analysis of organic-free reagent water to check for cross-contamination.

2.3.4. The volatile lab should be free of solvents and contamination. Special precautions must be taken to determine methylene chloride. The volatile area should be isolated from all atmospheric sources of methylene chloride, otherwise random background levels will result.

3.0 DETECTION LIMITS

3.1. Refer to applicable analytical SOP.

4.0 DYNAMIC RANGE

4.1. Refer to applicable analytical SOP.

5.0 SAMPLE HOLDING TIME AND PRESERVATION

5.1. **Holding Time**

5.1.1. Analyze preserved samples within 14 days from sampling date.

5.1.2. Analyzed extracts within 14 days from extraction date.

5.2. **Preservation**

5.2.1. Samples received in glass jars or brass tubes must be stored at ≤ 6°C without freezing. Samples must be analyzed within 14 days from sampling date.

5.2.2. Samples received in encore tubes or terra core are frozen, preserved with sodium bisulfate or extracted with methanol prior to analysis.

- Frozen encore tubes/terra core must be analyzed within 14 days from sampling date.
- Samples preserved with sodium bisulfate within 48 hours from sampling date must be analyzed within 14 days from sampling date.
- Methanol extracts must be analyzed within 14 days from sampling date.
- Preserved samples and extracts must be stored at ≤ 6°C without freezing.

6.0 ASSOCIATED SOPs

6.1.	EMAX-8015G	Gasoline Range Organics
6.2.	EMAX-8260	Volatile Organics by GC/MS
6.3.	EMAX-8260C	Volatile Organics by GC/MS
6.4.	EMAX-M8260SIM	1-4Dioxane by GC/MS SIM
6.5.	EMAX-QA05	Training
6.6.	EMAX-QA08	Corrective Action
6.7.	EMAX-QC01	Quality Control for Chemicals

6.8. EMAX-QC07 Glassware Cleaning

6.9. EMAX-SM03 Waste Disposal

6.10. EMAX-SM04 Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS of chemicals listed in this SOP.

7.2. Treat reagents, standards, and samples as potential hazards. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, and gloves at all times when performing this procedure. Perform sample and standard handling in the fume hood.

7.3. If for any reason, solvent and/or other reagents get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amounts of tap water. If irritations or any other discomfort related to the incident persists, inform your supervisor immediately so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS AND REAGENTS

8.1. **Instruments and Supplies**

8.1.1. Purge and Trap Autosampler : Archon / Centurion or equivalent

8.1.2. Trap: VOCARB 4000 (Supelco) or equivalent

8.1.3. Syringe: 5 ml, gas-tight with Luerlok tip

8.1.4. Microsyringe: 1, 5, 10, 25, 50, 100 µl (Hamilton 702N or equivalent)

8.1.5. Sparging Vessel: 40 ml vials with screw cap and Teflon-lined septum

8.1.6. Stir bars: Teflon lined

8.1.7. Archon Soil Method Program (If applicable to the method) : Internal Standard solution is added automatically by the instrument to the initial calibration standards containing all analytes of interest and surrogates, in the same fashion as used for the samples.

8.2. **Chemicals and Reagents**

8.2.1. Reagent Water : Organic free water, generated from active charcoal column.

8.2.2. Reagent Soil : Silica sand baked at 200°C overnight

8.2.3. Preservative : Sodium Bisulfate, Reagent grade

8.2.4. Extraction Solvent : Methanol, Ultrapure

9.0 STANDARDS

9.1. Preparation of standard is outlined in Section 9.0 of applicable analytical SOP.

9.2. **Spiking Standard Solution**

9.2.1. Refer to applicable analytical SOP.

10.0 PROCEDURES

10.1. Sample Preparation

10.1.1. Decontamination of Re-usable Lab wares

10.1.1.1. Stir bars – Wash recycled stir bars with tap water until no solids are visible. Rinse with methanol and final rinse with copious amount of reagent water. Bake for a minimum of 2 hours at 120°C and allow cooling before re-use.

10.1.2. Purifying Reagent Soil

10.1.2.1. Fill a clean 1 L wide mouth glass jar with silica sand. Label the jar with the silica sand lot number for traceability purposes and bake it at 200°C overnight.

10.1.2.2. Analyze a 5 g sample to verify that the reagent soil is organic free.

10.1.2.3. Sample result must be ≤ ½ LOQ for all target analytes, otherwise, the lot will be discarded.

10.1.2.4. Submit result to the QA Department.

10.1.3. Low Level Sample

10.1.3.1. Weigh 1 - 5 g of sample (depending on determinative method requirement) into a 40 ml vial. Note and record the actual weight to the nearest 0.1 g.

10.1.3.2. Add 5 ml organic free water using verified volumetric dispenser.[1]

10.1.4. High Level Sample

10.1.4.1. Weigh 1 - 5 ± 0.1 g of sample (depending on determinative method requirement) into a 40 ml vial. Add 5 ml of methanol using volumetric dispenser and mix thoroughly for 5 minutes. Allow the mixture to stand so that the sediment can settle.

10.1.4.2. Prepare 5 ml of organic free water solution. Withdraw up to 100 µl of methanol extract using an appropriate microsyringe.

10.1.4.3. Add the methanol extract to the 5 ml syringe through the Luerlok tip and pull the plunger slowly to make room for the extract. Take care not to introduce any air into the syringe.

10.1.5. EnCore

10.1.5.1. **Low Level Sample Preservation (< 200 µg/Kg)**

10.1.5.1.1. Remove EnCore tubes from freezer and let them warm up to room temperature. Line them up chronologically according to the sample IDs.

10.1.5.1.2. Label the vials and line them up in the same order as the EnCore tubes. Prepare at least one extra vial for preparation blank.

10.1.5.1.3. Add 1 g of sodium bisulfate, 5 ml of organics free water and a clean stirring bar to each of the vials. Re-cap the vial and gently mix the content.

[1] Volumetric dispenser is verified prior to use, using Class "A" volumetric flask noted in preparation log.

10.1.5.1.4. List the samples into the preparation log on the same order as the samples are lined up.

10.1.5.1.5. Weigh the first vial and record the weight to the nearest 0.01 g as W_1. Open the EnCore Tube envelope corresponding to the first vial and take-out one tub and re-seal the envelope.

10.1.5.1.6. Using the EnCore tube sample extruder, remove the tube seal and quickly extrude the entire content of the EnCore tube into the vial and seal the vial with the screw cap. Record the weight to the nearest 0.01 g as W_2.

Note: Due to the nature of volatile compounds, minimum sample exposure must be observed during the sample transfer from the EnCore tube to the vial.

10.1.5.1.7. Repeat the same procedures for the rest of the samples.

10.1.5.1.8. Duplicate the entire process suffixing the sample IDs with "R" to be used in case re-analysis is needed.

10.1.5.1.9. Extract another set of samples as described in 10.1.4 in case sample concentration(s) is > 200 µg/kg. Prepare another preparation blank for each preparation batch.

10.1.5.2. **Medium Level Samples (> 200 µg/Kg)**

10.1.5.2.1. Remove EnCore tubes from sample storage and let them warm up to room temperature. Line them up chronologically according to the sample IDs.

10.1.5.2.2. Label the vials and line up in the same order as the EnCore tubes. Prepare one extra vial for the extraction blank.

10.1.5.2.3. Add 5 ml of methanol containing 2.5 µg/ml of surrogate. Re-cap each vial after methanol addition.

10.1.5.2.4. List the samples into the extraction log on the same order as the samples are lined up.

10.1.5.2.5. Weigh the first vial and record the weight to the nearest 0.01 g as W_1. Open the EnCore Tube envelope correponding to the first vial, and take-out one tube.

10.1.5.2.6. Using the EnCore tube sample extruder, remove the tube seal and quickly extrude the entire content of the EnCore tube into the vial and seal the vial. Record the weight to the nearest 0.01 g as W_2.Use 5 g of reagent soil for the extraction blank.

Note: Due to the nature of volatile compounds, minimum sample exposure must be observed during the sample transfer from the EnCore tube to the vial.

10.1.5.2.7. Repeat the same procedures for the rest of the samples.

10.1.5.2.8. Store extracts at ≤ 6°C without freezing.

10.1.6. Terra Core

10.1.6.1. Weigh each sample as received. Record the initial weight as indicated in each sample label.

10.1.6.2. Samples are expected to be in either reagent water preserved with or without sodium bisulfate or Methanol.

10.2. **Instrument Parameters**

10.2.1. Refer to applicable analytical SOP.

10.3. **Calibration**

10.3.1. Refer to applicable analytical SOP.

10.4. **Analysis**

10.4.1. Refer to applicable analytical SOP.

10.5. **Calculations**

10.5.1. Refer to applicable analytical SOP.

10.6. **Data Reduction**

10.6.1. Refer to applicable analytical SOP.

10.7. **Report Generation**

10.7.1. Refer to applicable analytical SOP.

10.8. **Data Review**

10.8.1. Refer to applicable analytical SOP.

10.9. **Preventive Maintenance**

10.9.1. Refer to applicable analytical SOP.

11.0 QUALITY CONTROL

11.1. The sequence of runs and quality control acceptance criteria are specified in the individual analytical SOP. They include method blank, calibrations, lab control sample, and matrix spike/matrix spike duplicate.

11.2. Properly treat all lab wares used in the sample preparation as specified in EMAX-QC07.

11.3. Reagents and standards must undergo quality control check prior to use. Refer to EMAX-QC01 for details.

11.4. All analysts conducting this method must demonstrate capability (IDOC/DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTIONS

12.1. Refer to applicable analytical SOP.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of solvent that may go to wastewater drains.

13.2. Handle solvents and extracts and preparation of standards under the fume hood.

13.3. Keep extraction area clean to prevent contamination of sample.

14.0 WASTE MANAGEMENT

14.1. No sample may be dumped on the laboratory sink.

14.2. Separate and properly identify all unused expired standards for proper disposal.

14.3. Place all wastes generated during the process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, expired standards and other waste generated during the process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. When the low concentration samples are strongly alkaline or highly calcareous in nature, the sodium bisulfate solution may not be strong enough to reduce the pH of the sample to below 2. Additional steps may be required to preserve the samples. Such steps include: addition of large amount of sodium bisulfate solution, storage of the samples at -10°C, or significantly reducing the maximum holding time for low concentration samples. Whichever steps are employed, they should be clearly described in the case narrative.

15.2. Soil samples that contain carbonate minerals may effervescence upon contact with the acidic preservative solution in low concentration sampling vial. Therefore, when samples are known or suspected to contain high levels of carbonate, sodium bisulfate should be replaced with organic free reagent water and samples should be analyzed within 48 hours of sampling.

15.3. **Definition of Terms**

15.3.1. Analyte – the specific chemicals or components for which a sample is analyzed; may be a group pf chemicals that belongs to the same chemical family, and which are analyzed together.

15.3.2. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.3.2.1. **Preparation batch** – is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.3.2.2. **Analytical batch** – is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices; preparation batches, and can exceed 20 samples.

15.3.3. Safety Data Sheet (SDS) – is written information concerning a chemical physical properties, toxicity, health hazards, fire hazard and reactivity data including storage, spill and handling pre-cautions.

15.3.4. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.3.5. Calibration Blank – is a target-analyte-free solvent subjected to the entire analytical process to establish zero baseline or background value.

15.3.6. Calibration Check Compounds (CCC) – evaluate the integrity of the system. Variability of these compounds may indicate system leak or reactive sites in the column.

15.3.7. Instrument Method – is a file generated to contain the instrument calibration and instrument parameter settings for a particular analysis.

15.3.8. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical monitor contamination.

15.3.9. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.3.10. Lab Control Sample Duplicate (LCSD) – is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.3.11. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.3.12. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.3.13. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.3.14. Matrix – is a component or form of a sample.

15.3.15. Matrix Spike (MS) – is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyzed to monitor matrix effect on a method's recovery efficiency.

15.3.16. Matrix Spike Duplicate (MSD) – is a replicate of MS analyzed to monitor precision or recovery.

15.3.17. Response Factor – is the ratio of the peak area of the target compound in the sample or sample extract.

15.3.18. Surrogate – are compounds added to every blank, sample, matrix spike duplicate and standard; used to evaluate analytical efficiency by measuring recovery. Compounds not expected to be detected in environmental media.

15.3.19. System Performance Check Compounds (SPCC) – are compounds that are used to check compounds stability and to check for degradation caused by contaminated lines or active sites in the system.

15.3.20. Reagent Water – is purified water free from any target analyte or any other substance that may interfere with the analytical process.

15.3.21. Reagent Soil – organic-free Ottawa sand or equivalent.

15.4. **Application of EMAX QC Procedures**

15.4.1. The procedures and QC criteria summarized in this SOP applies to all projects when performing purgeable volatile analyses. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.5. **Department of Defense (DoD) and Department of Energy (DoE) Projects**

15.5.1. Samples from DoD and DoE sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD Quality System Manual (QSM), latest update, is applied.

16.0 REFERENCES

16.1. U.S. EPA Method 5035A, SW846, Rev. 1, 2002

16.2. EMAX Quality Systems Manual, as updated

17.0 APPENDICES

17.1. **Appendices**

17.1.1.	Appendix 1	Demonstration of Capability for 8260
17.1.2.	Appendix 2	Demonstration of Capability for 8015G

17.2. **Forms**

17.2.1.	5035FSA1	Sample Preparation Log for 8260
17.2.2.	5035FSA2	Extraction Log for 8260
17.2.3.	5030FSB1	Sample Preparation Log for 8015
17.2.4.	5030FSB2	Sample Preservation Log for 8015

Appendix 1: DEMONSTRATION OF CAPABILITY FOR 8260

DEMONSTRATION OF CAPABILITY
EPA 8260B / 8260C

MATRIX: WATER

Analytical SOP: EMAX-8260 Rev. 10

Analytical SOP: EMAX-8260C Rev. 1

Extraction SOP: EMAX-5035 Rev.3

Analysis date: 01/03/17

Unit: µg/Kg

Analyzed by: O. Dinh

Sample Amount(g): 5

Sample Purge(ml): 5

PARAMETER	RAP004 VS02A01L	RAP005 VS02A01C	RAP006 VS02A02L	RAP007 VS02A02C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
Acetone	252	240	239	241	250	243.0	97	6.055	2	40 - 150	Passed
Acetonitrile	504	474	486	463	500	481.8	96	17.557	4	30 - 160	Passed
Acrolein	214	203	205	201	250	205.8	82	5.737	3	30 - 160	Passed
Acrylonitrile	262	254	255	253	250	256.0	102	4.082	2	30 - 160	Passed
Benzene	50.7	51.7	50.9	49.6	50	50.73	101	0.866	2	70 - 130	Passed
Bromobenzene	49.9	48.5	47.7	46.9	50	48.25	97	1.279	3	50 - 150	Passed
Bromochloromethane	48.2	47.8	47.7	46.6	50	47.58	95	0.685	1	60 - 130	Passed
Bromodichloromethane	47.6	48.8	48.3	47.3	50	48.0	96	0.678	1	70 - 130	Passed
Bromoform	47.1	45.1	44.5	45.8	50	45.6	91	1.118	2	50 - 150	Passed
Bromomethane	40.0	39.8	41.2	37.5	50	39.63	79	1.546	4	60 - 140	Passed
tert-Butyl alcohol	268	251	255	240	250	253.5	101	11.561	5	30 - 160	Passed
2-Butanone (MEK)	257	246	248	244	250	248.8	100	5.737	2	10 - 160	Passed
n-Butylbenzene	59.9	59.2	57.5	54.8	50	57.85	116	2.269	4	30 - 150	Passed
sec-Butylbenzene	57.5	56.6	54.7	53.2	50	55.50	111	1.927	3	40 - 150	Passed
tert-Butylbenzene	54.0	53.2	51.2	50.5	50	52.23	104	1.646	3	50 - 150	Passed
Carbon disulfide	50.5	51.6	52.2	48.6	50	50.7	101	1.582	3	60 - 140	Passed
Carbon tetrachloride	53.5	56.1	55.1	52.8	50	54.4	109	1.500	3	60 - 140	Passed
Chlorobenzene	49.7	50.0	48.7	48.3	50	49.2	98	0.806	2	60 - 140	Passed
2-Chloroethyl vinyl ether	50.8	50.5	50.7	49.5	50	50.38	101	0.597	1	30 - 160	Passed
Chloroethane	42.9	45.2	46.2	41.1	50	43.85	88	2.296	5	60 - 130	Passed
Chloroform	51.0	51.9	50.9	49.8	50	50.9	102	0.860	2	70 - 130	Passed
1-Chlorohexane	53.9	55.5	53.2	52.0	50	53.65	107	1.462	3	30 - 160	Passed
Chloromethane	41.9	41.7	40.5	37.4	50	40.38	81	2.077	5	50 - 130	Passed
2-Chlorotoluene	58.0	55.3	54.0	53.2	50	55.13	110	2.103	4	40 - 160	Passed
4-Chlorotoluene	54.6	54.9	53.8	53.4	50	54.18	108	0.695	1	40 - 150	Passed
Dibromochloromethane	46.0	45.9	45.2	45.2	50	45.6	91	0.435	1	70 - 130	Passed
1,2-Dibromo-3-chloropropane	48.4	46.6	49.8	45.3	50	47.5	95	1.979	4	10 - 160	Passed
1,2-Dibromoethane	45.2	45.0	45.1	44.9	50	45.1	90	0.129	0.3	60 - 140	Passed
Dibromomethane	46.1	46.4	46.4	45.2	50	46.0	92	0.568	1	70 - 130	Passed
1,1-Dichloroethane	51.8	51.8	50.9	49.9	50	51.10	102	0.906	2	70 - 130	Passed
1,2-Dichloroethane	48.2	48.0	47.5	47.4	50	47.8	96	0.386	1	60 - 140	Passed
1,2-Dichlorobenzene	48.7	47.7	47.3	46.0	50	47.43	95	1.118	2	40 - 150	Passed
1,3-Dichlorobenzene	51.1	49.8	49.0	47.9	50	49.45	99	1.348	3	40 - 150	Passed
trans-1,4-Dichloro-2-Butene	56.3	52.6	53.7	52.5	50	53.78	108	1.769	3	30 - 160	Passed
1,4-Dichlorobenzene	50.8	51.0	49.5	48.0	50	49.83	100	1.387	3	40 - 150	Passed
Dichlorodifluoromethane	38.8	41.2	39.6	33.7	50	38.3	77	3.241	8	40 - 140	Passed
1,1-Dichloroethene	52.5	55.1	55.2	50.2	50	53.25	107	2.387	4	60 - 130	Passed
cis-1,2-Dichloroethene	50.0	49.8	48.9	48.6	50	49.33	99	0.680	1	50 - 140	Passed
trans-1,2-Dichloroethene	54.0	54.3	53.4	51.4	50	53.28	107	1.305	2	60 - 130	Passed
Dichlorofluoromethane	51.9	53.8	55.1	49.1	50	52.5	105	2.606	5	30 - 160	Passed
1,1-Dichloropropene	50.7	52.6	51.7	49.1	50	51.03	102	1.500	3	60 - 130	Passed

Appendix 1 (Cont.): DEMONSTRATION OF CAPABILITY FOR 8260

DEMONSTRATION OF CAPABILITY
EPA 8260B / 8260C

MATRIX: WATER

Analytical SOP: EMAX-8260 Rev. 10

Analytical SOP: EMAX-8260C Rev. 1

Extraction SOP: EMAX-5035 Rev.3

Analysis date: 01/03/17

Unit: µg/Kg

Analyzed by: O. Dinh

Sample Amount(g): 5

Sample Purge(ml): 5

PARAMETER	RAP004 VS02A01L	RAP005 VS02A01C	RAP006 VS02A02L	RAP007 VS02A02C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
1,2-Dichloropropane	48.1	48.5	48.0	47.3	50	47.98	96	0.499	1	60 - 130	Passed
1,3-Dichloropropane	46.1	46.2	45.7	46.0	50	46.0	92	0.216	0.5	70 - 140	Passed
2,2-Dichloropropane	55.0	56.9	54.9	52.3	50	54.8	110	1.889	3	60 - 140	Passed
cis-1,3-Dichloropropene	47.7	47.8	48.4	47.1	50	47.8	96	0.532	1	70 - 130	Passed
trans-1,3-Dichloropropene	48.7	48.4	47.6	47.8	50	48.1	96	0.512	1	70 - 130	Passed
tert-Butyl ethyl ether (ETB	48.4	48.5	48.2	47.3	50	48.1	96	0.548	1	30 - 160	Passed
Ethyl Methacrylate	47.8	47.6	46.8	47.4	50	47.4	95	0.432	1	30 - 160	Passed
Ethylbenzene	53.4	54.6	52.7	52.2	50	53.2	106	1.040	2	40 - 150	Passed
2-Hexanone (MBK)	266	259	258	258	250	260.3	104	3.862	1	20 - 160	Passed
Hexachlorobutadiene	48.8	47.9	49.4	45.1	50	47.8	96	1.903	4	10 - 160	Passed
Iodomethane	46.3	47.9	50.1	45.6	50	47.48	95	1.997	4	30 - 160	Passed
Isopropyl ether (DIPE)	49.2	49.1	48.5	47.7	50	48.63	97	0.690	1	30 - 160	Passed
Isopropylbenzene	53.7	55.5	53.7	51.5	50	53.6	107	1.637	3	40 - 160	Passed
p-Isopropyltoluene	57.8	56.3	54.4	52.9	50	55.35	111	2.146	4	10 - 160	Passed
Methyl acetate	46.9	46.6	47.1	44.5	50	46.28	93	1.201	3	30 - 160	Passed
Methylene Chloride	47.1	48.5	49.8	45.9	50	47.83	96	1.692	4	70 - 130	Passed
4-Methyl-2-pentanone (MIBK)	260	254	257	251	250	255.5	102	3.873	2	60 - 140	Passed
tert-Butyl methyl ether	47.3	46.6	46.7	45.8	50	46.6	93	0.616	1	70 - 130	Passed
Naphthalene	43.5	43.3	44.9	43.3	50	43.75	88	0.772	2	20 - 160	Passed
n-Propylbenzene	59.3	58.3	56.2	56.2	50	57.50	115	1.556	3	40 - 160	Passed
Styrene	51.0	51.7	50.9	49.1	50	50.68	101	1.109	2	60 - 140	Passed
tert-Amyl methyl ether (TAME)	45.9	45.9	46.3	44.7	50	45.7	91	0.693	2	30 - 160	Passed
1,1,1,2-Tetrachloroethane	48.6	48.8	48.4	47.1	50	48.2	96	0.768	2	50 - 150	Passed
1,1,2,2-Tetrachloroethane	52.1	49.5	49.0	49.4	50	50.0	100	1.417	3	10 - 160	Passed
Tetrachloroethene	50.4	53.6	50.1	49.7	50	50.95	102	1.790	4	50 - 140	Passed
Toluene	51.2	51.9	51.0	50.2	50	51.1	102	0.699	1	20 - 160	Passed
1,1,1-Trichloroethane	53.4	56.2	55.4	52.5	50	54.4	109	1.717	3	60 - 130	Passed
1,1,2-Trichloroethane	46.0	45.5	45.8	45.5	50	45.7	91	0.245	1	50 - 160	Passed
1,2,3-Trichlorobenzene	43.1	42.3	42.1	41.6	50	42.28	85	0.624	1	10 - 160	Passed
1,2,4-Trichlorobenzene	44.6	44.3	44.2	42.6	50	43.93	88	0.900	2	10 - 160	Passed
Trichloroethene	49.2	50.0	50.2	47.5	50	49.23	98	1.228	2	60 - 140	Passed
Trichlorofluoromethane	49.1	50.8	49.8	45.8	50	48.9	98	2.165	4	50 - 150	Passed
1,2,3-Trichloropropane	50.0	48.3	48.7	47.8	50	48.7	97	0.942	2	10 - 160	Passed
1,1,2-Trichloro1,2,2-trifluoroethane	47.5	49.9	53.5	45.4	50	49.1	98	3.476	7	30 - 160	Passed
1,2,4-Trimethylbenzene	56.3	55.8	54.1	52.8	50	54.75	110	1.605	3	10 - 160	Passed
1,3,5-Trimethylbenzene	58.5	56.6	54.8	53.6	50	55.88	112	2.141	4	40 - 160	Passed
Vinyl Acetate	46.5	44.9	42.7	41.0	50	43.78	88	2.419	6	30 - 160	Passed
Vinyl Chloride	41.8	46.5	46.0	41.4	50	43.93	88	2.697	6	60 - 140	Passed
m-Xylene & p-xylene	108	111	107	104	100	107.5	108	2.887	3	30 - 160	Passed
o-Xylene	52.2	53.3	51.9	50.5	50	52.0	104	1.153	2	30 - 160	Passed
1,4-Dioxane	914	954	952	909	1000	932.3	93	24.061	3	30 - 160	Passed

Appendix 1 (Cont.): DEMONSTRATION OF CAPABILITY FOR 8260

DEMONSTRATION OF CAPABILITY
EPA 8260B / 8260C

MATRIX: WATER

Analytical SOP: EMAX-8260 Rev. 10

Analytical SOP: EMAX-8260C Rev. 1

Extraction SOP: EMAX-5035 Rev.3

Analysis date: 01/03/17

Unit: µg/Kg

Analyzed by: O. Dinh

Sample Amount(g): 5

Sample Purge(ml): 5

PARAMETER	RAP004 V502A01L	RAP005 V502A01C	RAP006 V502A02L	RAP007 V502A02C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
2-Butanol	242	236	238	222	250	234.5	94	8.699	4	30 - 160	Passed
Cyclohexane	48.9	52.2	51.3	46.9	50	49.83	100	2.396	5	30 - 160	Passed
Methylcyclohexane	48.9	53.2	52.1	48.5	50	50.7	101	2.330	5	30 - 160	Passed
Tetrahydrofuran	46.6	45.4	47.1	44.2	50	45.83	92	1.297	3	30 - 160	Passed
1,2-Dichloroethane-d4	45.4	44.9	44.7	44.2	50	44.8	90	0.497	1	70 - 130	Passed
Toluene-d8	49.3	50.7	48.5	48.2	50	49.18	98	1.118	2.3	70 - 140	Passed
4-Bromofluorobenzene	53.9	52.1	51.5	52.9	50	52.60	105	1.039	2	10 - 160	Passed
Dibromofluoromethane	46.6	46.9	46.2	45.7	50	46.4	93	0.520	1	70 - 130	Passed

Appendix 1: DEMONSTRATION OF CAPABILITY FOR 8015G

DEMONSTRATION OF CAPABILITY
GASOLINE RANGE ORGANICS
METHOD: EPA 8015B

MATRIX: SOIL

SOP: EMAX-8015G Rev. 5
Conc Unit: µg/Kg
Sample Amount(g): 1

Instrument ID: 39
Analysis date: 1/12/2017
Analyzed by: Cervantes, Sergio

PARAMETER	EA11019A	EA11020A	EA11021A	EA11022A	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	QC Criteria	COMMENTS
	GSA001SL	GSA001SC	GSA001SX	GSA001SY							
Gasoline(TOTAL)	2317	2131	2124	2265	2500	2210	88	97	4	60 - 130	PASSED
GRO(C6-C10)	2640	2478	2468	2577	2500	2540	102	82	3	60 - 130	PASSED
GRO(2MP-124TMB)	2640	2478	2468	2577	2500	2540	102	82	3	60 - 130	PASSED
GRO(C5-C12)	2343	2149	2141	2285	2500	2230	89	100	4	60 - 130	PASSED
Bromofluorobenzene	178	168	167	171	200	171	86	5	3	70 - 130	PASSED
1,1,1-Trifluorotoluene	203	196	198	196	200	198	99	3	2	70 - 130	PASSED

5035FSA1: **SAMPLE PREPARATION LOG FOR 8260**

EMAX LABORATORIES, INC.

SAMPLE PREPARATION LOG FOR VOLATILES

FileID: VS.xls

PrepBatchID	Lab Sample ID	ExpW1(g)	W1 (g)	DateTime	ExpVe (ml)	Ve (ml)	DateTime	Prep. Factor	Comment

☐ EMAX-5030 Rev. ☐ Balance Calibration Check performed prior to use BlankSoil ID: Prepared By:

☐ EMAX- 5035 Rev. ☐ BalanceID 25451062 MeOH Lot#: Received by: Date

☐ Soil ☐ BalanceID 25650797 Expected W1(g): 5 Extract Location:

☐ Product Expected Ve(ml): 5

☐ Volumetric dispenser was checked with 5-ml volumetric flask W1=Sample Weight Ve=Extract Volume

5035FSA2: EXTRACTION LOG FOR 8260

EMAX LABORATORIES, INC.

EXTRACTION LOG FOR VOLATILES

FileID: VM.xls

PrepBathID	Lab Sample ID	W1 (g)	DateTime	Wf (g)	DateTime	ExpWs(g)	Ws(g)	%Moisture	CorrExt Vol(ml)	PrepBFactor	PFx50 df(T)	df(I)	df(J)	Comments

☐ EMAX-5035 Rev.	☐ Balance Calibration Check performed prior to use	BlankSoil Lot#:	Prepared By:
☐ Encore	☐ Balance ID 25650797	MeOH/Surr. ID:	Standard Added By:
☐ Frozen Sample	☐ Balance ID 25451062	Weight MeOH(g):	Witnessed By:
☐ Pre-weighed vial		Vol MeOH(ml):	Extract Rcvd By:
☐ Volumetric dispenser was checked with 5-ml volumetric flask		Expected Ws(g)	Extract Location:

W1=Weight of Vial+Solvent Wf=W1 + Sample

5035FSB1: **SAMPLE PREPARATION LOG FOR 8015**

FileID: GS.xls

EMAX LABORATORIES, INC.

SAMPLE PREPARATION LOG FOR TPH

PrepBatchID	LabSampleID	Aliquot	DateTime	Unit	Ve(ml)	ExpAmt	ExpVe(ml)	AliquotFctr	Comments

5035FSB2: SAMPLE PRESERVATION LOG FOR 8015

FileID: GM.xls

EMAX LABORATORIES, INC.

PRESERVATION LOG FOR TPH

PrepBatch ID	LabSampleID	Wi(g)	DateTime	Wf(g)	DateTime	Aliquot	Unit	Ve(ml)	%Moist	Vec(ml)	ExpAmt	ExpVe(ml)	AliquotFctr	Comments

Ve=extract volume AliquotFctr=ExpAmt/Aliquot

☐ Extraction Started @ Weight MeOH(g): ☐ EMAX-5035 Rev. No. 2 Prepared By:

☐ Extraction Ended @ Vol MeOH(ml): ☐ Volumetric dispenser was checked with 5 mL Volumetric Flask Checked By:

Comments: Date

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889

ADDENDUM TO	
Document	ALL SAMPLE PREPARATION SOPs
Revision Number	CURRENT REVISIONS
Section	11.0 Quality Control
Date	18 September 2019
Reference Number	AA.8

This applies to all Sample Preparation SOPs.

Section 11.0 shall include:

Whenever non-volumetric labware is used to measure extract or digestate volume, the non-volumetric labware must be verified by lot before use according to EMAX-QC04 Section 6.4 Non-Volumetric Labware Verification.

PREPARED BY: _____ Date: 09-18-19

Name Ye Myint

Title Operations Manager

APPROVED BY: _____ Date: 09.18.19

Name Kenette Pimentel

Title QA Manager

APPROVED BY: _____ Date: 09-19-19

Name Caspar Pang

Title Laboratory Director

ANNUAL REVIEW FORM

CLOSED SYSTEM PURGE & TRAP

SOP#: EMAX-5035 **Rev** 4 **Effective Date:** 22-Sep-17

COMMENTS	Reviewed By	Review Date
No update needed per DRF by ODinh dtd 9/4/18		9/4/18
No update needed per DRF by DNguyen dtd 7/2/19		7/2/19
No update needed per DRF by DNguyen dtd 7/1/20		7/1/20

STANDARD OPERATING PROCEDURES

CHEMICAL OXYGEN DEMAND (COLORIMETRIC, MANUAL)

SOP No.:	EMAX-5220D	Revision No.	4	Date:	12-Sep-18
Prepared By:	Tyler Kosaka			Date:	09/11/18
Approved By:	Kenette Pimentel QA Manager			Date:	09-11-18
Approved By:	Caspar Pang Laboratory Director			Date:	9-11-18

Control Number: 5220D-04-

1.0 SCOPE AND APPLICATION

1.1. This method measures the oxidizable organic matter content of an aqueous sample.

1.2. This SOP is an adaptation of Methods 5220D-1997 and 5220D-2011, Standard Methods for the Examination of Water and Wastewater, 21st and 22nd Editions.

2.0 SUMMARY OF METHOD

2.1. Sample, blanks and standards in sealed tubes are digested in a block digestor in the presence of dichromate at 150°C. After two hours, the tubes are removed from the digestor, cooled and measured spectrophotometrically at 600 nm.

2.2. **Interference**

2.2.1. Chlorides are quantitatively oxidized by dichromate and represent a positive interference. Mercuric sulfate is added to the digestion tubes to complex the chlorides.

3.0 DETECTION LIMITS

3.1. **Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ)**

3.1.1. Refer to EMAX-QA04 for generation, validation and verification of DL, LOD & LOQ.

3.1.2. Established DL, LOD and LOQ are:

MATRIX	DL	LOD	LOQ
Water (mg/L)	3	6	10

4.0 DYNAMIC RANGE

4.1. The highest quantifiable range requiring no dilution is equal to the highest calibration point (see Section 9.3.1). All samples analyzed above this range are considered "over range" and requires dilution to properly quantitate.

4.2. The lowest quantifiable range of diluted samples is equal to the lowest calibration point. All diluted samples analyzed below this range are considered "under range" and requires lower dilution factor to properly quantitate.

5.0 SAMPLE HOLDING TIME & PRESERVATION

5.1. Sample Collection

5.1.1. Samples received in the laboratory are expected to be contained in either glass or HDPE bottles and preserved with H_2SO_4 to a ph < 2 and cooled to ≤ 6°C without freezing.

5.2. Holding Time

5.2.1. Preserved samples must be analyzed within 28 days from date and time of collection.

5.2.2. Samples with no chemical preservative must be analyzed within 24 hours from time of collection.

5.3. Preservation

5.3.1. Store samples at ≤ 6°C without freezing.

6.0 ASSOCIATED SOPs

6.1.	EMAX-DM01	Data Flow and Review
6.2.	EMAX-QA04	Detection Limit (DL)
6.3.	EMAX-QA05	Training
6.4.	EMAX-QA08	Corrective Action
6.5.	EMAX-QC01	Quality Control for Chemicals
6.6.	EMAX-QC02	Analytical Standard Preparation
6.7.	EMAX-QC06	Calibration of Micropipettes
6.8.	EMAX-QC07	Glassware Cleaning
6.9.	EMAX-SM03	Waste Disposal
6.10.	EMAX-SM04	Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS of chemicals listed in this SOP. The following chemicals have the potential to be highly toxic or hazardous: Mercuric sulfate, potassium dichromate and sulfuric acid.

7.2. Treat reagents, standards, and samples as potential hazards. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, gloves, at all times when performing this procedure.

7.3. If for any reason, solvent and/or other reagents get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amounts of water. If irritations persist inform your supervisor immediately so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS & REAGENTS

8.1. **Instruments and Supplies**

Block digestor	Lachat Instrument or equivalent, capable of maintaining 150°C
Spectrophotometer	SPEC20D, Milton Roy at 600 nm or equivalent
Micropipettes/Tips	Variable

8.2. **Chemicals and Reagents**

Reagent Water	Type II
COD Reagent Vials	Environment Express or equivalent

8.2.1. All reagents are reagent grade or better.

8.2.2. In the absence of manufactured pre-mixed digestion solution, the following reagents are prepared:

8.2.2.1. Silver sulfate catalyst solution: Dissolve 22 g of Ag_2SO_4 in 4.09 kg (9 lb.) bottle of concentrated sulfuric acid (H_2SO_4).

8.2.2.2. Potassium Dichromate Digestion Solution: Add 10.216 g of potassium dichromate ($K_2Cr_2O_7$), 167 ml concentrated H_2SO_4 (Sp. Gr. 1.84) and 33.3 g of mercuric sulfate ($HgSO_4$) to 750 ml reagent water, mix, cool and dilute to 1 L, mix thoroughly.

8.2.2.3. H_2SO_4 sampler wash solution. Add 500 ml concentrated H_2SO_4 to 500 ml reagent water, slowly let it cool.

9.0 STANDARDS

9.1. Purchase all standards as certified solutions.

Standard	Source	Concentration (mg/L)	Use as
COD	Ricca	1000	Primary Standard
COD	Environmental Express	10000	Secondary Standard

9.2. Refer to EMAX-QC02 for proper preparation of analytical standards.

9.3. Store all standards solutions at ≤ 6°C without freezing.

9.4. Alternatively, you may prepare the above standards as follows:

9.4.1. COD, 1000 mg/L (Primary Standard): Oven-dry potassium hydrogen phthalate (KHP) at 100°C for at least 2 hours. Cool down in a dessicator and weigh 0.850 g. Dissolve in reagent water and dilute to 1000 ml.

9.4.2. COD, 10000 mg/L (Secondary Standard): Using a different source, dry KHP following the procedure in Section 9.4.1. Weigh and dissolve 1.7 g of KHP and dilute to 200 ml final volume using reagent water.

9.5. **Calibration Standards**

9.5.1. The initial calibration consists of six standards prepared from the primary standard and reagent water blank to a final volume of 2.5 ml. Other concentration levels may be prepared as appropriate in consideration of instrumentation limitations.

Standard	Primary Stock Standard (1000 mg/L) aliquot (ml)	Final Concentration (mg/L)
S0	-	0
S1	0.025	10
S2	0.125	50
S3	0.25	100
S4	0.5	200
S5	1.0	400
S6	2.0	800

9.6. **Initial Calibration Verification (ICV) Standard**

9.6.1. Using the secondary stock solution, dilute 0.1 ml in 2.5 ml of reagent water. This solution has a concentration of 400 mg/L.

9.7. **Continuing Calibration Verification (CCV) Standard**

9.7.1. Using the primary stock solution, dilute 1ml in 2.5 ml of reagent water. This solution has a concentration of 400 mg/L.

9.8. **Lab Control Sample (LCS)/Matrix Spike MS (MS)**

9.8.1. Using the secondary stock solution, spike reagent water for LCS and designated sample as MS with 0.1 ml. This is expected to yield 400 mg/L concentration.

10.0 PROCEDURES

10.1. **Sample Preparations**

10.1.1. Open the COD template (CD.xls) and click on the "**Save As**" button, input your electronic signature.

10.1.2. Bring the samples to equilibrate at room temperature. Meanwhile, pre-heat the digester block to 150°C.

10.1.3. Line up COD vials and label each one accordingly.

10.1.4. Remove the cap from a labeled COD vial and transfer 2.5 ml of sample down the side of each tube such that a layer is formed in top of the reagents. Use reagent water for method blank/S0 and LCS.

10.1.5. Similarly, prepare the ICAL standards as described in Section 9.5.1.

10.1.6. Replace the cap onto the COD vial tightly and carefully invert the vial several times to mix the contents.

Caution: When mixing, hold the vial by the cap, only the contents of the vial will become very hot during mixing.

10.1.7. Wipe the vials and check the color of the sample vials before placing it in the pre-heated digester block. If the color turns green or blue, prepare dilution(s) together with the parent sample. If dilution is necessary, document the observation in the analytical log. Otherwise, proceed with the digestion.

10.1.8. Allow the vials to heat in the digester block at 150°C ± 2°C for 2 hours. Record the temperature.

10.1.9. Turn the digester block off and allow the vials to remain in the unit to cool for 15 to 20 minutes.

10.1.10. Carefully remove each vial from the digester block making certain the cap is secured tightly.

10.1.11. Allow the COD vials to cool at room temperature to prevent excess condensation on the walls of vials during analysis.

Note: If excess condensation occurs inside the glass vial and on the liner of the cap, slowly invert or gently swipe the vial to re-collect the condensation. Allow the sample to sit until all suspended matter re-settles.

10.1.12. Wipe the outside of the vials clean. Standards and samples are now ready for analysis.

10.2. **Instrument Parameters**

10.2.1. Warm-up spectrophotometer for at least 15 mins.

10.2.2. Set the wavelength of spectrophotometer at 600 nm.

10.2.3. Empty the cell compartment then close it.

10.2.4. Adjust transmittance to zero. Get the samples ready.

10.3. **Calibration**

10.3.1. Initial Calibration

10.3.1.1. Analyze 6-points standard and one blank as prepared in Section 9.5.1 and digested in Section 10.1.

10.3.1.2. Measure and capture absorbance in the analysis for COD spreadsheet.

10.3.1.3. Refer to Section 10.5 for calculations.

10.3.1.4. Acceptance criteria are specified in Appendix 1.

10.3.1.5. Verify the initial calibration by second source standard.

10.3.2. Initial Calibration Verification (ICV) and Initial Calibration Blank (ICB)

10.3.2.1. Analyze ICV standard (Refer to Section 9.6) and ICB after initial calibration as described in Section 10.3.1.2.

10.3.2.2. Calculate the recovery of ICV using Equation 10.5.3.

10.3.2.3. Analyze the ICV sample to verify the concentration of the ICAL. See Appendix 1 for acceptance criteria.

10.3.3. Continuing Calibration Verification (CCV) and Continuing Calibration Blank (CCB)

10.3.3.1. Analyze CCV standard and CCB every after 10 samples and at the end of the analytical sequence as described in Section 10.3.1.2.

10.3.3.2. Calculate the recovery of CCV using Equation 10.5.3.

10.3.3.3. Analyze the CCV sample to verify the validity of the ICAL. See Appendix 1 for acceptance criteria.

10.4. **Analysis**

10.4.1. Analytical Sequence

10.4.1.1. ICAL

10.4.1.2. ICV

10.4.1.3. ICB

10.4.1.4. Method Blank

10.4.1.5. LCS/LCSD

10.4.1.6. Parent Sample

10.4.1.7. Sample Dup

10.4.1.8. MS

10.4.1.9. Samples (Max 20 per Batch)

10.4.1.10. CCV

10.4.1.11. CCB

10.4.2. Analysis of Sample

10.4.2.1. Analyze the digested samples in Section 10.1.

10.4.2.2. Measure and record absorbance in the analysis spreadsheet for COD.

10.4.3. Dilute, re-digest and re-analyze all samples detected above the calibration range with a new set of QC samples.

10.4.4. Sample Result Evaluation

10.4.4.1. Check the QC data as soon as available.

- ✓ Check the ICAL and ICV prior to sample analysis.
- ✓ Check the method blank and make sure that it meets the blank requirement.
- ✓ Check the LCS and make sure it meets the recovery limit.
- ✓ Check the sample duplicate and make sure it meets the % RPD limit.
- ✓ Check the MS and make sure it meets the recovery limit.
- ✓ Check that all samples are analyzed within calibration range. Dilute the samples measured over the absorbance of the highest calibration point and repeat the process from sample digestion to absorbance reading until result falls within the calibration range.

- ✓ Check the calibration check(s) to make sure the calibration still holds and that the instrument is functioning properly.

10.4.5. Refer to Section 11 for Quality Control and Section 12 for corrective action.

10.4.6. Refer to Appendix 1 for acceptance criteria. If any of the acceptance criteria is not met, perform the necessary corrective action. If problem persist, inform the Supervisor for further action.

10.5. **Calculations**

10.5.1. Calculate for Calibration Factor

Plot the absorbance versus the known concentration of the calibration standards using the Excel spreadsheet or equivalent. The value of the slope shall be the calibration factor.

10.5.2. Calculate for COD concentration

$$COD, mg/L = \left[\left(A * CF\right) - Y\right] * DF \qquad \text{Eq.-10.5.2}$$

where:

A – Absorbance

CF – Calibration Factor

Y – Intercept/Slope

DF – Dilution Factor

10.5.3. Calculate for Percent Recovery

$$\%\,\mathrm{Recovery} = \frac{\left(C_f - C\right)}{C_s} \times 100 \qquad \text{Eq.-10.5.3}$$

where:

C_f – Concentration found

C – Concentration of the sample (use 0 for LCS)

C_s – Concentration of spike

10.5.4. Calculate for Precision

$$RPD = \frac{\left|C_1 - C_2\right|}{\left(\frac{C_1 + C_2}{2}\right)} \times 100 \qquad \text{Eq.-10.5.4}$$

where:

RPD – Relative Percent Difference

C_1 – Measured concentration of the first sample aliquot

C_2 – Measured concentration of the second sample aliquot

10.6. **Data Reduction**

10.6.1. Print a copy of the run log.

10.6.2. Highlight the data to be reported.

10.6.3. Keep all other data generated with the analytical folder marked with "For record only".

10.7. **Report Generation**

10.7.1. Generate the method.txt, sample results and QC summaries using SPEC.exe.

10.7.2. Generate the case narrative using CN00.exe.

10.7.3. Arrange the analysis package in sequence as detailed below.

10.7.3.1. Case Narrative

10.7.3.2. Sample Results

10.7.3.3. LCS/LCSD Summary

10.7.3.4. MS Summary

10.7.3.5. Sample Duplicate Result Summary

10.7.3.6. Run Log

10.7.3.7. Non-Conformance Report (if any)

10.8. **Data Review**

10.8.1. Perform a 100% data review in accordance to EMAX-DM01 and the PSR.

- ✓ Check the ICAL and the calibration verifications.
- ✓ Check MB is compliant to Project Specific Requirements (PSR) criteria.
- ✓ Check LCS/LCSD recoveries against (PSR). In the absence of PSR, default to in-house QC limits.
- ✓ Check concentration of sample results that all are within calibration range.
- ✓ If any of the above checkpoints is non-compliant, re-analysis is required.
- ✓ Check the generated reports against the run log. Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.
- ✓ Review the case narrative and check that it accurately describes what transpired in the analytical process. Edit as necessary to reflect essential issues not captured by the case narrative generator programs.

10.8.2. Submit the analytical folder for secondary review.

10.9. **Preventive Maintenance**

10.9.1. Perform daily routine check and record it in the instrument maintenance log. This practice ensures optimum operating condition of the equipment thus reducing the possibility of frequent instrument malfunction.

10.9.2. Wavelength Calibration Check

10.9.2.1. Stock Cobalt Solution: Place 200 ml DI water into a 1 L volumetric flask. Slowly add 10 ml concentrated HCl. Transfer 22-23 g of Cobalt Chloride ($CoCl_2$) into the flask, dissolve and dilute to volume.

10.9.2.2. Turn on the Spectronic 20D, set the display mode to Transmittance, warm up for 15 minutes.

10.9.2.3. With the sample compartment empty and the cover closed, adjust Power Switch/Zero Control until display reads 0%T.

10.9.2.4. Set the wavelength at 500 nm and the filter at 340-599 nm.

10.9.2.5. Place a test tube filled with DI water into the sample compartment and use the Transmittance/Absorbance Control to set the display to 100%T. Set to Absorbance mode, meter display must be 0.0%.

10.9.2.6. Transfer Cobalt Chloride solution into a test tube, place into the sample compartment and record the absorbance display to 500 nm.

10.9.2.7. Repeat step 10.9.2.6 at 505 nm, 510 nm, 515 nm and 520 nm.

10.9.2.8. Plot absorbance or transmittance versus wavelength.

10.9.2.9. The instrument is in proper calibration when the minimum transmittance or maximum absorbance occurs between 505 and 515 nm. The specific values are not important.

10.9.3. Refer to the table below to perform troubleshooting.

Problem	Possible Cause	Remedy
Instrument does not function.	Power line cord not connected to outlet	Plug in power line cord
	Dead power outlet	Try a different power outlet
	Internal fuse blown	Refer to service manual or service center
	Defective electronic component	Refer to service manual or service center
Meter/Display does not zero.	Sample compartment cover not closed	Close cover
	Lamp access door not tightly closed	Close door and retighten thumbscrew
	Phototube defective	Replace as required
	Defective electronic component	Refer to service manual or service center
Readings are drifting or incorrect.	Poor sampling technique	Eliminate bubbles or particles in solution Set 100%T on appropriate blank solution
	Filter selection lever is in wrong position	Set filter lever to proper position
	Fumes from sample	Remove sample immediately after analysis
	Excessive line voltage variation	Check voltage and grounding
	Source lamp defective	Replace with new lamp
	Phototube defective	Replace as required
	Defective electronic component	Refer to service manual or service center

Problem	Possible Cause	Remedy
Cannot set 100%T (0.0A), or display flashes.	100%T not properly set	Set 100%T with blank solution in the sample compartment and cover closed **Several turns of the 100%T control may be necessary**
	Filter selection lever in wrong position	Set filter lever to proper position
	Occluder closed	Install test tube in sample compartment
	Sample holder not fully inserted into adapter	Insert fully
	Source lamp weak or burned out	Replace with new lamp
	Phototube weak	Replace as required
	Error in wavelength calibration	Check calibration
Readings are not repeatable even though the 0%T and 100%T readings are set correctly.	Loose lamp	Tighten thumbscrew on lamp access door
	Loose sample holder adapter	Tighten set screw inside adapter
	Poor analytical technique	Clean or replace dirty test tubes; remove bubbles, etc
	Test tube position not repeating	Always position fiducial line in exactly the same place when test tube is inserted into adapter. Use square cuvettes
	Meter sticking (SPECTRONIC® 20 and 20+ only)	Tap lightly for possible correction If problem persists, refer to service center

11.0 QUALITY CONTROL

11.1. Acceptance criteria for each quality control procedure, is summarized in Appendix 1.

11.2. **Analytical Batch QC**

11.2.1. Pipettes must be calibrated prior to use. Refer to EMAX-QC06 for details.

11.2.2. Reagents are subjected to QC check prior to its use. Refer to EMAX-QC01 for details.

11.2.3. A minimum of 5-point initial calibration must be performed prior to analysis.

11.2.4. Analyze second source standard to verify the initial calibration concentrations.

11.2.5. Analyze calibration check standard at the end of the analytical run.

11.2.6. Perform wavelength calibration check at least once a year.

11.3. **Preparation Batch QC**

11.3.1. 20 is the maximum number of original field samples in a prep batch unless otherwise specified by the project.

11.3.2. Prepare method blank, LCS, MS and Sample Duplicate in every prep batch, unless otherwise specified by the project. They are subjected to the same process that the field samples undergo as described in Section 10.

11.3.3. Dilute and re-analyze all samples having concentrations over the highest calibration point.

11.3.4. Properly treat all lab wares used in the sample preparation as specified in EMAX-QC07.

11.4. **Method QC**

11.4.1. A valid DL and LOD must exist prior to sample analysis. Refer to EMAX-QA04 for details.

11.4.2. All analysts conducting this analysis must have an established Demonstration of Capability (DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTION

12.1. Corrective action for each Quality Control procedure is summarized in Appendix 1.

12.2. **Calibration**

12.2.1. Initial Calibration – If ICAL is non-compliant consider the following suggestions to correct the problem:

- If calibration point appears to be an outlier, re-prepare that ICAL point and re-analyze.
- Prepare a fresh intermediate standard, as well as fresh reagents and repeat the calibration.
- If problem persist, perform wavelength calibration check, prepare a new standards and repeat the ICAL.

12.2.2. Initial Calibration Verification – If ICV is non-compliant, consider the following suggestions to correct the problem:

- Prepare a fresh intermediate standard, as well as fresh reagents and repeat the calibration.
- If problem persist, perform wavelength calibration check, prepare new standards and repeat the ICAL.

12.2.3. Continuing Calibration Verification – If CCV is non-compliant, consider the following suggestions to correct the problem:

- Prepare a fresh intermediate standard, as well as fresh reagents and repeat the calibration.
- If problem persist, perform wavelength calibration check, prepare new standards and repeat the ICAL.

12.3. **Preparation Batch QC**

12.3.1. For insufficient amount of sample(s), inform the supervisor immediately for further action.

12.3.2. Method Blank (MB) – If MB is non-compliant consider the following suggestions to possibly correct the problem:

- If sample results are ND or > 10x the MB result, it is indicative that the MB is an isolated case and the results are reportable. Refer to the issue to the Supervisor and the PM if data is reportable, otherwise determine the source and the problem and repeat the process.

- If sample used for MB is the same source as the calibration blank, then it is indicative that contamination may have been attributed through distillation.
- If sample results are non-detect, then it is indicative that the MB contamination is an isolated incident. Report the result and discuss in the case narrative.
- If sample result(s) is/are detected at about the same level as the MB contamination then it is indicative that contamination may have come from the reagents used during distillation or from the distillation vessels. Perform a distillation vessel check and a reagent check to rule out the source of contamination. Repeat the distillation of all associated samples.

12.3.3. Lab Control Sample (LCS) – If LCS non-compliant consider the following suggestions to possibly correct the problem:

- Check for errors in calculation and concentration of the analyte solution.
- If recovery of LCS is non-compliant, check the PSR for corrective action otherwise, determine the probable cause of problem and perform corrective action and re-analyze all associated samples.

12.3.4. Matrix Spike (MS)/Matrix Spike Duplicate (MSD)/Sample Duplicate (Dup) – If recovery of MS/MSD or DUP is non-compliant consider the following suggestions to possibly correct the problem:

- If recovery of MS/MSD or RPD of DUP is non-compliant and LCS is in control and no apparent procedural or calculation error is noted, it is indicative of matrix interference. Check the PSR for corrective action. Otherwise, discuss in the case narrative.

12.4. A Non-Conformance Report (NCR) is required when the following circumstances occur:

- Anomalies other than specified in Appendix 1, is observed.
- Sample is out of technical holding time.

12.4.1. Refer to EMAX-QA08 for NCR details.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of standards and reagents that may go to wastewater drains.

13.2. Prepare all standards in fume hoods.

14.0 WASTE MANAGEMENT

14.1. No samples shall be dumped on the laboratory sink.

14.2. Separate and properly identify all unused and expired analytical standards for proper disposal.

14.3. Place all waste generated during analytical process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, expired analytical standards and other waste generated during the analytical process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. Definition of Terms

15.1.1. Colorimetry – is a technique used to determine concentration on an analyte that develops to a certain color resulting from its reaction to a coloring agent. The intensity of its color is measured by its absorbance of a specific wavelength of light.

15.1.2. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.1.2.1. **Preparation Batch** – is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.1.2.2. **Analytical batch** – is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices, preparation batches, and can exceed 20 samples.

15.1.3. Detection Limit (DL) – is defined as the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

15.1.4. Limit of Detection (LOD) – is defined as the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

15.1.5. Limit of Quantitation (LOQ) – is at the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

15.1.6. Safety Data Sheet (SDS) – is a written information concerning a chemical physical properties, toxicity, health hazards, fire hazard and reactivity data including storage, spill and handling precautions.

15.1.7. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.1.8. Calibration Blank – is a target-analyte-free solvent subjected to the entire analytical process to establish zero baseline or background value.

15.1.9. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical to monitor contamination.

15.1.10. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.1.11. Lab Control Sample Duplicate (LCSD) – is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.1.12. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise

specified by the project.

15.1.13. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.1.14. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.1.15. Matrix – is a component or form of a sample.

15.1.16. Matrix Spike (MS) – is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyzed to monitor matrix effect on a method's recovery efficiency.

15.1.17. Matrix Spike Duplicate (MSD) – is a replicate of MS analyzed to monitor precision or recovery.

15.1.18. Reagent Water – is purified water free from any target analyte or any other substance that may interfere with the analytical process.

15.2. **Application of EMAX QC Procedures**

15.2.1. The procedures and QC criteria summarized in this SOP applies to all projects when performing analysis for Chemical Oxygen Demand. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.3. **Department of Defense (DoD) and Department of Energy (DOE) Projects**

15.3.1. Samples from DoD and/or DOE sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD and DOE Consolidated Quality Systems Manual (QSM), latest update, is applied.

15.4. Note that SOP was revised on the merit of updating to Standard Method 22nd Edition. There are no analytical changes made from the previous version.

16.0 REFERENCES

16.1. Standard Methods For the Examination Of Water and Wastewater, 21st and 22nd Editions, Method 5220 D-1997 and 5220D-2011

16.2. Environmental Express COD Test procedure

16.3. Title 40 Code of Federal Regulations, Part 136 - Guidelines Establishing Test Procedure for the Analysis of Pollutants, latest edition

16.4. EMAX Quality Systems Manual, as updated

17.0 APPENDICES

17.1. **Figures**

17.1.1. Figure 1 Typical Sample Results Summary

17.1.2. Figure 2 Typical LCS/LCSD Summary

17.1.3. Figure 3 Typical MS Summary

17.1.4. Figure 4 Typical Sample Duplicate Summary

17.1.5. Figure 5 Typical Case Narrative

17.1.6. Figure 6 Typical Wavelength Calibration

17.2. **Appendices**

17.2.1. Appendix 1 Summary of Quality Control Procedures

17.2.2. Appendix 2 Demonstration of Capability

17.3. **Forms**

17.3.1. 5220DFA Analytical Run Log

17.3.2. 5220DFM Instrument Maintenance Log

Figure 1: TYPICAL SAMPLE RESULT SUMMARY

METHOD SM5220D
COD

Client : XYZ, INC.
Project : CLEAN PROJECT
Batch No. : YYMXXX
Matrix : WATER
InstrumentID : 70

CLIENT SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DFxPREP FACTOR	MOIST (%)	LOQ (mg/L)	DL (mg/L)	LOD (mg/L)	ANALYSIS DATETIME	PREPARATION DATETIME	DATA FILE ID	CAL REF	PREP BATCH	COLLECTION DATETIME	RECEIVED DATE
MBLK1W	CDM002WB	ND	1	NA	10	3	6	MM/DD/YYHH:MM	MM/DD/YYHH:MM	YYCDM00210	YYCDM002	CDM002W	NA	NA
LCS1W	CDM002WL	401	1	NA	10	3	6	MM/DD/YYHH:MM	MM/DD/YYHH:MM	YYCDM00211	YYCDM002	CDM002W	NA	NA
LCD1W	CDM002WC	411	1	NA	10	3	6	MM/DD/YYHH:MM	MM/DD/YYHH:MM	YYCDM00212	YYCDM002	CDM002W	NA	NA
ABCDEF-05	MXXX-05	3.77J	1	NA	10	3	6	MM/DD/YYHH:MM	MM/DD/YYHH:MM	YYCDM00213	YYCDM002	CDM002W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-05DUP	MXXX-05D	3.77J	1	NA	10	3	6	MM/DD/YYHH:MM	MM/DD/YYHH:MM	YYCDM00214	YYCDM002	CDM002W	MM/DD/YYHH:MM	MM/DD/YY
ABCDEF-05MS	MXXX-05M	420	1	NA	10	3	6	MM/DD/YYHH:MM	MM/DD/YYHH:MM	YYCDM00215	YYCDM002	CDM002W	MM/DD/YYHH:MM	MM/DD/YY

Figure 2: **TYPICAL LCS/LCSD SUMMARY**

EMAX QUALITY CONTROL DATA
LAB CONTROL SAMPLE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : SM5220D

MATRIX	: WATER		% MOISTURE:NA
DILUTION FACTOR	: 1	1	1
SAMPLE ID	: MBLK1W	LCS1W	LCD1W
LAB SAMPLE ID	: CDM002WB	CDM002WL	CDM002WC
LAB FILE ID	: YYCDM00210	YYCDM00211	YYCDM00212
DATE PREPARED	: MM/DD/YYHH:MM	MM/DD/YYHH:MM	MM/DD/YYHH:MM
DATE ANALYZED	: MM/DD/YYHH:MM	MM/DD/YYHH:MM	MM/DD/YYHH:MM
PREP BATCH	: CDM002W	CDM002W	CDM002W
CALIBRATION REF	: YYCDM002	YYCDM002	YYCDM002

ACCESSION:

PARAMETERS	MBResult (mg/L)	SpikeAmt (mg/L)	LCSResult (mg/L)	LCSRec (%)	SpikeAmt (mg/L)	LCDResult (mg/L)	LCDRec (%)	RPD (%)	QCLimit (%)	MaxRPD (%)
COD	ND	400	401	100	400	411	103	2	90-110	20

MB: Method Blank sample LCS: Lab Control Sample LCD: Lab Control Sample Duplicate

Figure 3: TYPICAL MS SUMMARY

EMAX QUALITY CONTROL DATA
MATRIX SPIKE SAMPLE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : SM5220D

MATRIX : WATER % Moisture: NA
DILUTION FACTOR: 1 1
SAMPLE ID : ABCDEF-05 ABCDEF-05MS
LAB SAMPLE ID : MXXX-05 MXXX-05M
LAB FILE ID : YYCDM00213 YYCDM00215
DATE PREPARED : MM/DD/YYHH:MM MM/DD/YYHH:MM
DATE ANALYZED : MM/DD/YYHH:MM MM/DD/YYHH:MM
PREP BATCH : CDM002W CDM002W
CALIBRATION REF: YYCDM002 YYCDM002

ACCESSION:

PARAMETER	PSResult (mg/L)	SpikeAmt (mg/L)	MSResult (mg/L)	MSRec (%)	QCLimit (%)
COD	3.77J	400	420	104	90-110

PS: Parent Sample MS: Matrix Spike

Figure 4: TYPICAL SAMPLE DUPLICATE SUMMARY

EMAX QUALITY CONTROL DATA
SAMPLE DUPLICATE ANALYSIS

CLIENT : XYZ, INC.
PROJECT : CLEAN PROJECT
BATCH NO. : YYMXXX
METHOD : SM5220D

MATRIX : WATER

DILUTION FACTOR:	1	1
SAMPLE ID :	ABCDEF-05	ABCDEF-05DUP
LAB SAMPLE ID :	MXXX-05	MXXX-05D
LAB FILE ID :	YYCDM00213	YYCDM00214
DATE PREPARED :	MM/DD/YYHH:MM	MM/DD/YYHH:MM
DATE ANALYZED :	MM/DD/YYHH:MM	MM/DD/YYHH:MM
PREP BATCH :	CDM002W	CDM002W
CALIBRATION REF:	YYCDM002	YYCDM002

ACCESSION:

PARAMETER	PSResult (mg/L)	DUPResult (mg/L)	RPD (%)	QCLimit (%)
COD	3.77J	3.77J	NA	20

PS: Parent Sample DUP: Sample Duplicate

Figure 5: TYPICAL CASE NARRATIVE

CASE NARRATIVE

Client : XYZ, INC.

Project: CLEAN PROJECT

SDG : YYMXXX

METHOD SM5220D
COD

One (1) water sample was received on MM/DD/YY to be analyzed for COD in accordance with Method SM5220D and project specific requirements.

Holding Time
The sample was analyzed within the prescribed holding time.

Calibration
Calibration was performed as prescribed by the method and was verified using a secondary source (ICV). All calibration requirements were within acceptance criteria.

Method Blank
Method blank was prepared and analyzed at the frequency required by the project. For this SDG, one (1) method blank was analyzed. COD was not detected in CDM002WB. Refer to sample result summary form for details.

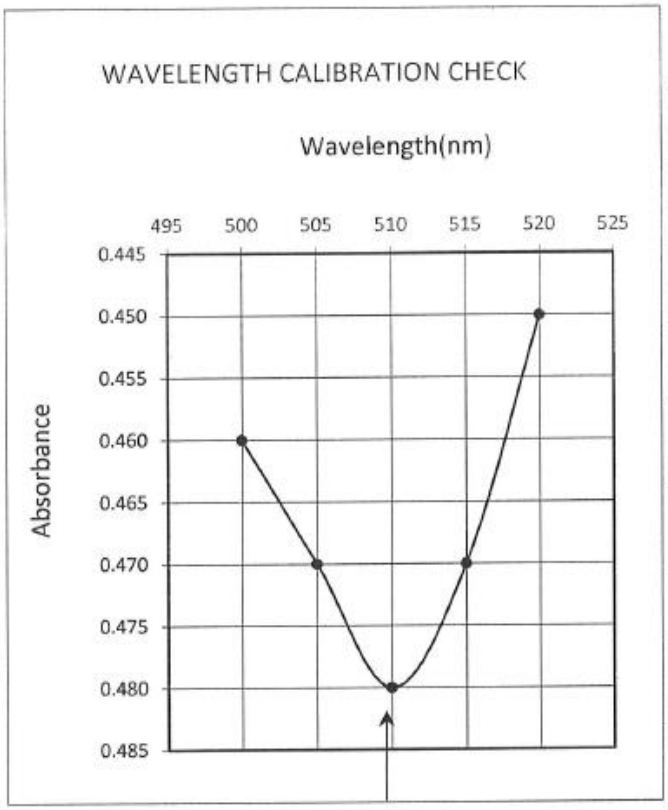
Lab Control Sample
Lab control sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) set of LCS/LCD was analyzed. CDM002WL/CDM002WC were within LCS limits. Refer to LCS summary form for details.

Matrix QC Sample
Matrix spike sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) MS was analyzed. Percent recovery for COD was within MS QC limits in MXXX-05M. Sample duplicate was analyzed and RPD was within expected value. Refer to Matrix QC summary forms for details.

Sample Analysis
The sample was analyzed according to prescribed analytical procedures. Results were evaluated in accordance to project requirements. For this SDG, all quality control requirements were met.

Figure 6: TYPICAL WAVELENGTH CALIBRATION

Photo Linearity Check



Instrument ID: 70

WL (nm)	Response	DateTime
500	0.46	03/27/18 17:56
505	0.47	03/27/18 17:57
510	0.48	03/27/18 17:58
515	0.47	03/27/18 17:59
520	0.45	03/27/18 18:00

Acceptance Criteria	
Maximum Absorbance must be between	505 - 515 nm

Performed By: ALy

Reviewed By: TK

Date: 03/28/18

Appendix 1: SUMMARY OF QUALITY CONTROL PROCEDURES

QC PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	1st Rvw	2nd Rvw
Multipoint calibration curve	Initial daily calibration prior to sample analysis	Correlation coefficient ≥ 0.995 for linear regression	Correct the problem then repeat initial calibration		
Initial Calibration Verification (ICV)	After initial calibration	Within ± 10% of expected value.	Correct the problem then repeat initial calibration		
Continuing Calibration Verification (CCV)	Every 10 samples and at the end of the run	Within ± 10% of expected value.	Re-calibrate and re-analyze all associated samples.		
Initial and Continuing Calibration Blank (ICB & CCB)	After ICV / CCV	No interference above LOD	Re-calibrate and re-analyze all associated samples.		
Method blank (MB)	One MB per preparation batch	Refer to PSR Otherwise result must be ≤ ½ LOQ	If sample result is ND or > 10X the contaminant level, you may report the result and discuss it in the case narrative. Otherwise, re-prep and re-analyze method blank and all samples processed with the contaminated blank		
Lab Control Sample (LCS)	One LCS per preparation batch	Within project limit *%Rec. 90-110%	Re-prep and re-analyze the LCS and all associated samples.		
Matrix Spike (MS)	One MS for every 10 project samples or less per matrix	Within project limit *%Rec. 90-110%	If LCS is in control and no apparent reason for MS to be outside the QC limits, it is indicative of matrix interference, discuss in the case narrative.		
Sample Duplicate (Dup)	One Dup per every 10 project samples or less per matrix	Within project limit *RPD ≤ 20%	If LCS is in control and no apparent reason for Dup to be outside the QC limits, it is indicative of matrix interference, discuss in the case narrative.		
Comments: Refer to PSR for flagging criteria 21st and/or 22nd Editions			Reviewed By: Date		

* in the absence of project limit default to

Appendix 2: DEMONSTRATION OF CAPABILITY

DEMONSTRATION OF CAPABILITY
CHEMICAL OXYGEN DEMAND
SM 5220D

SOP: EMAX-5220D Rev. 3

Conc Unit: mg/L

Sample Amount(ml): 2.5

Analysis date: 3/27/2018

Analyzed by: A. Ly

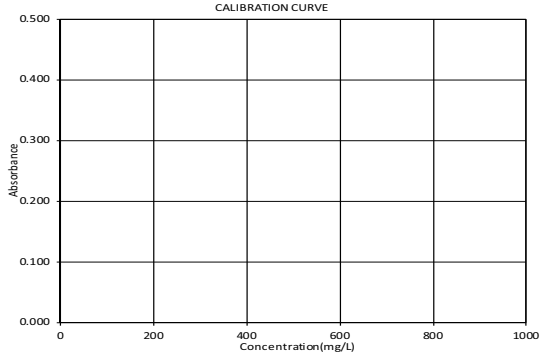
PARAMETER	CDC004WL CDC00411	CDC004WC CDC00412	CDC004WX CDC00413	CDC004WY CDC00414	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	Accuracy Acceptance Limits (% Rec)	RSD (%) Criteria	COMMENTS
COD	398	394	406	400	400	399	100	4.96	1	90 - 110	≤ 20	Passed

5220DFA: ANALYTICAL RUN LOG (Page 1)

Data File Name	Calibration ID	Conc. mg/L	WL	Abs	CalDate	FC	%Rec
C00	S0	0					
C00	S1	0					
C00	S2	0					
C00	S3	0					
C00	S4	0					
C00	S5	0					
C00	S6	0					
C00	ICV	0					
C00	ICB	0					

$$FC = [(A * CF) - Y] * DF$$

InstrumentID: 70



CF= Y= r=

DL Water(mg/L)	3
LOD Water(mg/L)	6
LOQ Water(mg/L)	10

SOP

☐ EMAX-410.4 Rev. ☐ EMAX-5220D Rev.

Comments:

Standard / Reagent ID	Description	Conc.	Exp.Date
	Intermediate ICAL CCV Std (mg/L)	1000	
	Intermediate ICV LCS Std (mg/L)	1000	
	MS Std (mg/L)	1000	
	Mercuric Sulfate		
	Reagent Water		
	Sand		
	Digestion Solution		
	pH Strip		

Standard Prep	Intermediate Std Aliquot (ml)	Final Vol (ml)	DateTime
S0		2.5	
S1		2.5	
S2		2.5	
S3		2.5	
S4		2.5	
S5		2.5	
S6		2.5	
ICV		2.5	
CCV		2.5	
LCS EV		2.5	
MS EV		2.5	

Expected Sample Amount:

Digestion Temp (°C):

Thermometer ID:

Snapseal Lot | 1.5oz | 4oz | 10oz |

Balance ID:

Micropipette ID:

☐ Digestion Date Time Start: ☐ End:

Analyzed by:

5220DFA: **ANALYTICAL RUN LOG (Page 2)**

DataFileID	LabSampleID	Result	Flag	RUnit	Sample Amt	SUnit	PDateTime	FinalVol (ml)	WL	Abs	ADateTime	Sample Bkgnd	DF	%M	Conc.	DFxPrep Factor	Notes	Analyst	Sample pH

5220DFA: ANALYTICAL RUN LOG (Page 3)

LAB QC CHECK

DataFileID	LabSampleID	Result	Expected Value	QC Result

MS CHECK

DataFileID	LabSampleID	Result	Expected Value	QC Result

DUP CHECK

DataFileID	LabSampleID	Result	Expected Value	RPD

5220DFM: INSTRUMENT MAINTENANCE LOG

Page 1

EMAX LABORATORIES, INC.

SPECTROPHOTOMETER MAINTENANCE LOG

Instrument No: 70 Month: Year: 201_ Book # M70-010

Date							
Analysis							
Zero Control (0%T)							
Transmittance/Absorbance Control (100%T/0.0A)							
Instrument Warm-up, 15 min minimum							
Wavelength, nm.							
Analyst Initial							
Troubleshooting							
Problem(s) Encountered							
Return To Specs (Analyst Initial)							

Code	Problems Encountered	Code	Corrective Action

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889

ADDENDUM TO	
Document	ALL COLORIMETRIC STANDARD METHOD SOPS
Revision Number	CURRENT REVISIONS
Section	17.0 Appendices
Date	24 October 2018
Reference Number	AA.6

This applies to all Standard Method SOPs where the spectrophotometer is used and Photo Linearity Check (PLC) is required.

Photo Linearity Check record shall bear a Control Number PLC-MMYY where:

MM – is a two digit number representing the month of the year (e.g., 01 for January) when PLC was performed.

YY – is a two digit number representing to the last two digits of the year when PLC was performed.

Refer to attached Sample Photo Linearity Check record.

PREPARED BY: _____ Date: 10/24/18

Name Farina Madamba

Title QA / QC Coordinator

APPROVED BY: _____ Date: 10 25 18

Name Kenette Pimentel

Title QA Manager

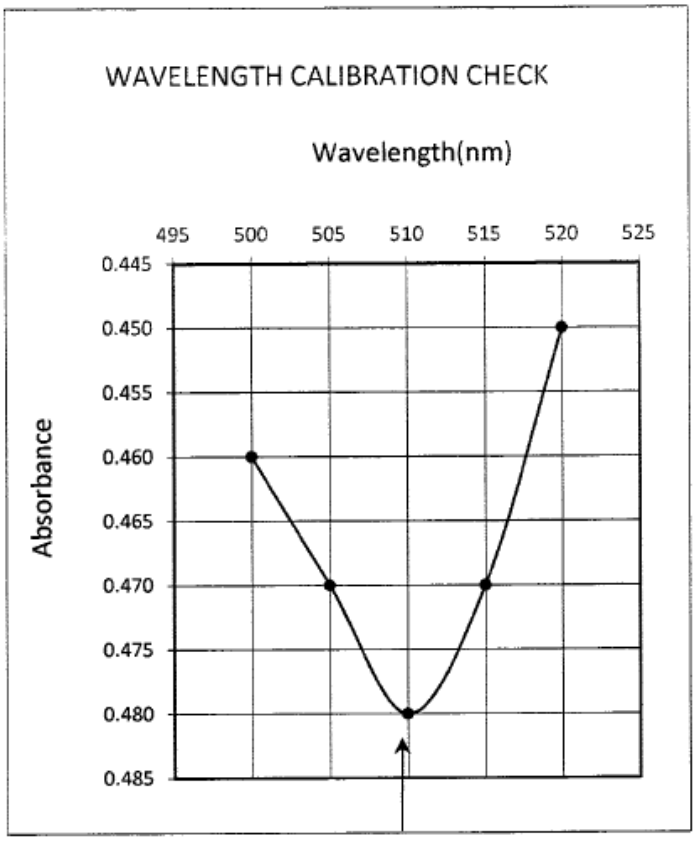
APPROVED BY: _____ Date: 10/24/18

Name Caspar Pang

Title Laboratory Director

Control No. PLC-0318

Photo Linearity Check



Instrument ID: 70

WL (nm)	Response	DateTime
500	0.46	03/27/18 17:56
505	0.47	03/27/18 17:57
510	0.48	03/27/18 17:58
515	0.47	03/27/18 17:59
520	0.45	03/27/18 18:00

Acceptance Criteria	
Maximum Absorbance must be between	505 - 515 nm

Performed By: ALy

Reviewed By: TK

Date: 03/28/18

ANNUAL REVIEW FORM

CHEMICAL OXYGEN DEMAND (COLORIMETRIC, MANUAL)

SOP#: EMAX-5220D **Rev** 4 **Effective Date:** 12-Sep-18

COMMENTS	Reviewed By	Review Date
No updated needed per DRF by CMyint dtd 7/19/19		7/19/19
No update needed per DRF by T. Kosaka 10/22/2020.		10/22/2020

STANDARD OPERATING PROCEDURES

TOTAL ORGANIC CARBON

SOP No.:	EMAX-5310B	Revision No.	4	Effective Date:	18-Sep-17
Prepared By:	Tyler Kosaka			Date:	09/14/17
Approved By:	Kenette Pimentel QA Manager			Date:	09-14-17
Approved By:	Caspar Pang Laboratory Director			Date:	09-14-17

Control Number: 53010B-04

1.0 SCOPE AND APPLICATION

1.1. This method is used to determine total organic carbons (TOC) in an aqueous sample by combustion-infrared technique. This procedure is only applicable to homogenous samples.

1.2. This SOP is an adaptation of Method 5310B-2000, Standard Methods for the Examination of Water and Wastewater, 21st and 22nd Editions.

2.0 SUMMARY OF METHOD

2.1. An aliquot of acidified sample is injected into the Analyzer, sparged with gas (compressed air or nitrogen) to remove IC content, and heated at 680°C to convert IC to Total Organic Compound.

2.2. **Interference**

2.2.1. Carbonate and bicarbonate carbon represents interference and must be removed or accounted for in the final calculation.

2.2.2. Suspended particles of a liquid sample or extract, is known to alter results.

3.0 DETECTION LIMITS

3.1. **Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ)**

3.1.1. Refer to EMAX-QA04 for generation, validation and verification for DL, LOD and LOQ.

3.1.2. Established DL, LOD and LOQ are:

Matrix	DL	LOD	LOQ
Water (mg/L)	0.25	0.5	1.0

4.0 DYNAMIC RANGE

4.1. The highest quantifiable range requiring no dilution is equal to the concentration of the highest calibration point. All samples analyzed above this range are considered "over range" and requires dilution to properly quantitate.

4.2. The lowest quantifiable range of diluted samples is equal to the concentration of the lowest calibration point. All diluted samples analyzed below this range are considered "under range" and requires lower dilution factor to properly quantitate.

5.0 SAMPLE HOLDING TIME & PRESERVATION

5.1. **Sample Collection**

5.1.1. Samples received in the laboratory are expected to be contained in HDPE or glass bottles and cooled to ≤ 6°C without freezing.

5.2. **Holding Time**

5.2.1. Samples are expected to be stable for 28 days.

5.3. **Preservation**

5.3.1. Preserve samples at pH <2 with either HCl or H_2SO_4.

5.3.2. Store samples in plastic or glass containers that prevent any possible carbon contamination.

5.3.3. Store samples at ≤ 6°C without freezing.

6.0 ASSOCIATED SOPs

6.1. EMAX-DM1 Data Flow and Review

6.2. EMAX-QA04 Detection Limit (DL)

6.3. EMAX-QA05 Training

6.4. EMAX-QA08 Corrective Action

6.5. EMAX-QC01 Quality Control for Chemicals

6.6. EMAX-QC02 Analytical Standard Preparation

6.7. EMAX-QC06 Calibration of Micropipettes

6.8. EMAX-QC07 Glassware Cleaning

6.9. EMAX-SM03 Waste Disposal

6.10. EMAX-SM04 Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS for chemicals listed in this SOP.

7.2. Treat reagents, standards, and samples as potential hazards. Observe the standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, gloves at all times when performing this procedure.

7.3. If for any reason, solvent and/or other reagents get in contact with your skin or any other part of your body, rinse the affected body part thoroughly with copious amounts of tap water. If irritations or any other discomfort related to the incident persist, inform your supervisor immediately so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS & REAGENTS

8.1. Instruments and Supplies

8.1.1. Total Organic Carbon Analyzer Model TOC-V_{CPN} or equivalent

8.1.2. Autosampler – ASI-V

8.1.3. Filtering apparatus and 0.45-µm-pore diam filters, preferably HPLC syringe filters or similar.

8.1.4. Micropipettes – 1 and 5 ml, 200 µl

8.2. Chemicals and Reagents

8.2.1. All reagents are reagent grade or better.

8.2.2. Hydrochloric Acid, 2M HCl

8.2.3. Sulfuric Acid, concentrated H_2SO_4

8.2.4. Reagent Water

9.0 STANDARDS

9.1. Standard Preparation

9.1.1. Refer to EMAX-QC02 for proper preparation of analytical standards.

9.1.2. Oven dry Potassium Hydrogen Phthalate @ 105°C - 120°C for 1- hour.

9.1.3. Oven dry Sodium Hydrogen Carbonate @ 280°C - 290°C for 1- hour.

9.1.4. All standards are cooled and stored in dessicator.

9.1.5. Other concentration levels may be prepared other than specified below as long as it is compliant to required acceptance criteria, and should be stored at ≤ 6°C without freezing.

9.2. Stock Standards

9.2.1. Primary Stock Standards – are purchased commercially as certified standards. These standards are primarily used for calibration.

Standard Name	Source	Concentration (mg/L)
Total Organic Carbon	ERA or equivalent	1,000

9.2.2. Secondary Stock Standards – are purchased commercially from different sources. These standards are used for ICV and LCS.

Standard Name	Source	Concentration (mg/L)
Potassium Phthalate, crystal	Mallinckrodt or equivalent	Assay

9.2.3. Other Standards – are purchased commercially and these standards are used to determine the removal of carbonate and bicarbonate by purging.

Standard Name	Source	Concentration (mg/L)
Sodium Bicarbonate	BDH or equivalent	Assay
Sodium Carbonate	Mallinckrodt or equivalent	Assay

9.3. **Intermediate Standards**

9.3.1. Secondary Intermediate Standards – are prepared using the secondary stock standards as follows:

Standard Name	Concentration	Amount	Final Conc.	Solvent	Final Volume
Potassium Phthalate	Assay	0.2128 g	1,000 mg/L	Reagent Water	100 ml

9.3.2. Carbonate/Bicarbonate Intermediate Standards – is prepared as follows:

Standard Name	Concentration	Amount	Final Conc.	Solvent	Final Volume
Sodium Carbonate	Assay	0.4418 g	1,000 mg/L	Reagent Water	100 ml
Sodium Bicarbonate	Assay	0.3512			

9.4. **ICAL Standards**

9.4.1. A minimum of 5 point calibration standards are prepared using a clean 100 ml volumetric flask, in reagent water.

ICAL Pt.	Primary Stock Standard (1,000 mg/L) Aliquot (µl)	Final Volume (ml)	Concentration (mg/L)
S0	0	100	0
S1	0.1	100	1
S2	0.5	100	5
S3	1.0	100	10
S4	4.0	100	40
S5	8.0	100	80

9.5. **Check Standards**

9.5.1. Initial Calibration Verification (ICV)

9.5.1.1.1. Prepare ICV standard by diluting 2.5 ml of secondary intermediate standard (1000 mg/L) solution to 100 ml reagent water. The expected value of this is 25 mg/L.

9.5.2. Continuing Calibration Verification (CCV)

9.5.2.1.1. Prepare CCV standard by diluting 2.5 ml of primary stock standard solution to 100 ml reagent water. The final concentration of the check standard shall be 25 mg/L.

9.5.3. Carbonate/Bicarbonate Standard

9.5.3.1. Prepare Carbonate/Bicarbonate standard by diluting 0.1 ml of Carbonate/Bicarbonate intermediate standard (1,000 mg/L) to 100 ml of reagent water. The expected value of this is 1 mg/L.

10.0 PROCEDURES

10.1. Sample Preparations

10.1.1. When Dissolved Organic Carbon (DOC) is to be determined, filter the sample prior to injection. Otherwise, aqueous sample is directly injected into the instrument.

10.2. Instrument Parameters

10.2.1. TOC-V_{CPN}

Catalyst Type	TOC High Sensitivity Catalyst
Furnace Temperature	680°C
Gas Flow Rate	150 ml/min
Tubing Diameter	0.5 min.
NDR Cell Length	Long
Range	X3
Replicate Injection	2

10.2.2. Autosampler : ASI-V

Tray Type	24 ml vial
Needle	Sample needle
Needle Wash/Flow Line Wash	2
Rack	0 – 93

10.3. Calibration

10.3.1. Analyze the ICAL standards. Refer to Section 9.4.

10.3.2. Generate the calibration curve after the multi-level ICAL analysis is completed.

10.3.3. Analyze ICV to verify the ICAL.

10.3.4. Refer to Appendix 1 for acceptance criteria.

10.4. Analysis

10.4.1. Place ICAL standards, check standards and sample in designated Auto Sampler positions.

10.4.2. Set up calibration(*.cal)\method(*.met)\template(*.tpl) parameters, refer to Shimadzu TOC-VCPN Sections 4.3 to 4.4.

10.4.2.1. If desired calibration\method\template parameter already exist, in C:\Program Files\Shimadzu Corporation\TOC3201, save and rename the templates in their respective folders, such that, 80_9060.cal(4x injections) and/or 80_415.cal(2x injections) as TCI001.cal.

10.4.2.2. Make sure the templates fulfill all project requirements and generate a sequence by opening a new file to include, Calibration curve, Control Calibration Checks and Auto-Generate to program sample positions.

10.4.3. Check background monitor in the instrument menu before starting the analysis. All window should display green check marks.

10.4.4. Set quantitation to average duplicate determination. Refer to NPOC/TOC Criteria Quantitation of TOC results outlined in TOC-V manual Section 5.1.3 and 5.1.5.

10.4.5. Sparge the acidified sample (pH = 2~3) with zero grade air and/or high purity nitrogen gas, to eliminate the IC Component. Measure the TC remaining in the sample and determine the Total Organic Carbon (NPOC).

10.4.6. The ICAL, check standards and samples must be injected in duplication.

10.4.7. Analytical Sequence

10.4.7.1. ICAL – initial calibration

10.4.7.2. ICV – initial calibration verification

10.4.7.3. ICB – initial calibration blank

10.4.7.4. MB - method blank

10.4.7.5. LCS – lab control sample

10.4.7.6. LCSD – lab control sample duplicate (in the absence of MS)

10.4.7.7. Samples - maximum of 10 field samples

10.4.7.8. Duplicate – sample duplicate

10.4.7.9. MS – matrix spike

10.4.7.10. CCV – continuing calibration check

10.4.7.11. CCB – continuing calibration blank

10.4.7.12. Samples - maximum of 10 field samples

10.4.7.13. Duplicate – sample duplicate

10.4.7.14. MS – matrix spike

10.4.7.15. ECC – ending calibration check

10.4.7.16. ECB – ending calibration blank

10.5. **Sample Result Evaluation**

10.5.1. Evaluate QC results as soon as the data is available.

- ✓ Check CCVs that they are within the acceptance criteria.

- ✓ Check that the batch QC samples met the acceptance criteria.
- ✓ Check concentration of target analytes. If the response exceeds the calibration range, dilute and re-analyze the sample until the response falls within the calibration range.
- ✓ If any of the above checkpoints indicate a problem, check the specified corrective action in Appendix 1 to determine if re-analysis is necessary. If re-analysis results are the same as the initial result, consult the Supervisor for further action.

10.6. **Calculations**

10.6.1. Calculate for Standard Deviation (SD)

$$SD = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \bar{x})^2}{N-1}} \qquad \text{Eq.-10.6.1}$$

where:

X_i – Result at the ith measurement

$\bar{x}$ – Mean

N – Number of measurements

10.6.2. Calculate for % Relative Standard Deviation (%RSD)

$$\%RSD = \left[\frac{SD}{ACF}\right] 100 \qquad \text{Eq.-10.6.2}$$

where:

SD – Standard deviation

ACF – Average Calibration Factor

10.6.3. Calculate for Percent Recovery

$$\%\,\mathrm{Recovery} = \frac{(C_f - C)}{C_s} \times 100 \qquad \text{Eq.-10.6.3}$$

where:

C_f – Concentration found

C – Concentration of the sample (use 0 for LCS)

C_s – Concentration of spike

10.6.4. Calculate for Relative Percent Difference (RPD)

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)} x100 \qquad \text{Eq.-10.6.4}$$

where*:*

C_1 – Measured concentration of the first sample aliquot

C_2 – Measured concentration of the second sample aliquot

10.7. **Data Reduction**

10.7.1. Make a copy of the analytical run log.

10.7.2. Print a copy of the raw data and the QC report.

10.7.3. Highlight the data to be reported.

10.7.4. Collate the reportable data separating the QC results from the sample results.

10.7.5. Keep all other data generated with the analytical folder marked with “For record only”.

10.8. **Report Generation**

10.8.1. Generate the method.txt file using WDB5N.exe.

10.8.2. Generate sample results using MSRB6.exe.

10.8.3. Generate the QC Summary using QCIC.exe.

10.8.4. Generate the sample duplicate result using CQ1N.exe.

10.8.5. Generate the Case Narrative using CN00.exe.

10.8.6. Arrange the analysis package in sequence as detailed below.

10.8.6.1. Case Narrative

10.8.6.2. Sample Results

10.8.6.3. LCS/LCD Summary

10.8.6.4. MS/MSD Summary

10.8.6.5. Sample Duplicate Result

10.8.6.6. Calibration Summary

10.8.6.7. Analytical Run Log

10.8.6.8. Non-Conformance Report (If any)

10.9. **Data Review**

10.9.1. Perform a 100% data review in accordance to EMAX-DM01 and the PSR.

10.9.2. Review the generated reports for calculation accuracy and that dilution factors are properly applied.

10.9.3. Review the attached logs that they are properly filled.

10.9.4. Check the generated reports against the raw data. Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.

10.9.5. Review the case narrative and check that it accurately describes what transpired in the analytical process. Edit as necessary to reflect essential issues not captured by the case narrative generator program.

10.9.6. Submit the analytical folder for secondary review.

10.10. **Preventive Maintenance**

10.10.1. Perform daily instrument check prior to sample analysis. Refer to Form 5310BFM – Instrument Maintenance Log.

Maintenance Activity	Description	Frequency
Documentation	Record all instrument maintenance performed in the instrument maintenance log.	Daily prior to analysis
System Cleaning	Remove dust from fans and vent covers	Every 6 months
Parts Maintenance	Replace worn out parts	Every 6 months
Lubrication	Lubricate mechanical parts	Every 6 months
Flow and Waste lines	Inspect flow and waste lines and replace	Every 6 moths or as necessary
Combustion Tube	Change combustion tube	Every 6 months or as necessary
Absorber	Change CO2 absorber	Every 6 months or as necessary
Scrubber	Change halogen scrubber	Every 6 months or as necessary
Humidifier	Change humidifier water	Every 6 months
Inspection	Perform general inspection of the complete system	Once a year

10.10.2. Maintain an inventory of instrument parts and supplies for routinely maintenance.

10.10.3. For troubleshooting refer to the TOC analyzer operations manual or go to http://www.ssi.shimadzu.com/toc_virtualadvisor/ for virtual troubleshooting assistance.

11.0 QUALITY CONTROL

11.1. Acceptance criteria for each quality control procedure, is summarized in Appendix 1.

11.2. **Analytical Batch QC**

11.2.1. Pipettes must be calibrated prior to its use. Refer to EMAX-QC06 for details.

11.2.2. Reagents are subjected to QC check prior to its use. Refer to EMAX-QC01 for details.

11.2.3. All analytical standards are prepared fresh on the day the analysis is done. Follow the procedures for all analytical standard preparations as described in EMAX-QC02 and document in the analytical standard preparation log.

11.3. **Preparation Batch QC**

11.3.1. A preparative batch includes a MB, LCS, and a maximum of 20 field original samples unless otherwise specified by the project.

11.3.2. MS/MSD is analyzed every 10 samples unless otherwise specified by the project.

11.3.3. In the absence of MS/MSD, a LCS duplicate (LCD) is prepared and analyzed.

11.3.4. Properly treat all lab wares used in the sample preparation as specified in EMAX-QC07.

11.4. **Method QC**

11.4.1. A valid DL and LOD must exist prior to sample analysis. Refer to EMAX-QA04 for details.

11.4.2. All analysts conducting this analysis must have an established Demonstration of Capability (DOC) as described in EMAX-QA05.

12.0 CORRECTIVE ACTION

12.1. Corrective action for each quality control procedure is summarized in Appendix 1.

12.2. **Calibration**

12.2.1. When ICAL is not compliant, consider the following suggestions to correct the problem:

12.2.1.1. If the correlation coefficient (r) is out of acceptance criteria, review the results and identify presence of an outlier.

- If one of the standards returns a bias-low or bias high on all of the analytes then that point is considered an outlier. Prepare a standard at that ICAL point and re-analyze.
- If the highest ICAL point appears to be saturated, drop the highest point and analyze a lower concentration.
- If the lowest point returns a bias low response or the peaks are not distinct and sharp, drop the point and analyze a higher concentration.
- Otherwise, optimize the instrument and repeat the ICAL.

12.2.2. When ICV or CCV is not compliant, consider the following suggestions to correct the problem:

- Rule out standard degradation. Prepare a fresh standard and re-analyze.
- If response is low check for leak or if gas pressure is low.
- If response is high, run a blank to rule out contamination. If contamination exists, determine the source of contamination and apply necessary measures to correct the problem. Re-analyze all associated samples that had positive detections.
- Otherwise, inform the supervisor for further instruction.

12.3. **Preparation Batch QC**

12.3.1. For insufficient amount of sample(s), inform the supervisor immediately for further action.

12.3.2. Method Blank (MB) - When MB is not compliant, consider the following suggestions to correct the problem:

- Rule-out instrument contamination by analyzing instrument blank. In the event that instrument contamination is observed perform the following:
  - replace CO_2 absorber
  - replace the Halogen scrubber
  - clean the humidifier tubing
  - replace the content of the dilution bottle with a freshly harvested reagent water. Purge the wash line.
  - re-analyze instrument blank
- If problem persist, perform the decontamination procedure as described in the operations manual or go to http://www.ssi.shimadzu.com/toc_virtualadvisor/.
- If no apparent instrument contamination is observed, re-analyze another reagent blank freshly harvested from the reagent water purifier. If problem persist, inform the Supervisor.
- Re-analyze all samples with positive results. Where re-analysis is not possible, flag the data as described by the PSR and discuss in the case narrative.

12.3.3. Lab Control Sample (LCS) - When LCS in is not compliant, consider the following suggestions to correct the problem:

- Rule out standard degradation. Prepare a fresh standard and re-analyze.
- If recovery is low check for leak or if gas pressure is low. Apply necessary measures to correct the problem and re-analyze all associated samples. Where re-analysis is not possible, flag the data as described by the PSR and discuss in the case narrative.
- If response is high, run a blank to rule out contamination. If contamination exists, determine the source of contamination and apply necessary measures to correct the problem. Re-analyze all associated samples positive results.
- Otherwise, inform the supervisor for further instruction.

12.3.4. Matrix Spike/Matrix Spike Duplicate (MS/MSD) - When MS/MSD in is not compliant, consider the following suggestions to correct the problem:

- Rule out procedural error, e.g., sample was properly spiked, calculations are correct, etc. If procedural error is apparent, re-analyze MS/MSD.
- If matrix interference is suspected, discuss it in the case narrative.

12.4. A Non-Conformance Report (NCR) is required when the following circumstances occur:

- Anomalies other than specified in Appendix 1, is observed.
- Sample is out of technical holding time.

12.4.1. Refer to EMAX-QA08 for NCR details.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of solvent that may go to the wastewater drains.

13.2. Prepare all standards in fume hoods to prevent air pollution in the work area.

14.0 WASTE MANAGEMENT

14.1. No samples shall be dumped on the laboratory sink.

14.2. Separate and properly identify all unused and expired analytical standards for proper disposal.

14.3. Place all waste generated during analytical process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, expired analytical standards and other waste generated during the analytical process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. **Definition of Terms**

15.1.1. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.1.1.1. **Preparation Batch –** is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.1.1.2. **Analytical Batch –** is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices; preparation batches, and can exceed 20 samples.

15.1.2. Detection Limit (DL) – is defined as the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

15.1.3. Limit of Detection (LOD) – is defined as the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

15.1.4. Limit of Quantitation (LOQ) – is at the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

15.1.5. Safety Data Sheet (SDS) – is a written information concerning a chemical physical properties, toxicity, health hazards, fire hazard and reactivity data including storage, spill and handling precautions.

15.1.6. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.1.7. Calibration Blank – is a target-analyte-free solvent subjected to the entire analytical process to establish zero baseline or background value.

15.1.8. Instrument Method – is a file generated to contain the instrument calibration and instrument parameter settings for a particular analysis.

15.1.9. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical procedure to monitor contamination.

15.1.10. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.1.11. Lab Control Sample Duplicate (LCSD) – is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.1.12. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.1.13. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.1.14. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.1.15. Matrix – is a component or form of a sample.

15.1.16. Matrix Spike (MS) – is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyzed to monitor matrix effect on a method's recovery efficiency.

15.1.17. Matrix Spike Duplicate (MSD) – is a replicate of MS analyzed to monitor precision or recovery.

15.1.18. Reagent Water – is purified water free from any target analyte or any other substance that may interfere with the analytical process.

15.2. **Application of EMAX QC Procedures**

15.2.1. The procedures and QC criteria summarized in this SOP applies to all projects when performing Total Organic Carbon analysis. In instances where there is a project or program QAPP, the requirement given in the project takes precedence over this SOP.

15.3. **Department of Defense (DoD) and Department of Energy (DoE) Projects**

15.3.1. Samples from DoD and DoE sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD Quality Systems Manual (QSM), latest update, is applied.

16.0 REFERENCES

16.1. Standard Methods for Examination of Water and Wastewater, 21st and 22nd Editions

16.2. Title 40 Code of Federal Regulations, Part – 136 Guidelines Establishing Test Procedures for the Analysis of Pollutants, latest edition

16.3. Instructional Manual TOC-VCSH/CSN & TOC-Control V Software TOC-VCPH/CPN

16.4. EMAX Quality Systems Manual, as updated

17.0 APPENDICES

17.1. **Figures**

- 17.1.1. Figure 1 Typical Raw Data
- 17.1.2. Figure 2 Typical Sample Result Summary
- 17.1.3. Figure 3 Typical LCS/LCSD Report Summary
- 17.1.4. Figure 4 Typical MS/MSD Summary
- 17.1.5. Figure 5 Typical Sample Duplicate Result Summary
- 17.1.6. Figure 6 Typical Case Narrative

17.2. **Appendices**

- 17.2.1. Appendix 1 Summary of Quality Control Procedures
- 17.2.2. Appendix 2 Demonstration of Capability

17.3. **Forms**

- 17.3.1. Form 5310BFA Analytical Run Log
- 17.3.2. Form 5310BFM Instrument Maintenance Log

Figure 1: TYPICAL RAW DATA

CZhao 07/13/17 01:25:59 PM TCC006.t32

Sample

Sample Name: C778-01
Sample ID: TCC006-36
Origin: TCC006.cal
Chk. Result

Type	Anal.	Dil.	Result
Unknown	NPOC	1.000	NPOC:6.006 mg/L

1. Det

Anal.: NPOC

No.	Area	Conc.	Inj. Vol.	Aut. Dil.	Ex.	Cal. Curve	Date / Time
1	23.28	5.941mg/L	50uL	1		TCC006.2017_03_21_12_17_49.cal	03/21/17 11:25:04 PM
2	23.44	5.982mg/L	50uL	1		TCC006.2017_03_21_12_17_49.cal	03/21/17 11:26:37 PM
3	23.79	6.071mg/L	50uL	1		TCC006.2017_03_21_12_17_49.cal	03/21/17 11:28:16 PM
4	23.62	6.028mg/L	50uL	1		TCC006.2017_03_21_12_17_49.cal	03/21/17 11:29:52 PM

Mean Area 23.53
Mean Conc. 6.006mg/L

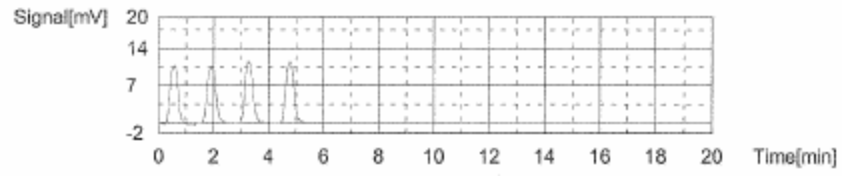


Figure 2: TYPICAL SAMPLE RESULT SUMMARY

METHOD SM5310B
TOC

Client : XYZ, INC.
Project : CLEAN PROJECT
Batch No. : YYMXXX
Matrix : WATER
Instrument ID : I62

SAMPLE ID	EMAX SAMPLE ID	RESULTS (mg/L)	DLF	MOIST	RL (mg/L)	MDL (mg/L)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1W	TCC004WB	ND	1	NA	1.00	0.500	03/21/1718:20	NA	TCC006-11	TCC006-09	TCC004W	NA	NA
LCS1W	TCC004WL	23.9	1	NA	1.00	0.500	03/21/1718:35	NA	TCC006-12	TCC006-09	TCC004W	NA	NA
LCD1W	TCC004WC	23.9	1	NA	1.00	0.500	03/21/1718:50	NA	TCC006-13	TCC006-09	TCC004W	NA	NA
AABBCCDDEEFF	MXXX-01	6.01	1	NA	1.00	0.500	03/21/1723:29	NA	TCC006-36	TCC006-32	TCC004W	03/14/1723:59	03/16/17
AABBCCDDEEFFDUP	MXXX-01D	6.10	1	NA	1.00	0.500	03/21/1723:42	NA	TCC006-37	TCC006-32	TCC004W	03/14/1723:59	03/16/17
AABBCCDDEEFFMS	MXXX-01M	30.8	1	NA	1.00	0.500	03/21/1723:57	NA	TCC006-38	TCC006-32	TCC004W	03/14/1723:59	03/16/17

Figure 3: TYPICAL LCS/LCSD SUMMARY

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: XYZ, INC.
PROJECT: CLEAN PROJECT
BATCH NO.: YYMXXX
METHOD: METHOD SM5310B

MATRIX:	WATER			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	MBLK1W				
LAB SAMP ID:	TCC004WB	TCC004WL	TCC004WC		
LAB FILE ID:	TCC006-11	TCC006-12	TCC006-13		
DATE EXTRACTED:	NA	NA	NA	DATE COLLECTED:	NA
DATE ANALYZED:	03/21/1718:20	03/21/1718:35	03/21/1718:50	DATE RECEIVED:	NA
PREP. BATCH:	TCC004W	TCC004W	TCC004W		
CALIB. REF:	TCC006-09	TCC006-09	TCC006-09		

ACCESSION:

PARAMETER	BLNK RSLT (mg/L)	SPIKE AMT (mg/L)	BS RSLT (mg/L)	BS % REC	SPIKE AMT (mg/L)	BSD RSLT (mg/L)	BSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
TOC	ND	25	23.9	96	25	23.9	96	0	80-120	20

Figure 4: TYPCAL MS/MSD SUMMARY

EMAX QUALITY CONTROL DATA
MS ANALYSIS

CLIENT:	XYZ, INC.			
PROJECT:	CLEAN PROJECT			
BATCH NO.:	YYMXXX			
METHOD:	METHOD SM5310B			
MATRIX:	WATER		% MOISTURE:	NA
DILUTION FACTOR:	1	1		
SAMPLE ID:	AABBCCDDEEFF	AABBCCDDEEFFMS		
LAB SAMP ID:	C778-01	C778-01M		
LAB FILE ID:	TCC006-36	TCC006-38		
DATE EXTRACTED:	NA	NA	DATE COLLECTED:	03/14/17 23:59
DATE ANALYZED:	03/21/1723:29	03/21/1723:57	DATE RECEIVED:	03/16/17
PREP. BATCH:	TCC004W	TCC004W		
CALIB. REF:	TCC006-32	TCC006-32		

ACCESSION:

PARAMETER	SMPL RSLT (mg/L)	SPIKE AMT (mg/L)	MS RSLT (mg/L)	MS % REC	QC LIMIT (%)
TOC	6.01	25	30.8	99	80-120

Figure 5: TYPICAL SAMPLE DUPLICATE RESULT SUMMARY

EMAX QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: XYZ, INC.
PROJECT: CLEAN PROJECT
BATCH NO.: YYMXXX
METHOD: METHOD SM5310B

MATRIX:	WATER		% MOISTURE:	NA
DILUTION FACTOR:	1	1		
SAMPLE ID:	AABBCCDDEEFF	AABBCCDDEEFFDUP		
EMAX SAMP ID:	MXXX-01	MXXX-01D		
LAB FILE ID:	TCC006-36	TCC006-37		
DATE EXTRACTED:	NA	NA	DATE COLLECTED:	03/14/17 23:59
DATE ANALYZED:	03/21/1723:29	03/21/1723:42	DATE RECEIVED:	03/16/17
PREP. BATCH:	TCC004W	TCC004W		
CALIB. REF:	TCC006-32	TCC006-32		

ACCESSION:

PARAMETER	SMPL RSLT (mg/L)	DUPL RSLT (mg/L)	RPD RSLT %	QC LIMIT (%)
TOC	6.01	6.10	2	20

Figure 6: TYPICAL CASE NARRATIVE

CASE NARRATIVE

Client : XYZ, INC.

Project: CLEAN PROJECT

SDG : YYMXXX

METHOD SM5310B
TOC

One (1) water sample was received on 03/16/17 to be analyzed for TOC in accordance with Method SM5310B and project specific requirements.

Holding Time
The sample was analyzed within the prescribed holding time.

Calibration
Calibration was performed as prescribed by the method and was verified using a secondary source (ICV). All calibration requirements were within acceptance criteria.

Method Blank
Method blank was prepared and analyzed at the frequency required by the project. For this SDG, one(1) method blank was analyzed. TOC was not detected in TCC004WB. Refer to sample result summary form for details.

Lab Control Sample
Lab control sample was prepared and analyzed at a frequency required by the project. For this SDG, one(1) set of LCS/LCD was analyzed. TCC004WL/TCC004WC were within LCS limits. Refer to LCS summary form for details.

Matrix QC Sample
Matrix spike sample was prepared and analyzed at a frequency required by the project. For this SDG, one (1) MS was analyzed. Sample duplicate was analyzed and RPD was within expected value. Refer to Matrix QC summary forms for details.

Sample Analysis
The sample was analyzed according to prescribed analytical procedures. Results were evaluated in accordance to project requirements. For this SDG, all quality control requirements were met.

Appendix 1: SUMMARY OF QUALITY CONTROL PROCEDURES

QC PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	1st Rvw	2nd Rvw
ICAL - Minimum of 5-point calibration	Prior to sample analysis	Correlation coefficient (r) $\geq$ 0.995	Correct the problem then repeat initial calibration		
Initial Calibration Verification (ICV)	Every after ICAL	%Recovery: $\pm$ 10% of expected value	Re-analyze ICV to rule out bad injection and/or standard degradation. Otherwise, repeat calibration		
Calibration verification	Every 15 samples and at the end of analysis sequence	%Recovery: $\pm$ 10% of expected value	Re-analyze CCV to rule out bad injection and/or standard degradation. Otherwise, repeat calibration and re-analyze all samples since last successful calibration verification.		
Replicate Injection	Every injection	RSD $\leq$ 10%	Re-analyze		
Method Blank	One per preparation batch	No analytes detected > ½ LOQ	If instrument blank is clean, re-analyze MB and all samples with positive results.		
LCS	One per preparation batch	%Rec: 80-120%	Re-prep and re-analyze the LCS and all associated samples		
Dup/MS	Refer to PSR otherwise, one set every 10 samples	%Rec: 80-120% %D $\leq$ 20%	If no procedural error is observed, and bracketing CCVs are in control, matrix interference is suspected. Discuss finding in case narrative. Otherwise, re-prep and re-analyze MS/MS and parent sample.		
Comments: Refer to PSR for flagging criteria. 21st / 22nd Editions			Reviewed By: Date:		

Appendix 2: DEMONSTRATION OF CAPABILITY

DEMONSTRATION OF CAPABILITY
TOTAL ORGANIC CARBON
SM 5310B

SOP: EMAX-5310B Rev. 3
Conc Unit: mg/L

Analysis date: 1/6/2017
Analyzed by: W. Zhao

PARAMETER	TCA002WL TCA002-06	TCA002WC TCA002-07	TCA002WX TCA002-08	TCA002WY TCA002-09	TV	Ave. Conc.	Ave. %Rec	SD	RSD (%)	QC Criteria	COMMENTS
TOC	23.3	23.4	23.2	23.3	25	23.31	93	0.053	0.2	80 - 120	PASSED

5310BFA: ANALYTICAL RUN LOG

EMAX LABORATORIES, INC.

ANALYSIS RUN LOG
for
TOC

Page 1

	Date	Time
Start		
End		

Note: For samples and relevant QCs/Standards analyzed, refer to attached analytical sequence.

Comments:

Reagent Water ID #:

pH Strips Lot #:

2 M HCl

Book #:	A62-025
Instrument No.:	62
Pipette ID:	039380025
	SW3-01-33
	SI1A-01-4
Balance ID:	40706360
Analytical Sequence:	
Method File:	
Analytical Batch:	

SOP #	Rev. #
☐ EMAX-415.1	
☐ EMAX-5310B	
☐ EMAX-9060	
☐ EMAX-	

STANDARDS ID	CONC. (mg/L)
S0	
S1	
S2	
S3	
S4	
S5	
S6	
ICV/LCS	
CCV	

ELECTRONIC DATA ARCHIVAL	
Location	Date
☐ TOC	
☐	

Analyzed By:

Date:

5310BFM: INSTRUMENT MAINTENANCE LOG

Page 1

INSTRUMENT MAINTENANCE LOG

Instrument No: 62 Month: Year: 201_ Book # M62-004

Date							
Air Tank							
Air Pressure (150ml/min)							
Humidifier Water Level							
Pure Water Trap Level							
Rinse Bottle							
Dilution Water Bottle							
External Acid Bottle							
Halogen Scrubber							
CO_2 Absorber							
Background Monitor:							
1) Furnace: 680°C							
2) NDIR: Baseline Position							
Baseline Fluctuation							
Baseline Noise							
3) Dehumidifier: 1.000 reading							
Printer Paper							
Sampler Needle							
Computer Clock							
Analyst Initial							
Trouble Shooting							
Problem(s) Encountered							
Return To Specs (Analyst Initials)							

Code	Problems Encountered	Code	Corrective Action

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889

ADDENDUM TO	
Document	ALL ANALYTICAL SOPS
Revision Number	CURRENT REVISIONS
Section	10.2 Instrument Parameters
Date	11 September 2019
Reference Number	AA.7

This applies to all GC/MS, GC, HPLC-MS, HPLC, ICP-MS, ICP and IC Method SOPs

Section 10.2 shall include:

10.2. **Instrument Parameters**

10.2.1. Instrument parameters setup stipulated in the SOPs, are instrument suggested parameters. Fine tune the instrument to obtain optimum instrument condition.

10.2.2. Print and staple a copy of the current instrument parameter on the instrument log for easy access when performing daily instrument routine check.

10.2.3. In the event that instrument parameters necessitate a change, replace the instrument parameter printout with the new parameter setup. Archive the previous instrument parameters at the back of the instrument maintenance log.

PREPARED BY: _____ Date: 9/11/19

Name Farina Madamba

Title QA / QC Coordinator

APPROVED BY: _____ Date: 09.11.19

Name Kenette Pimentel

Title QA Manager

APPROVED BY: _____ Date: 09-11-19

Name Caspar Pang

Title Laboratory Director

ANNUAL REVIEW FORM

TOTAL ORGANIC CARBON

SOP#: EMAX-5310B **Rev** 4 **Effective Date:** 18-Sep-17

COMMENTS	Reviewed By	Review Date
None	IG	10/7/18
No update needed per DRF by CMyint dtd 7/19/19		7/19/19
No update needed per DRF by YAquin dtd (11/19/19)		11/19/19
No update needed per DRF by T. Kosaka 10/22/2020		10/22/2020

STANDARD OPERATING PROCEDURES

VOLATILE ORGANICS BY GC/MS

SOP No.:	EMAX-8260	Revision No.	10	Effective Date:	06-Jun-14
Prepared By:	Souzan Greas			Date:	06-04-14
Approved By:	Kenette Pimentel QA Manager			Date:	06.04.14
Approved By:	Caspar Pang Laboratory Director			Date:	06.04.14

Control Number: 8260-10-

1.0 SCOPE AND APPLICATION

1.1. This analytical method is used to determine the concentration of volatile organic compounds whose boiling points are below 200°C and are water insoluble or slightly water-soluble found in solid or liquid samples. The list of compounds is summarized in Tables 6 and 7. Additional analytes may be added after verification.

1.2. This SOP is an adaptation of SW846 Method 8260B.

2.0 SUMMARY OF METHOD

2.1. A measured sample is extracted using a purge and trap concentrator system. The extract is introduced to a temperature-programmed GC. The analytes are eluted through the GC column separating each analyte relative to its volatility. These analytes are captured and ionized by the mass spectrometer. The ionized fragments are measured by mass to charge ratio. Analyte qualitative identification is based on the characteristic electron impact mass spectra. Analyte quantitative identification is based on the response of the major ion relative to an internal standard using a multi-point calibration curve.

2.2. **Interferences**

2.2.1. Contamination may occur by diffusion of volatile organics (particularly chlorofluorocarbons and methylene chloride) through sample container septum during shipment and storage. Trip blanks and storage blanks can serve as means of monitoring.

2.2.2. Glassware and other sample processing materials in which the samples come into contact with are possible sources of contamination. All glassware and other materials used must be purchased pre-cleaned or decontaminated prior to use.

2.2.3. Solvents and reagents are possible sources of contamination. All solvents and reagents must be GC grade and must pass the QC checks prior to use.

2.2.4. Contamination by carry-over can occur whenever high concentration samples are analyzed in sequence with a low concentration sample. To reduce potential carry-over, the concentrator must be thoroughly baked-out between samples and the sample syringe and purging device must be thoroughly rinsed with an appropriate solvent between samples.

2.2.5. Another possible source of contamination is the analytical instrument itself. This can be monitored by analyzing an instrument blank prior to any analysis.

3.0 DETECTION LIMITS

3.1. **Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ)**

3.1.1. Refer to EMAX-QA04 for generation, validation and verification for DL, LOD and LOQ.

3.1.2. Refer to Table 6 and Table 7 for established DL, LOD and LOQ levels.

4.0 DYNAMIC RANGE

4.1. The highest quantifiable concentration requiring no dilution is equal to the highest calibration point (see Sec. 9.4). All samples analyzed above this concentration are considered "over-range" and requires dilution to properly quantitate.

4.2. The concentration in the diluted sample should be at or above the project reporting limit. All diluted samples analyzed below this concentration are considered "under-range". A lower dilution factor is required to properly quantitate.

4.3. **Typical Dynamic Range**

4.3.1. Water: 5 μg/L to 200 μg/L (5 ml purge)

1 μg/L to 40 μg/L (25 ml purge)

4.3.2. Soil: 5 μg/kg to 200 μg/kg

5.0 SAMPLE HOLDING TIME & PRESERVATION

5.1. **Aqueous Samples**

5.1.1. Samples received in the laboratory are expected to be contained in 40 ml vials with teflon lined septa with zero headspace.

***Note: The size of any bubble caused by degassing upon cooling the sample must not exceed 6 mm.*[1]**

5.1.2. Samples must be stored at ≤ 6°C without freezing.

5.1.3. Samples preserved in HCL must be analyzed within 14 days from the date of sampling. Samples with no chemical preservative must be analyzed within 7 days from the date of sampling.

5.1.4. If Acrolein and Acrylonitrile are target analytes, samples must be analyzed within 14 days if preserved with $Na_2S_2O_3$ to pH 4-5. Samples received unpreserved must be analyzed with 3 days from sampling date[2].

5.2. **Soil Samples**

5.2.1. Samples received in glass jars or brass tubes must be stored at ≤ 6°C without freezing. Samples for low level and extracted in methanol for high level must be analyzed within 14 days from sampling date.

5.2.2. Samples received in encore tubes may be frozen, preserved with sodium bisulfate or extracted with methanol prior to analysis.

[1] Referenced from SW846 Method 5030B, Section 6.1.
[2] Reference: 40CFR Table 11 Footnote 10

- Encore samples to be frozen must be analyzed within 14 days from sampling date.
- Encore samples to be preserved with sodium bisulfate for low level and extracted with methanol for high level must be done within 48 hours and analyzed within 14 days from sampling date.
- Preserved samples and extracts must be stored at ≤ 6°C without freezing.

6.0 ASSOCIATED SOPs

6.1. EMAX-5030 Purge and Trap

6.2. EMAX-5035 Closed-System Purge and Trap

6.3. EMAX-DM01 Data Flow and Review

6.4. EMAX-QA04 Detection Limit (DL)

6.5. EMAX-QA05 Training

6.6. EMAX-QA08 Corrective Action

6.7. EMAX-QC01 Quality Control for Chemicals

6.8. EMAX-QC02 Analytical Standard Preparation

6.9. EMAX-QC07 Glassware Cleaning

6.10. EMAX-SM01 Sample Management

6.11. EMAX-SM03 Waste Disposal

6.12. EMAX-SM04 Analytical and QC Sample Labeling

7.0 SAFETY

7.1. Read all SDS of chemicals listed in this SOP.

7.2. Treat all reagents, standards, and samples as potential hazards. Observe standard laboratory safety procedures. Wear protective gear, i.e., lab coat, safety glasses, and gloves at all times when performing this procedure. Perform all sample and standard handling in the fume hood.

7.3. If for any reason, solvent and/or other reagents get in contact with your skin or any other part of the body, rinse the affected body part thoroughly with copious amounts of water. If irritations or any other discomfort related to the incident persist, inform your supervisor immediately so that proper action can be taken.

8.0 INSTRUMENTS, CHEMICALS & REAGENTS

8.1. **Instruments and Supplies**

Gas Chromatography	HP 5890 Series II or equivalent
Detector	HP 5971 MSD or equivalent

Column	RTX 502.2 (0.32 mm x 60 m), 1.8 µm thickness or equivalent after verification that the four gases (chloromethane, bromomethene, chloroethane, and vinyl chloride) can be resolved > 90% from each other in the total ion chromatogram
Data Acquisition Software	ChemStation or equivalent
Purge & Trap Device	OI 4560/Encon Evolution/EST or equivalent
Multiple purging module	Archon/Centurion or equivalent
Gases	Ultra-high purity helium/Air
Syringes	5 ml, 25 ml Luerlok gas-tight
Microsyringes	1, 10, 20, 25, 50, 100 and 1000 µl (Hamilton 702N or equivalent)
Volumetric Flasks	2, 5, 10, 50 and 100 ml with ground glass stopper
Heated Sparge	Archon or Automatic sample heating jacket or equivalent

8.2. **Chemicals and Reagents**

Extraction Solvent	Purge & Trap Grade Methanol or equivalent
Reagent Water	Organic-free water
Reagent Soil	Organic-free Ottawa Sand or equivalent
Preservative	Sodium Bisulfate

9.0 STANDARDS

9.1. Standard preparation for VOA is summarized in Tables 1 to 4. Refer to EMAX-QC02 for proper analytical standard preparation and EMAX-SM04 for proper labeling. Other concentration levels may be prepared as long as it complies with the method and/or project requirements.

9.2. **Stock Standard**

9.2.1. Purchase Stock Standards as certified solutions.

9.2.2. Purchase one set of calibration standard (refer to Table 1) for calibration and a secondary source Stock Standard for calibration verification (refer to Table 2).

9.2.3. Purchase Surrogate Mix at 2500 mg/L and Internal Standard at 2500 mg/L (refer to Table 3).

9.2.4. Purchase BromoFluorobenzene (BFB) as Tuning Standard at 5000 mg/L (refer to Table 4).

9.2.5. After opening, transfer in inert vials with minimal headspace and store at -10°C to -20°C.

9.3. **Intermediate Standards**

9.3.1. Using the stock standard solutions, prepare intermediate standards in methanol according to Tables 1 to 4 and store with minimal headspace in an inert vial.

9.4. **Initial Calibration Standards (ICAL)**

9.4.1. ICAL for 5 ml Purge

9.4.1.1. Using intermediate standards (refer to Tables 1 and 3), prepare multi calibration standards (minimum of five different concentrations) in reagent water as suggested below.

Calibration Pt.	VOA (µg/L)*	Surrogate (µg/L)	Internal Std (µg/L)
1	5	5	50
2	10	10	50
3	20	20	50
4	50	50	50
5	100	100	50
6	200	200	50

** Ketones, Acrolein, Acrylonitrile and tert-Butanol are 5X the indicated concentration and m/p-Xylene is 2x the indicated concentration.*

9.4.2. ICAL for 25 ml Purge

9.4.2.1. Using intermediate standards (refer to Tables 1 and 3), prepare multi calibration standards (minimum of five different concentrations) in reagent water as suggested below:

Calibration Pt.	VOA (µg/L)*	Surrogate (µg/L)	Internal Std (µg/L)
1	0.5	0.5	10
2	1	1	10
3	2	2	10
4	10	10	10
5	20	20	10
6	40	40	10

** Ketones, Acrolein, Acrylonitrile and tert-Butanol are 5X the indicated concentration and m/p-Xylene is 2x the indicated concentration.*

9.5. **Initial Calibration Verification Standard (ICV)**

9.5.1. Using the Intermediate Standard prepared from the secondary source (refer to Tables 2 and 3), spike into 5 ml or 25 ml purge in reagent water as suggested below.

9.5.1.1. ICV for 5 ml purge

ICV	VOA* (µg/L)	Surrogate (µg/L)	Internal Standard (µg/L)
5 ml	50	50	50

** Ketones, Acrolein, Acrylonitrile and Tert-Butanol are 5x the indicated concentration and M/P-xylene is 2X the indicated concentration.*

9.5.1.2. ICV for 25 ml purge

ICV	VOA* (µg/L)	Surrogate (µg/L)	Internal Standard (µg/L)
25 ml	10	10	10

** Ketones, Acrolein, Acrylonitrile and Tert-Butanol are 5x the indicated concentration and M/P-xylene is 2X the indicated concentration.*

9.6. **Daily Calibration Check Standard (DCC)**

9.6.1. Using the Intermediate Standard prepared from the same source as the ICAL Standard (refer to Tables 1 and 3), spike into 5 ml or 25 ml purge in reagent water as suggested below.

9.6.1.1. DCC for 5 ml purge

DCC	VOA* (µg/L)	Surrogate (µg/L)	Internal Standard (µg/L)
5 ml	50	50	50

** Ketones, Acrolein, Acrylonitrile and Tert-Butanol are 5x the indicated concentration and M/P-xylene is 2X the indicated concentration.*

9.6.1.2. DCC for 25 ml purge

DCC	VOA* (µg/L)	Surrogate (µg/L)	Internal Standard (µg/L)
25	10	10	10

** Ketones, Acrolein, Acrylonitrile and Tert-Butanol are 5x the indicated concentration and M/P-xylene is 2X the indicated concentration.*

9.7. **LCS and Matrix Spike Standard**

9.7.1. For spike standards, use the Intermediate Standard prepared from the secondary source (refer to Tables 2 and 3), spike into the 5 ml or 25 ml purge sample as suggested below (unless otherwise specified by the project). Spike 5 ml or 25 ml reagent water for LCS water or 5 g reagent soil in 5 ml reagent water for LCS soil.

9.7.1.1. LCS and Matrix Spike for 5 ml purge

LCS or MS/MSD	VOA* (µg/L)	Surrogate (µg/L)	Internal Standard (µg/L)
5 ml	50	50	50

** Ketones, Acrolein, Acrylonitrile and Tert-Butanol are 5x the indicated concentration and M/P-xylene is 2X the indicated concentration.*

9.7.1.2. LCS and Matrix Spike for 25 ml purge

LCS or MS/MSD	VOA* (µg/L)	Surrogate (µg/L)	Internal Standard (µg/L)
25 ml	10	10	10

** Ketones, Acrolein, Acrylonitrile and Tert-Butanol are 5x the indicated concentration and M/P-xylene is 2X the indicated concentration.*

10.0 PROCEDURES

10.1. Sample Preparation

10.1.1. For aqueous samples, refer to EMAX-5030.

10.1.1.1. Check the pH and presence of residual chlorine from remaining sample. Record samples with pH ≥ 2 and residual chlorine ≥ 5 mg/L in the analysis log.

10.1.2. For soil samples, refer to EMAX-5035.

10.2. Instrument Parameters

10.2.1. From the main gas supply (gas Tanks) regulate gas pressure at 80 psi.

10.1.1. Fine-tune the instrument guided by the parameter conditions suggested below. Adjust the parameter conditions accordingly to obtain optimum condition. Print the instrument parameter and post it on the instrument for daily routine maintenance check.

10.2.2. Typical GC Parameters

Carrier gas flow (column) helium	1 – 5 ml/min
Initial Temp	35°C; hold for 1 min.
Rate 1	8°C/min. to 160°C/min
Rate 2	30°C/min to 230°C/min; hold for 3 min.
Inject Port	200°C
Interface	250°C

10.2.3. Mass Spectrometer Parameter

Scan Start	0.5 min.
Mass Range	35 to 300
Multiplier	1200 to 2700

10.2.4. Typical Purge and Trap Condition

10.2.4.1. Purge samples at 40°C for 11 minutes, desorbed at 250°C for 2 minutes and then bake the trap at 260°C for 11 minutes.

10.3. Calibration

10.3.1. Set GC/MS operating condition as described in Section 10.2.

10.3.2. Perform Tune Check

10.3.2.1. Introduce a BFB to yield 5 – 50 ng by either direct injection or purge and trap in 5 ml or 25 ml organic-free water (using tuning standard). Refer to table 4.

10.3.2.2. Evaluate the tune check by the highest scan on the peak or the average of at least 3 scans (before, at and after the apex) with a background subtraction using a single scan no more than 20 scans prior to the elution of BFB.

10.3.2.3. Check Table 5 for acceptance criteria or follow the manufacturer's recommendation for tuning. A valid tune check expires after 12 hours.

10.3.2.4. If non-compliant refer to Section 12 for corrective action.

10.3.3. Initial Calibration (ICAL)

10.3.3.1. Perform ICAL when one of the conditions occurs.

- Instrument is new
- Instrument undergoes a major repair
- DCC failed to meet the acceptance criteria

10.3.3.2. Optimize the instrument condition prior to ICAL

- Ensure that instrument parameters are set up properly
- Ensure that there is no evidence of leak
- Ensure that instrument maintenance is performed on schedule
- Ensure that instrument tune check and column performance is not indicative that it is at the threshold of failing the acceptance criteria

10.3.3.3. Analyze a multi-point initial calibration curve as suggested in Figure 3 after a valid tune check.

10.3.3.4. Base quantitation of identified compounds on the integrated abundance from the EICP of the assigned primary characteristic ion (refer to Tables 6 and 7). For optimum output, assign internal standard to each compound based on the nearest retention time or as suggested on Tables (6 and 7).

10.3.3.5. Evaluate the ICAL Acceptance

10.3.3.5.1. Check for completeness of target compound list. If there is/are missing compound(s), perform the following:

- Check the established retention time window
- Check the relative intensity of major ions
- Adjust accordingly if necessary

10.3.3.5.2. Evaluate retention time of each analyte with respect to the nearest internal standard. The relative retention time (RRT) of each analyte should agree within ± 0.06 RRT units.

10.3.3.5.3. At a minimum, evaluate System Performance Check Compounds (SPCC) and Calibration Check Compounds (CCC) as specified in Appendix 1.

10.3.3.5.4. Check RSD and correlation coefficient. If more than 10% of the compounds included with the initial calibration exceed the 15% RSD limit and do not meet the minimum correlation coefficient (0.99) for alternate curve fits, then the chromatographic system is considered too reactive for analysis to begin. Perform necessary instrument maintenance and repeat calibration. Refer to 10.3.3.2, Section 12 for corrective action.

10.3.3.6. Application of ICAL Curve for Quantitation

10.3.3.6.1. Generate a summary of Relative Response Factors for each analyte at each concentration. Calculate the Average Relative Response Factor (RRFm), the Standard Deviation (SD), and the Relative Standard Deviation (RSD) according to Eq.-10.5.1.1, Eq.-10.5.1.2, Eq.-10.5.1.6 and Eq.-10.5.1.7 respectively.

10.3.3.6.2. If RSD is ≤ 15% average response factor may be applied.

10.3.3.6.3. Apply Inverse Weighting Factor (1/y or $1/y^2$; y being the instrument response) if it is determined to be the best fit for specific analytes. This approach may be applied to any analyte including analyte that has RSD of ≤ 15% and correlation coefficient of ≥ 0.995.

10.3.3.6.4. Apply linear least squares regression if past experience or priori knowledge of instrument response is known to be the best fit for specific analytes. This approach may be applied to any analyte including analyte that has RSD of ≤ 15% and correlation coefficient of ≥ 0.995.

10.3.3.6.5. It may be appropriate to force the regression through zero for specific analytes[3]. When exercising this option [as included in the data acquisition software], make sure that the origin (0,0) is not included as a calibration point but rather the intercept is set to zero. This option shall only be applied if the curve favors better accuracy of quantitation.

10.3.3.7. Submit summary of ICAL, raw data and manual integration (if any) for secondary review.

10.3.4. Initial Calibration Verification (ICV)

10.3.4.1. Analyze ICV to verify the concentration of the ICAL standards (refer to Section 9.5).

10.3.4.2. Check for completeness of analytes as described in Section 10.4.3.

10.3.4.3. Compare the retention times of the internal standards to the ICAL mid-point. Excursion of ± 30 seconds indicates instrument malfunction. When non-compliant check the column head pressure, gas supply or leaks. Corrective action is required prior to further analysis.

10.3.4.4. Compare the area of the Internal Standards (IS) acquired against the midpoint of the initial calibration point. The extracted ion current profile (EICP) must be within a factor of two (-50% to +100%).

[3] SW846 Method 8000B, Section 7.5.3

10.3.4.5. Refer to Appendix 1 for ICV acceptance criteria and/or corrective action.

10.3.4.6. When non-compliant refer to Section 12 for corrective action.

10.3.5. Daily Continuing Calibration (DCC)

10.3.5.1. Analyze DCC to check the validity of the ICAL (refer to 9.6).

10.3.5.2. Check for completeness of analytes as described in Section 10.4.3.

10.3.5.3. Evaluate System Performance Check Compounds (SPCC) and Calibration Check Compounds (CCC) as specified in Appendix 1.

10.3.5.4. Compare the retention times of the internal standards to the ICAL mid-point. Excursion of ± 30 seconds indicates instrument malfunction. When non-compliant check the column head pressure, gas supply or leaks. Corrective action is required prior to further analysis.

10.3.5.5. Compare the area of the Internal Standards (IS) acquired against the midpoint of the initial calibration point. The extracted ion current profile (EICP) must be within a factor of two (-50% to +100%).

10.3.5.6. Establish RRF of each analyte, calculate %D (Eq.-10.5.2.1) against the ICAL.

10.3.5.7. Refer to Appendix 1 for DCC acceptance criteria and/or corrective action.

10.3.5.8. When non-compliant refer to Section 12 for corrective action.

10.4. **Analysis**

10.4.1. Analytical Sequence

10.4.1.1. Analyze BFB and evaluate tuning

10.4.1.2. Analyze DCC and check ICAL validity

10.4.1.3. Analyze Lab Control Sample

10.4.1.4. Analyze Lab Control Sample Duplicate (if required)

10.4.1.5. Analyze Method Blank

10.4.1.6. Analyze samples to a maximum number of 12-hours from the time of BFB injection.

10.4.1.7. Analyze a pair of matrix spikes (MS/MSD) for every 20 samples of the same matrix.

10.4.1.8. Record analytical sequence in the analysis log.

10.4.2. Sample Result Evaluation

10.4.2.1. Check the QC criteria as soon as the data is available.

- ✓ Check method blank. If result is non-compliant and analyte in question is not detected in any sample or contamination is < 10X of the sample concentration, results maybe reportable. Verify with the PM if results can be reported.
- ✓ Compare the retention times of each Internal Standards (IS) to the ICAL mid point (must be ± 30 seconds).

- ✓ Compare the area of each IS acquired against the mid point of the ICAL. The Extracted Ion Current Profile (EICP) must be within a factor of two (-50 to +100%).
- ✓ Check concentration of target analytes if calibration range is exceeded.
- ✓ Check surrogate recoveries against project specific requirement (PSR). In the absence of PSR, default to Appendix 1 QC limits.
- ✓ If any of the above checkpoints indicate a problem, re-analysis is required. Note observations on the analysis log. When results arise to questionable result, e.g. inconsistency from the first analysis, consult the Supervisor for further action.

10.4.2.2. Properly fill up the analysis log.

10.4.3. Qualitative Identification

- The intensities of the characteristic ions maximize in the same scan or within one scan of each other.
- The relative retention time (RRT) of the sample component is within 0.06 RRT units of the RRT of the standard component.
- The relative intensity of the characteristic ions agrees within 30% of the relative intensity of these ions in the reference spectrum.
- Check the chromatogram for possible misidentified analytes. Investigate visible peaks in the chromatogram that were not identified in the data output. Manually integrate the peak if necessary. For manual integration refer to EMAX-DM01.
- Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.[4]

10.4.3.1. For samples containing components not associated with the calibration standards, perform a library search for purposes of tentative identification[5] (TIC). Execute LSC (Chem Station program) to initiate the library search using NIST/EPA/MSDC mass spectral library. Visually inspect each extracted mass ion chromatograph to determine the identification of the unknown before final reporting following the guidelines below.

- Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.
- The relative intensities of the major ions should agree within + 20%. Example: for an ion with an abundance of 50% of the standard spectra, the corresponding sample ion abundance must be between 30 and 70%.

[4] SW846 Method 8260B, Section 7.6.1.4

[5] Library search is performed only when indicated in the PSR.

- Molecular ions present in reference spectrum should be present in sample spectrum.
- Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting analytes.
- Ions present in the reference spectrum but not present in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting analytes. Data system library reduction programs can sometimes create these discrepancies.

10.4.3.2. **Reporting TICs**

- If the library search produces a match at or above 85%, report the analyte.
- If the library search produces more than one analyte at or above 85%, report the first analyte (highest).
- If the library search produces no matches at or above 85%, the compound should be reported as unknown.

10.4.4. Quantitation

10.4.4.1. Apply the appropriate quantitation method (Section 10.3.3.6). Calculate the concentration of any positively identified target analyte using Eq.-10.5.3. Apply the dilution factor for diluted samples to calculate for the final concentration of the sample.

10.4.5. Manual Integration

10.4.5.1. Refer to EMAX-DM01, Manual Integration Section.

10.4.6. Dealing with Carryover

10.4.6.1. Check the sample analyzed after a sample having target analyte concentrations exceeding the calibration range.

10.4.6.2. If there is no target analyte detected as found in the sample that exceeded the calibration range, proceed with data reduction.

10.4.6.3. If there is any target analyte detected as found in the sample that exceeded the calibration range, re-analyze the sample to rule out carry over. If carry over is confirmed, proceed with data reduction and report the data from re-analysis.

10.4.6.4. To clean-up the autosampler purge line consider purging a 25 ml or 5 ml sample spiked with 100 µl of methanol and let it run like a blank sample. If improved result is noted repeat this process until no evidence of contamination is observed. Otherwise inform the Supervisor for further instruction.

10.5. **Calculations**

10.5.1. Initial Calibration

10.5.1.1. **Calculate for the Relative Response Factor (RRF)**

$$RRF = \frac{A_X C_{IS}}{A_{IS} C_X}$$ Eq.-10.5.1.1

where:

A_X – Area of characteristic ion for the compound being measured
A_{IS} – Area of characteristic ion for the specific internal standard
C_X – Concentration of the compound being measured
C_{IS} – Concentration of the specific internal standard

10.5.1.2. **Calculate for the Average Relative Response Factor (RRF_m)**

$$RRF_m = \frac{\sum RRF}{n}$$ Eq.-10.5.1.2

where:

$\sum RRF$ – Summation of response factors
n – Number of measurements

10.5.1.3. **Calculate for Least Square Linear Regression**

$$y = ax + b$$ Eq.-10.5.1.3

where:

y – Response ratio (A_X/A_{IS})
x – Amount ratio (C_X/C_{IS})
a – x1 = slope of the line

$$a = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$

where:

$\bar{x}$ = average of amount ratios
$\bar{y}$ = average of response ratios

b – x0 = intercept of the line

$$b = \bar{y} - a * \bar{x}$$

10.5.1.4. **Calculate for Inverse Weighting Factor**

$$y = ax + b$$ Eq.-10.5.1.4

where:

y – Response ratio (A_X/A_{IS})
x – Amount ratio (C_X/C_{IS})
a – x1 = slope of the line

$$a = \frac{\sum (x - x_a)(y - y_a)}{\sum (x - x_a)^2}$$

where:

$$x_a = \sum \left[x(1/x) / \sum (1/x) \right]$$
$$y_a = \sum \left[y(1/x) / \sum (1/x) \right]$$

or $x_a = \sum\left[x(1/x^2)/\sum(1/x^2)\right]$

$y_a = \sum\left[y(1/x^2)/\sum(1/x^2)\right]$

b – x0 = intercept of the line

$b = y_a - a * x_a$

10.5.1.5. **Calculate Inverse Quadratic**

$y = ax^2 + bx + c$

where:

y – Resp_Ratio =**x0** + **x1** * Amt_Ratio + **x2** * (Amt_Ratio)^2

x – Amt_Ratio

c – **x0**=Det 0/Det b

b – **x1**=Det 1/Det b

a – **x2**=Det 2/Det b

$$W_i = \frac{\frac{1}{x_i}}{\sum_{i=1}^{n}\frac{1}{x_i}}$$

where:

X_i = amount ratio= Conc of Std/Conc of IS

Y_i = response ratio=Resp of Std/Resp of IS

Wi= 1/X)/SUM(1/X)

<X>= SUM(W_i*X_i)

<Y>= SUM(W_i*Y_i)

<XX>= SUM(W_i*(X_i)^2)

<XXX>= SUM(W_i*(X_i)^3)

<XXXX>= SUM(W_i*(X_i)^4)

<YY>= SUM(W_i*(Y_i)^2)

<XY>= SUM(W_i*X_i*Y_i)

<XXY>= SUM(W_i*(X_i)^2*Y_i)

<Yd2>= SUM((Y_i-<Y>)^2*W_i)

Ye= x0+x1*X_i+x2*X_i^2-<Y>)

<Ye2>= SUM(Ye^2*W_i)

Det b	1	<X>	<XX>
	<X>	<XX>	<XXX>
	<XX>	<XXX>	<XXXX>

Det 0	1	<X>	<XX>
	<X>	<XX>	<XXX>
	<Y>	<XY>	<XXY>

Det 1	1	<X>	<XX>
	<Y>	<XY>	<XXY>
	<XX>	<XXX>	<XXXX>

Det 2	<Y>	<XY>	<XXY>
	<X>	<XX>	<XXX>
	<XX>	<XXX>	<XXXX>

r2= <Ye2>/<Yd2>

ccf2= $(r2)^{1/2}$

10.5.1.6. **Calculate the Standard Deviation (SD)**

$$SD = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \qquad \text{Eq.-10.5.1.6}$$

where:

x_i – Result at i^{th} measurement

$\bar{x}$ – Mean of the n measurements

n – Number of measurements

10.5.1.7. **Calculate the % relative standard deviation (%RSD)**

$$\%RSD = \frac{SD}{RRF_m} * 100\% \qquad \text{Eq.-10.5.1.7}$$

where:

SD – Standard deviation

RRF_m – Average response factor

10.5.1.8. **Calculate the relative retention time (RRT)**

$$\text{RRT} = \frac{\text{Retention Time of the Analyte}}{\text{Retention Time of the Internal Standard}} \qquad \text{Eq.-10.5.1.8}$$

10.5.2. Calibration Check/Continuing Calibration

10.5.2.1. **Calculate Percent Difference (%D)**

$$\%D = \frac{\left[RRF_c - RRF_m\right]}{RRF_m} * 100\% \qquad \text{Eq.-10.5.2.1}$$

where:

RRF_c – Response factor from continuing calibration standard
RRF_m – Average response factor

10.5.2.2. **% Drift**

$$\%Drift = \frac{\left[found\ Conc. - true\ Conc\right]}{true\ Conc.} * 100\% \qquad \text{Eq.-10.5.2.2}$$

10.5.3. Calculation of Sample Concentration (Water and Soil/Sediment Samples)

10.5.3.1. When a compound is identified, the quantitation of that compound shall be based on the integrated abundance from the EICP of the primary characteristic ion.

10.5.3.2. **Water Samples**

$$Concentration\ (ug/L) = \frac{(Ax)(Is)}{(Ais)(RRF_m)}\ x\ DF \qquad \text{Eq.-10.5.3.2}$$

where:

A_x – Area of characteristic ion for the compound to be measured
I_s – Concentration of internal standard added in µg/L
A_{is} – Area of characteristic ion for the internal standard
RRF_m – Average response factor
DF – Dilution factor = $\frac{purge\ volume\ in\ ml\ \ (5\ ml\ or\ 25\ ml)}{sample\ \ amount\ \ in\ ml}$

10.5.3.3. **Soil/Sediment Samples (Dry weight basis)**

$$Concentration\ (ug/kg) = \frac{(Ax)(Is)}{(Ais)(RRF_m)(DW)}\ x\ DF \qquad \text{Eq.-10.5.3.3}$$

where:

A_x – Area of characteristic ion for the compound to be measured
I_s – Concentration of internal standard added in µg/L
A_{is} – Area of characteristic ion for the internal standard
RRF_m – Average response factor
DF – Dilution factor = $\frac{5\ g}{(sample\ \ amount\ \ in\ g)}$
DW – % solid = $\frac{100 - \%moisture}{100}$

10.5.3.4. **Extracted Soil/Sediment Samples (Dry weight basis)**

$$Concentration\ (ug/kg) = \frac{(Ax)(Is)}{(Ais)(RRF_m)(DW)}\ x\ DF \qquad \text{Eq.-10.5.3.4}$$

where:

A_x – Area of characteristic ion for the compound to be measured

I_s – Concentration of internal standard added in µg/L
A_{is} – Area of characteristic ion for the internal standard
RRF_m – Average response factor
DF – Dilution factor

$$\frac{(purged \quad volume \quad in \ \mu L)(5\,g)}{(extract \quad aliquot \quad in \ \mu L)(sample \quad amount \quad in \ g)}$$

DW – % solid = $\frac{100 - \%moisture}{100}$

10.5.4. Alternatively, the regression line (area ratio of Ax/Ais versus concentration using first degree) fitted to the initial calibration may be used for determination of the sample concentration when RSD of the analyte is greater than 15% (Section 10.3.3.6) .

10.5.5. Concentration of TIC is estimated by the same method as target compounds with the following assumptions:

10.5.5.1. The area Ax and Ais are derived from total ion chromatogram. Ais refers to the closest internal standard (IS) free of interference.

10.5.5.2. RRF of the TIC is 1.

10.5.6. Method Proficiency

10.5.6.1. **Percent Recovery**

$$\%\,\mathrm{Recovery} = \frac{(C_f - C)}{C_s} \times 100 \qquad \text{Eq.-10.5.6.1}$$

where:

C_f – Concentration found
C – Concentration of sample (use 0 for LCS)
C_s – Concentration of spike

10.5.6.2. **Relative Percent Difference (RPD)**

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)} \times 100 \qquad \text{Eq.-10.5.6.2}$$

where:

C_1 – Measured concentration of the first sample aliquot
C_2 – Measured concentration of the second sample aliquot

10.6. **Data Reduction**

10.6.1. Make a copy of the analysis log.

10.6.2. Print a copy of the sample weight log (if any).

10.6.3. Highlight the data to be reported.

10.6.4. Print a copy of the raw data and the QC report.

10.6.5. Collate the reportable raw data separating the QC results from the sample results.

10.6.6. Keep all other data generated with the analytical folder marked with “For record only”.

10.7. **Report Generation**

10.7.1. Generate the method.txt file using WDB1C.exe.

10.7.2. Generate the sample results using F1NV3C.exe or F1NV3C4.exe.

10.7.3. Generate the QC summary using QCV3CN.exe or QCV3CN4.exe.

10.7.4. Generate the Instrument Performance Check (ICAL and DCC) using F5VOA.exe.

10.7.5. Generate the IS and RT summary using F8VC.exe.

10.7.6. Generate Lab Chronicle using LABCHRN1.exe

10.7.7. Generate Case Narrative using CN1.exe

10.7.8. Arrange the analysis package in sequence as detailed below using section separators. Attach all raw data to every form generated, to include manual integration and re-analyses.

10.7.8.1. Case Narrative

10.7.8.2. Lab Chronicle

10.7.8.3. Sample Results

10.7.8.4. Method Blank Results

10.7.8.5. LCS/LCSD Summary

10.7.8.6. MS/MSD Summary

10.7.8.7. Instrument Performance Check (ICAL)

10.7.8.8. ICAL Summary

10.7.8.9. ICV Summary

10.7.8.10. Instrument Performance Check (DCC)

10.7.8.11. IS and RT Summary

10.7.8.12. DCC Summary

10.7.8.13. Analysis Log

10.7.8.14. Sample Weight Log (if any)

10.7.8.15. Non-Conformance Report (If any)

10.8. **Data Review**

10.8.1. Perform a 100% data review in accordance to EMAX-DM01and the PSR.

10.8.1.1. If any of the checkpoints below indicates a problem, re-analysis is required.

- ✓ Check internal standard area. They should be within -50 to +100% of ICAL midpoint to be acceptable, otherwise follow PSR.

- ✓ Check retention time of each IS to the ICAL midpoint. They should be within ± 30 seconds to be acceptable, otherwise follow PSR.
- ✓ Check surrogate recoveries against project specific criteria (PSR). In the absence of PSR, default to in-house QC limits.
- ✓ Check concentration of target analytes if calibration range is exceeded.

10.8.1.2. Review the attached logs that they are properly filled.

10.8.1.3. Check the generated reports against the raw data. Check that the analytical data generated indicating positive results are qualitatively and quantitatively correct.

10.8.1.4. Review the case narrative and check that it accurately describes what transpired in the analytical process. Edit as necessary to reflect essential issues not captured by the case narrative generator program.

10.8.2. Submit the analytical folder for secondary review.

10.9. **Preventive Maintenance**

10.9.1. Perform instrument routine preventive maintenance and record on instrument-specific maintenance logs. Routine maintenance ensures that all equipment is operating under optimum conditions, thus reducing the possibility of instrument malfunction that may affect data quality.

10.9.2. The table below list suggested routine maintenance schedule.

Task	Every Day	Every Week	Every Month	Every 3 Months	Every 6 Months	As Needed
Tune Check	✓					
Check gas cylinders pressure	✓					
Check the foreline pump oil level		✓				
Check the calibration vial						✓
Check and if necessary, change injection port liners, septa and O-rings.					✓	
Replace the foreline pump oil					✓	
Replace the diffusion pump fluid					✓	
Replace the traps and filters					✓	
Clean the ion source						✓
Change the carrier gas trap(s) and purifier						✓
Replace column						✓
AutoTune the MSD						✓
Replace the worn out parts						✓

11.0 QUALITY CONTROL

11.1. **Analytical Batch QC**

11.1.1. Perform tune check to verify that the mass spectrometer meets standard mass spectra abundance criteria prior to calibration and check for any contamination.

11.1.2. Perform initial calibration (ICAL) to establish a calibration curve for the quantification of the analytes of interest.

11.1.3. Establish retention time window position for each analyte every after ICAL for proper qualitative identification.

11.1.4. Perform initial continuing calibration verification (ICV) every after ICAL to verify accuracy of ICAL.

11.1.5. Perform continuing calibration verification (CCV) every 12 hours to verify that instrument response is reliable, and has not changed significantly from the current ICAL curve.

11.1.6. Evaluate relative retention time for each analytes in every sample to be within ± 0.06 RRT units.

11.1.7. Verify internal standard (IS) for quantitative accuracy and that its Retention time is within ± 30 seconds from retention time of the midpoint standard in the ICAL and EICP area is within -50% to +100% of ICAL midpoint standard.

11.1.8. Evaluate surrogate recovery to monitor instrument response on every sample.

11.2. **Preparation Batch QC**

11.2.1. Reagent water used for IB shall be of the same source for all QC samples and sample dilutions.

11.2.2. Analyze MB, LCS, MS/MSD and < 20 field samples.

11.2.3. Solvents and reagents must undergo quality control check prior to its use. Refer to EMAX-QC01 for details.

11.2.4. Properly treat lab wares used in the sample preparation as specified in EMAX-QC07.

11.3. **Method QC**

11.3.1. All analytes reported must have a valid DL, LOD and LOQ as described in EMAX-QA04.

11.3.2. All analysts conducting this analysis must demonstrate capability (IDOC/DOC) as described in EMAX-QA05.

11.4. Refer to Appendix 1 for all related Quality Control parameters, frequency and acceptance criteria.

12.0 CORRECTIVE ACTION

12.1. Corrective action for each Quality Control procedure is summarized in Appendix 1.

12.2. **Analytical Batch QC**

12.2.1. Tune Check – If tune check is non-compliant consider the following suggestion to correct the problem:

- Check the abundance of mass 95 and 174. If it is significantly less than previous tune checks, it is indicative of insufficient amount of BFB injected. Probable causes are:

improper spiking, leaks, standard degradation or low vacuum system. Repeat tune check ensuring that BFB was properly spiked or rule out leaks, prepare a fresh BFB standard and repeat the tune check.

- If problem persist, re-tune the instrument and repeat tune check.
- If problem is unresolved, inform the supervisor for further action.

12.2.2. Initial Calibration

12.2.2.1. If the %RSD is out of acceptance criteria, consider the following suggestions to correct the problem.

- If one of the standards returns a bias low or bias high on all of the analytes then that point is considered an out-liner. Prepare a standard at that ICAL point and re-analyze.
- If the highest ICAL point appears to be saturated, drop the highest point.
- If the lowest point returns a bias low or bias high response or the peaks are not distinct and sharp, drop the lowest point.

Note : The lowest calibration point identifies the limit of quantitation (LOQ). Therefore, check that the LOQ is in conformance to the current projects where the ICAL will be used.

12.2.2.2. If instrument problem is suspected, consider the following suggestion to correct the problem:

- Check the connection and make sure they are air tight and perform maintenance as needed.
- Check the gas flow.
- Re-tune the MS.
- Prepare a fresh standard and repeat calibration.
- Clean the MS source and repeat calibration.
- If problem is unresolved, inform the supervisor for further action.

12.2.3. Initial Calibration Verification (ICV) – If the ICV is non-compliant, consider the following suggestions to correct the problem:

- Re-analyze ICV to rule out poor purge.
- If ICV is still out of acceptance criteria, prepare a fresh standard and re-analyze to rule out any preparation error.
- If ICV is still out of acceptance criteria, prepare a fresh ICAL standard and repeat calibration.
- If problem is unresolved, inform the supervisor for further action.

12.2.4. Daily Calibration Check (DCC) – If DCC is non-compliant consider the following suggestions to correct the problem:

- If majority of the analyte response are low and no evidence of leak in the system is apparent, it is indicative of a bad purge or leak in the vial. Re-analyze DCC.
- If problem persist, rule out standard degradation. Prepare a fresh standard and repeat DCC.
- Otherwise execute instrument maintenance and perform ICAL.

12.2.5. Instrument Blank – If instrument blank is non-compliant, consider the following suggestions to correct the problem:

- If trace level of THMs is observed, it is indicative that water filters need replacement. Otherwise, bake the trap at the manufacturer's recommended temperature for about 30 minutes.
- If contamination is high, flush the sample line with methanol and replace the trap.
- If problem is unresolved, inform the supervisor for further action.

12.3. **Preparation Batch QC**

12.3.1. For insufficient amount of sample(s), inform the supervisor immediately for further action.

12.3.2. If MB is non-compliant, consider the suggestions as described in Instrument Blank.

12.3.3. If LCS is non-compliant, consider the following suggestions to correct the problem:

- If result is bias low or high, prepare a fresh standard and re-analyze LCS and the associated samples.
- If problem is unresolved, inform the supervisor for further advice.

12.3.4. If MS is non-compliant consider the following suggestion to correct the problem:

- Check the standard log and analytical log and verify that the spike amount value used for calculation is correct.
- If LCS is within acceptance criteria then and the right amount of spike amount used for calculation is correct, then it is indicative of matrix interference. Discuss the probable matrix interference in the case narrative.

12.4. Discuss water samples that are labeled preserved having a pH ≥ 2 and/or residual chlorine ≥ 5 mg/L in the case narrative.

12.5. A Non-Conformance Report (NCR) is required when the following circumstances occur.

- Anomalies other than specified in Appendix 1, is observed.
- Sample is out of technical holding time.

12.5.1. Refer to EMAX-QA08 for NCR details.

13.0 POLLUTION PREVENTION

13.1. Observe all necessary precautions to avoid spillage of solvent that may go to wastewater drains.

13.2. Prepare all standards in fume hoods.

14.0 WASTE MANAGEMENT

14.1. No samples shall be dumped on the laboratory sink.

14.2. Separate and properly identify all unused and expired analytical standards for proper disposal.

14.3. Place all waste generated during analytical process in properly labeled satellite waste containers for proper collection.

14.4. Dispose all unused samples, expired analytical standards and other waste generated during the analytical process in accordance to EMAX-SM03.

15.0 SUPPLEMENTARY NOTES

15.1. **Definition of Terms**

15.1.1. Analyte – The specific chemicals or components for which a sample is analyzed; may be a group of chemicals that belong to the same chemical family, and which are analyzed together.

15.1.2. Batch – is a group of samples that are prepared and/or analyzed at the same time using the same lot of reagents.

15.1.2.1. **Preparation Batch** - is composed of one to 20 samples of the same matrix, a method blank, a lab control sample and matrix spike/matrix spike duplicate.

15.1.2.2. **Analytical batch** - is composed of prepared samples (extracts, digestates, or concentrates), which are analyzed together as a group using an instrument in conformance to the analytical requirement. An analytical batch can include samples originating from various matrices, preparation batches, and can exceed 20 samples.

15.1.3. Detection Limit (DL) – is defined as the smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

15.1.4. Limit of Detection (LOD) – is defined as the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative result rate (Type II error) is 1 %.

15.1.5. Limit of Quantitation (LOQ) – is at the lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

15.1.6. Safety Data Sheet (SDS) – is written information concerning a chemical physical properties, toxicity, health hazards, fire hazard and reactivity data including storage, spill and handling precautions.

15.1.7. Calibration – is a determinant measured from a standard to obtain the correct value of an instrument output.

15.1.8. Calibration Blank – is a target-analyte-free solvent subjected to the entire analytical process to establish zero baseline or background value.

15.1.9. Carry-over – are contaminants retained in the instrument/apparatus from a highly contaminated sample that is passed into the succeeding sample(s).

15.1.10. Calibration Check Compounds (CCC) – evaluate the integrity of the system. Variability of these compounds may indicate system leak or reactive sites in the column.

15.1.11. Instrument Method – is a file generated to contain the instrument calibration and instrument parameter settings for a particular analysis.

15.1.12. Method Blank – is a target-analyte-free sample subjected to the entire sample preparation and/or analytical to monitor contamination.

15.1.13. Lab Control Sample (LCS) – is a target-analyte-free sample spiked with a verified known amount of target analyte(s) or a reference material with a certified known value subjected to the entire sample preparation and/or analytical process. LCS is analyzed to monitor the accuracy of the analytical system.

15.1.14. Lab Control Sample Duplicate (LCSD) – is a replicate of LCS analyzed to monitor precision in the absence of MS/MSD sample.

15.1.15. Sample – is a specimen received in the laboratory bearing a sample label traceable to the accompanying COC. Samples collected in different containers having the same field sample ID are considered the same and therefore labeled with the same lab sample ID unless otherwise specified by the project.

15.1.16. Sample Duplicate – is a replicate of a sub-sample taken from one sample, prepared and analyzed within the same preparation batch.

15.1.17. Sub-sample – is an aliquot taken from a sample for analysis. Each sub-sample is uniquely identified by the sample preparation ID.

15.1.18. Matrix – is a component or form of a sample.

15.1.19. Matrix Spike (MS) – is a sample spiked with a verified known amount of target analyte(s) subjected to the entire sample preparation and/or analytical process. MS is analyzed to monitor matrix effect on a method's recovery efficiency.

15.1.20. Matrix Spike Duplicate (MSD) – is a replicate of MS analyzed to monitor precision or recovery.

15.1.21. Response Factor – is the ratio of the peak area of the target compound in the sample or sample extract.

15.1.22. Surrogate – are compounds added to every blank, sample, matrix spike, matrix spike duplicate and standard; used to evaluate analytical efficiency by measuring recovery. Compounds not expected to be detected in environmental media.

15.1.23. SPCC – System performance check compounds are compounds that are used to check compound stability and to check for degradation cause by contaminated lines or active sites in the system.

15.1.24. Reagent Water – is purified water free from any target analyte or any other substance that may interfere with the analytical process.

15.1.25. Reagent Soil – organic-free Ottawa sand or equivalent.

15.2. **Application of EMAX QC Procedures**

15.2.1. The procedures and QC criteria summarized in this SOP applies to all projects when performing Volatile analysis by GC/MS. The standard analyte list and RL are presented in Tables 6 & 7. In instances where there is a project or program QAPP, the requirements given in the project takes precedence over this SOP.

15.3. **Department of Defense (DoD) and Department of Energy (DoE) Projects**

15.3.1. Samples from DoD and DoE sponsored projects follows the Quality Assurance Project Plan (QAPP), Statement of Work (SOW) and/or client's quality control directive. In the absence of QAPP, the DoD Quality Systems Manual (QSM), latest update, is applied.

16.0 REFERENCES

16.1. U.S. EPA Method 8260B; SW846, as updated

16.2. EMAX Quality Systems Manual, as updated

17.0 APPENDICES

17.1. **Tables**

17.1.1.	Table 1	Initial Calibration Intermediate Standards Preparation
17.1.2.	Table 2	Initial Calibration Verification/LCS/MS/MSD Intermediate Standards Preparation
17.1.3.	Table 3	Surrogate/Internal Standards Preparation
17.1.4.	Table 4	Tuning Solution Standards Preparation
17.1.5.	Table 5	BFB Key Ion Abundance Criteria
17.1.6.	Table 6	Typical Analyte List, Quantitation Ions, IS, Surrogates, Calibration Standards, Detection Limits for 5 ml Purge
17.1.7.	Table 7	Typical Analyte List, Quantitation Ions, IS, Surrogates, Calibration Standards, Detection Limits for 25 ml Purge

17.2. **Figures**

17.2.1.	Figure 1	Peak Evaluation Techniques
17.2.2.	Figure 2	Typical Chromatogram
17.2.3.	Figure 3	Typical ICAL Summary
17.2.4.	Figure 4	Typical Instrument Performance Check (Tuning)
17.2.5.	Figure 5	Typical Instrument Performance Check (Tuning) Summary
17.2.6.	Figure 6	Typical Internal Standard Area and Retention Time Summary
17.2.7.	Figure 7	Typical Sample Result Summary
17.2.8.	Figure 8	Typical LCS/LCSD Summary
17.2.9.	Figure 9	Typical MS/MSD Summary
17.2.10.	Figure 10	Typical Case Narrative

17.3. **Appendices**

17.3.1.	Appendix 1	Summary of Quality Control Procedures
17.3.2.	Appendix 2	Demonstration of Capability for 25 ml
17.3.3.	Appendix 3	Demonstration of Capability for 5 ml
17.3.4.	Appendix 4	Demonstration of Capability for 5 g

17.4. **Forms**

17.4.1.	8260FS	Sample Preparation Log
17.4.2.	8260FA	Analytical Run Log
17.4.3.	8260FM	Instrument Maintenance Log

Table 1: INITIAL CALIBRATION INTERMEDIATE STANDARDS PREPARATION

ICAL/DCC Intermediate Standard	Stock Standard			Preparation (Solvent: Methanol)		Final Conc. (mg/L)
	Standard Name	Source	Conc. (mg/L)	Aliquot (µl)	Final Vol. (ml)	
I	1-Chlorohexane	AccuStandard	2000	50	2	50
	2-Chloroethylvinylether	CPI	2000	50	2	50
	Oxygenate Gasoline Additive	AccuStandard	2000-10000	50	2	50 - 250
	Custom VOA Mix	CPI	2000, 20000, 40000	50	2	50, 500, 1000
II	VOC Gas Mix	Ultra Scientific	2000	250	2	250
	Vinyl Acetate	CPI	2500	200	2	250
III	Carbon Disulfide	CPI	5000	100	2	250
IV	VOA Calibration Mix 1	Restek	5000	100	2	250
	Acrolein / Acrylonitrile	AccuStandard	5000	100	2	250

Table 2: INITIAL CALIBRATION VERIFICATION/LCS/MS/MSD INTERMEDIATE STANDARDS PREPARATION

ICV / LCS / MS Intermediate Standard	Stock Standard			Preparation (Solvent: Methanol)		Final Conc. (mg/L)
	Standard Name	Source	Conc. (mg/L)	Aliquot (µl)	Final Vol. (ml)	
I	1-Chlorohexane	Ultra Scientific	1000	100	2	50
	2-Chloroethylvinylether	AccuStandard	2000	50	2	50
	California Oxygenate Mix	Restek	2000 - 10000	50	2	50 – 250
	Custom 8260 Mega Mix	Restek	2000, 20000, 40000	50	2	50, 500, 1000
II	Volatile Organic Cpds Mix 6	Supelco	2000	250	2	250
	Vinyl Acetate	Restek	2000	250	2	250
III	Carbon Disulfide Solution	Ultra scientific	5000	20	2	50
IV	TCL Volatile Mix 1	Supelco	2000	250	2	250
	Acrolein / Acrylonitrile	Ultra Scientific	2000	250	2	250

Table 3: SURROGATE / INTERNAL STANDARDS PREPARATION

Intermediate Standard	Stock Standard			Preparation (Solvent: Methanol)		Final Conc. (mg/L)
	Standard Name	Source	Conc. (mg/L)	Aliquot (µl)	Final Vol. (ml)	
Surrogate	8260 Surrogate Mix	Restek	2500	200	2	250
Internal Standard	Custom 8260 Internal Standard Mix, 3-30	CPI	2500	200	2	250

Table 4: TUNING SOLUTION STANDARDS PREPARATION

BFB Intermediate Standard	Stock Standard			Preparation (Solvent: Methanol)		Final Conc. (mg/L)
	Standard Name	Source	Conc. (mg/L)	Aliquot (µl)	Final Vol. (ml)	
Tuning Compound	BFB	Restek	5000	20	2	50

Table 5: BFB KEY ION ABUNDANCE CRITERIA

M/z	Required Intensity (relative abundance)
50	15 to 40% of m/z 95
75	30 to 60% of m/z 95
95	Base peak, 100% relative abundance
96	5 to 9% of m/z 95
173	Less than 2% of m/z 174
174	Greater than 50% of m/z 95
175	5 to 9% of m/z 174
176	Greater than 95% but less than 101% of m/z 174
177	5 to 9% of m/z 176

Table 6: TYPICAL TARGET ANALYTE LIST FOR 5-ml PURGE

ANALYTES	CHARACTERISTIC ION(S)		IS	SURR	ICAL ANALYTE CONCENTRATIONS (µg/L)								ICV/DCC EV(µg/L)	LCS/MS EV(µg/L)	WATER (µg/L)			SOIL (µg/Kg)		
	PRIMARY	SECONDARY			1	2	3	4	5	6	7	8			DL	LOD	LOQ	DL	LOD	LOQ
1,1,1,2-Tetrachloroethane	131	133, 119, 117	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,1,1-Trichloroethane	97	99, 61	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,1,2,2-Tetrachloroethane	83	85	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,1,2-Trichloro-1,2,2-trifluoroethane	151	153	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
1,1,2-Trichloroethane	97	83, 85, 99	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,1-Dichloroethane	63	65, 83	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,1-Dichloroethene	61	63, 96	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,1-Dichloropropene	110	112	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,2,3-Trichlorobenzene	180	182, 145	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	1	2	5
1,2,3-Trichloropropane	110	61, 77	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
1,2,4-Trichlorobenzene	180	182, 145	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	1	2	5
1,2,4-Trimethylbenzene	105	120	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.55	1	5
1,2-Dibromo-3-chloropropane	157	155, 75	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
1,2-Dibromoethane	107	109	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,2-Dichlorobenzene	146	111, 148	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,2-Dichloroethane	62	64	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,2-Dichloropropane	63	41, 76	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,3,5-Trimethylbenzene	105	120, 119	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.59	1	5
1,3-Dichlorobenzene	146	111, 148	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.52	1	5
1,3-Dichloropropane	76	78	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1,4-Dichlorobenzene	146	111, 148	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
1-Chlorohexane	91	93, 55, 56	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.58	1	5
2,2-Dichloropropane	77	97, 79	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
2-Butanone (MEK)	43	72	IS1	Sur0/1	10	25	50	100	250	400	500	1000	250	250	2.5	5	10	2.5	5	10
2-Chloroethyl vinyl ether	63	65, 106	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
2-Chlorotoluene	91	126	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.82	1	5
2-Hexanone (MBK)	43	58, 100	IS2	Sur3	10	25	50	100	250	400	500	1000	250	250	2.5	5	10	2.86	5	10
4-Chlorotoluene	91	126	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.61	1	5	0.67	1	5
4-Methyl-2-pentanone (MIBK)	43	58, 85, 100	IS1	Sur0/1	10	25	50	100	250	400	500	1000	250	250	2.5	5	10	2.75	5	10
Acetone	43	58, 42	IS1	Sur0/1	10	25	50	100	250	400	500	1000	250	250	2.5	5	10	3.06	5	10
Acrolein	56	55	IS1	Sur0/1	10	25	50	100	250	400	500	1000	250	250	2.5	5	10	2.5	5	10
Acrylonitrile	53	52, 51	IS1	Sur0/1	10	25	50	100	250	400	500	1000	250	250	2.5	5	10	2.5	5	10
Benzene	78	77, 52	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Bromobenzene	156	77, 158	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Bromochloromethane	49	128, 130	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Bromodichloromethane	83	85	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Bromoform	173	171, 175	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	1	2	5
Bromomethane	94	96	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	1.1	2	5	1.81	2	5

Table 6: TYPICAL TARGET ANALYTE LIST FOR 5-ml PURGE

ANALYTES	CHARACTERISTIC ION(S)		IS	SURR	ICAL ANALYTE CONCENTRATIONS (µg/L)								ICV/DCC EV(µg/L)	LCS/MS EV(µg/L)	WATER (µg/L)			SOIL (µg/Kg)		
	PRIMARY	SECONDARY			1	2	3	4	5	6	7	8			DL	LOD	LOQ	DL	LOD	LOQ
Carbon disulfide	76	78	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Carbon tetrachloride	119	117	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.54	1	5
Chlorobenzene	112	51, 77, 114	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Chloroethane	64	49, 66	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
Chloroform	83	85, 47	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Chloromethane	50	52	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	1	2	5	1.02	2	5
cis-1,2-Dichloroethene	96	61, 98	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
cis-1,3-Dichloropropene	75	77, 39, 110	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Dibromochloromethane	129	127	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Dibromomethane	93	95, 174	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Dichlorodifluoromethane	85	87	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	1.3	2	5	1.16	2	5
Dichlorofluoromethane	67	69	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Diisopropyl ether (DIPE)	45	87	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Ethyl Methacrylate	69	99, 41	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
Ethylbenzene	91	106	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Ethyl-tert-butyl ether (ETBE)	59	87	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Hexachlorobutadiene	225	223, 227	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	1	2	5
Iodomethane	142	127	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	1	2	5
Isopropylbenzene	105	120, 79, 103	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.64	1	5
m/p-Xylenes	91	106	IS2	Sur3	4	10	20	40	100	160	200	400	100	100	1	2	10	1	2	10
Methylene chloride	49	84, 86	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	1	2	5
Methyl-t-butyl ether (MTBE)	73	57	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
Naphthalene	128	127	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
n-Butylbenzene	91	92, 134	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.73	1	5	0.7	1	5
n-Propylbenzene	91	65, 120	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.51	1	5	0.65	1	5
o-Xylene	91	106	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
p-Isopropyltoluene	119	91, 134	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.56	1	5	0.62	1	5
sec-Butylbenzene	105	134	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.67	1	5
Styrene	104	78, 103	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
tert-Amylmethyl ether (TAME)	87	55,73	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
tert-Butyl alcohol (TBA)	59	41	IS1	Sur0/1	10	25	50	100	250	400	500	1000	250	250	7.1	10	25	9.18	10	20
tert-Butylbenzene	134	91, 119	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.62	1	5
Tetrachloroethene	164	129, 131, 166	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.52	1	5	0.5	1	5
Toluene	91	92	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
trans-1,2-Dichloroethene	61	96, 98	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
trans-1,3-Dichloropropene	75	77, 39	IS2	Sur3	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5
trans-1,4-Dichloro-2-butene	53	88	IS3	Sur2	2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
Trichloroethene	130	97, 132, 95	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.5	1	5	0.5	1	5

Table 6: TYPICAL TARGET ANALYTE LIST FOR 5-ml PURGE

ANALYTES	CHARACTERISTIC ION(S)		IS	SURR	ICAL ANALYTE CONCENTRATIONS (µg/L)								ICV/DCC EV(µg/L)	LCS/MS EV(µg/L)	WATER (µg/L)			SOIL (µg/Kg)		
	PRIMARY	SECONDARY			1	2	3	4	5	6	7	8			DL	LOD	LOQ	DL	LOD	LOQ
Trichlorofluoromethane	101	103	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.86	1	5	1.06	2	5
Vinyl acetate	43	86	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	1	2	5	1.26	2	5
Vinyl chloride	62	64	IS1	Sur0/1	2	5	10	20	50	80	100	200	50	50	0.61	1	5	1	2	5
Dibromofluoromethane (Sur0)	111	113, 192	IS1		2	5	10	20	50	80	100	200	50	50	1	2	5	0.5	1	5
1,2-Dichloroethane-d4 (Sur1)	65	102	IS1		2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
4-Bromofluorobenzene (Sur2)	95	174, 176	IS3		2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
Toluene-D8 (Sur3)	98	100	IS2		2	5	10	20	50	80	100	200	50	50	1	2	5	1	2	5
1,4-Difluorobenzene (IS1)	114	88																		
Chlorobenzene-d5 (IS2)	117	82, 119																		
1,2-Dichlorobenzene-d4 (IS3)	152	150																		

Note: Since, retention time of Dibromofluoromethane (Sur0) and 1,2-Dichloroethane-d4 (Sur1) is too close (~43 sec) hence, Dibromofluoromethane (Sur0) is only used when required by the project.

Table 7: TYPICAL TARGET ANALYTE LIST FOR 25-ml PURGE

Analytes	CHARACTERISTIC ION(S)		IS	SURR	ICAL ANALYTE CONCENTRATIONS (µg/L)									ICV/DCC EV(µg/L)	LCS/MS EV(µg/L)	WATER (µg/L)		
	PRIMARY	SECONDARY			1	2	3	4	5	6	7	8	9			DL	LOD	LOQ
1,1,1,2-Tetrachloroethane	131	133, 119, 117	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,1,1-Trichloroethane	97	99, 61	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,1,2,2-Tetrachloroethane	83	85	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
1,1,2-Trichloro-1,2,2-trifluoroethane	151	153	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.17	0.3	0.5
1,1,2-Trichloroethane	97	83, 85, 99	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,1-Dichloroethane	63	65, 83	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,1-Dichloroethene	61	63, 96	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,1-Dichloropropene	110	112	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,2,3-Trichlorobenzene	180	182, 145	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.15	0.3	0.5
1,2,3-Trichloropropane	110	61, 77	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.25	0.5	1
1,2,4-Trichlorobenzene	180	182, 145	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.15	0.3	0.5
1,2,4-Trimethylbenzene	105	120	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
1,2-Dibromo-3-chloropropane	157	155, 75	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.25	0.5	1
1,2-Dibromoethane	107	109	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,2-Dichlorobenzene	146	111, 148	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,2-Dichloroethane	62	64	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,2-Dichloropropane	63	41, 76	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,3,5-Trimethylbenzene	105	120, 119	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.13	0.2	0.5
1,3-Dichlorobenzene	146	111, 148	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
1,3-Dichloropropane	76	78	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1,4-Dichlorobenzene	146	111, 148	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
1-Chlorohexane	91	93, 55, 56	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.14	0.2	0.5
2,2-Dichloropropane	77	97, 79	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.16	0.2	0.5
2-Butanone (MEK)	43	72	IS1	Sur0/1	1.5	2.5	5	10	25	50	100	150	200	50	50	2	4	10
2-Chloroethyl vinyl ether	63	65, 106	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.5	1	2
2-Chlorotoluene	91	126	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.12	0.2	0.5
2-Hexanone (MBK)	43	58, 100	IS2	Sur3	1.5	2.5	5	10	25	50	100	150	200	50	50	2.3	4	5
4-Chlorotoluene	91	126	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
4-Methyl-2-pentanone (MIBK)	43	58, 85, 100	IS1	Sur0/1	1.5	2.5	5	10	25	50	100	150	200	50	50	2.2	4	5
Acetone	43	58, 42	IS1	Sur0/1	1.5	2.5	5	10	25	50	100	150	200	50	50	2.6	5	10
Acrolein	56	55	IS1	Sur0/1	1.5	2.5	5	10	25	50	100	150	200	50	50	2.5	5	10
Acrylonitrile	53	52, 51	IS1	Sur0/1	1.5	2.5	5	10	25	50	100	150	200	50	50	2.5	5	10
Benzene	78	77, 52	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5

Table 7: TYPICAL TARGET ANALYTE LIST FOR 25-ml PURGE

Analytes	CHARACTERISTIC ION(S)		IS	SURR	ICAL ANALYTE CONCENTRATIONS (µg/L)									ICV/DCC EV(µg/L)	LCS/MS EV(µg/L)	WATER (µg/L)		
	PRIMARY	SECONDARY			1	2	3	4	5	6	7	8	9			DL	LOD	LOQ
Bromobenzene	156	77, 158	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Bromochloromethane	49	128, 130	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
Bromodichloromethane	83	85	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Bromoform	173	171, 175	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.15	0.3	0.5
Bromomethane	94	96	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.16	0.3	0.5
Carbon disulfide	76	78	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Carbon tetrachloride	119	117	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Chlorobenzene	112	51, 77, 114	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Chloroethane	64	49, 66	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.27	0.3	0.5
Chloroform	83	85, 47	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Chloromethane	50	52	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.15	0.3	0.5
cis-1,2-Dichloroethene	96	61, 98	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
cis-1,3-Dichloropropene	75	77, 39, 110	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Dibromochloromethane	129	127	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Dibromomethane	93	95, 174	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Dichlorodifluoromethane	85	87	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.15	0.3	0.5
Dichlorofluoromethane	67	69	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Diisopropyl ether (DIPE)	45	87	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
Ethyl Methacrylate	69	99, 41	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.25	0.5	1
Ethylbenzene	91	106	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Ethyl-tert-butyl ether (ETBE)	59	87	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
Hexachlorobutadiene	225	223, 227	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.22	0.3	0.5
Iodomethane	142	127	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.15	0.3	0.5
Isopropylbenzene	105	120, 79, 103	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
m/p-Xylenes	91	106	IS2	Sur3	0.6	1	2	4	10	20	40	60	80	20	20	0.21	0.4	1
Methylene chloride	49	84, 86	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.25	0.5	1
Methyl-t-butyl ether (MTBE)	73	57	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.13	0.2	0.5
Naphthalene	128	127	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.25	0.5	1
n-Butylbenzene	91	92, 134	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.17	0.2	0.5
n-Propylbenzene	91	65, 120	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.13	0.2	0.5
o-Xylene	91	106	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
p-Isopropyltoluene	119	91, 134	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.14	0.2	0.5
sec-Butylbenzene	105	134	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.13	0.2	0.5

Table 7: TYPICAL TARGET ANALYTE LIST FOR 25-ml PURGE

Analytes	CHARACTERISTIC ION(S)		IS	SURR	ICAL ANALYTE CONCENTRATIONS (µg/L)									ICV/DCC EV(µg/L)	LCS/MS EV(µg/L)	WATER (µg/L)		
	PRIMARY	SECONDARY			1	2	3	4	5	6	7	8	9			DL	LOD	LOQ
Styrene	104	78, 103	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
tert-Amylmethyl ether (TAME)	87	55,73	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
tert-Butyl alcohol (TBA)	59	41	IS1	Sur0/1	1.5	2	5	10	25	50	100	150	200	50	50	2.5	5	10
tert-Butylbenzene	134	91, 119	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.13	0.2	0.5
Tetrachloroethene	164	129, 131, 166	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.15	0.2	0.5
Toluene	91	92	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
trans-1,2-Dichloroethene	61	96, 98	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
trans-1,3-Dichloropropene	75	77, 39	IS2	Sur3	0.3	0.5	1	2	5	10	20	30	40	10	10	0.11	0.2	0.5
trans-1,4-Dichloro-2-butene	53	88	IS3	Sur2	0.3	0.5	1	2	5	10	20	30	40	10	10	0.5	1	2
Trichloroethene	130	97, 132, 95	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.1	0.2	0.5
Trichlorofluoromethane	101	103	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.15	0.3	0.5
Vinyl acetate	43	86	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.25	0.5	1
Vinyl chloride	62	64	IS1	Sur0/1	0.3	0.5	1	2	5	10	20	30	40	10	10	0.12	0.2	0.5
Dibromofluoromethane (Sur0)	111	113, 192	IS1		0.3	0.5	1	2	5	10	20	30	40	10	10	0.5	1	2
1,2-Dichloroethane-d4 (Sur1)	65	102	IS1		0.3	0.5	1	2	5	10	20	30	40	10	10	0.5	1	2
4-Bromofluorobenzene (Sur2)	95	174, 176	IS3		0.3	0.5	1	2	5	10	20	30	40	10	10	0.5	1	2
Toluene-D8 (Sur3)	98	100	IS2		0.3	0.5	1	2	5	10	20	30	40	10	10	0.5	1	2
1,4-Difluorobenzene (IS1)	114	88																
Chlorobenzene-d5 (IS2)	117	82, 119																
1,2-Dichlorobenzene-d4 (IS3)	152	150																

Note: Since retention time of Dibromofluoromethane (Sur0) and 1,2-Dichloroethane-d4 (Sur1) is too close (~43 sec) hence, Dibromofluoromethane (Sur0) is only used when required by the project.

Figure 1: PEAK EVALUATION TECHNIQUES

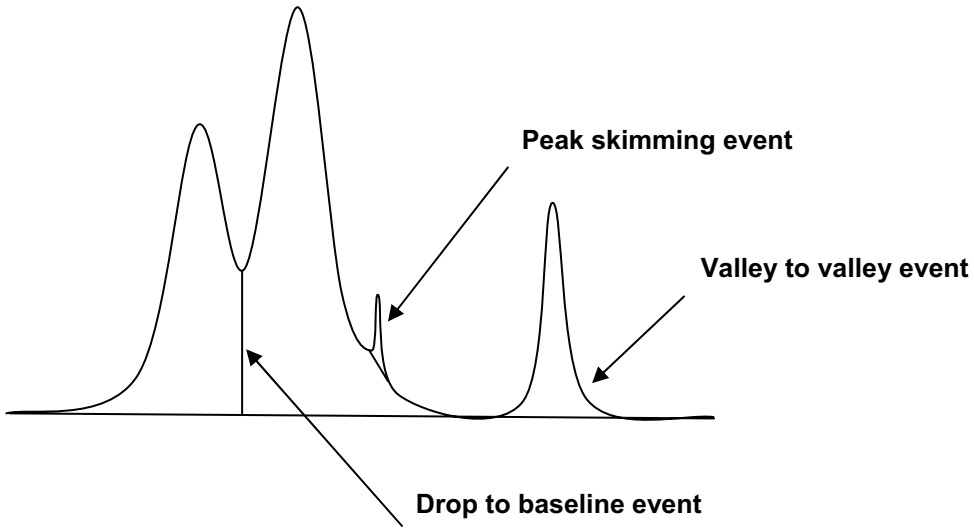
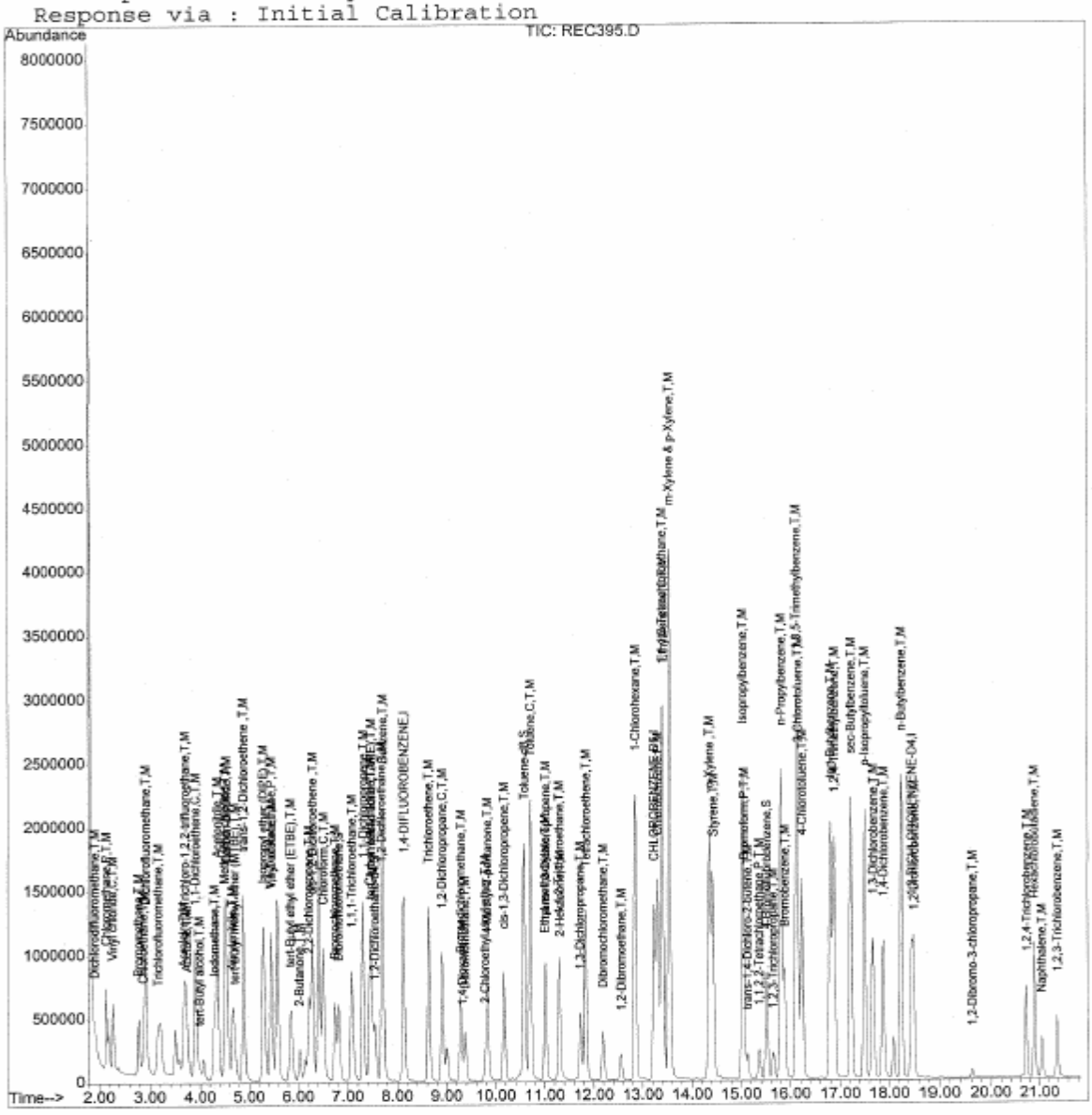


Figure 2: **TYPICAL CHROMATOGRAM**

Quantitation Report

Data File : D:\HPCHEM\1\DATA\11E25\REC395.D Vial: 2
Acq On : 25 May 2011 1:40 pm Operator: AS
Sample : IVO67E2402 10ppb Inst : TO67
Misc : 10ppb 8260/50ppb KET-ACR-ACN-TBA Multiplr: 1.00
MS Integration Params: LSCINT1.P
Quant Time: May 25 16:32 2011 Quant Results File: VO67E24.RES

Method : D:\HPCHEM\1\METHODS\VO67E24.M (RTE Integrator)
Title : METHOD 8260B 4.0
Last Update : Wed May 25 16:26:28 2011
Response via : Initial Calibration



REC395.D VO67E24.M Wed May 25 16:38:57 2011 Page 4

Figure 3: **TYPICAL ICAL SUMMARY**

INITIAL_CALIBRATION - RELATIVE_RESPONSE_FACTOR

Instrument ID :03
Beginning DateTime :03/12/13 07:57
Spike Units :PPB
IC File :RCB023

Column Spec :ZB-624 ID :0.25MM
Ending DateTime :03/12/13 12:58
HPChem Method :V003C12

M	IDX	Parameters	.3 07:57 RCB018	.5 08:31 RCB019	1 09:05 RCB020	2 09:39 RCB021	5 10:11 RCB022	10 10:45 RCB023	20 11:18 RCB024	30 11:52 RCB025	50 12:25 RCB026	100 12:58 RCB027	Av_RRF	%_RSD	Av_Rt_M
	1	1,4-DIFLUOROBENZENE	1	1	1	1	1	1	1	1	1	1	1	0	13.1167
	2	Chlorotrifluoroethylene	------	------	------	------	------	------	------	------	------	------	0.000	0.00	0.0000
	3	Dichlorodifluoromethane	0.312	0.311	0.326	0.327	0.302	0.284	0.298	0.281	0.271	0.265	0.298	7.35	4.0527
	4	Chloromethane	0.497	0.479	0.499	0.498	0.449	0.423	0.434	0.414	0.395	0.379	0.447	10.02	4.5516
	5	Vinyl chloride	0.295	0.288	0.315	0.308	0.286	0.271	0.286	0.277	0.270	0.273	0.287	5.39	4.8866
	6	2-Chloro-1,1,1-trifluoroethane	------	------	------	------	------	------	------	------	------	------	0.000	0.00	0.0000
	7	Bromomethane	0.307	0.306	0.320	0.311	0.275	0.265	0.267	0.247	0.210	------	0.279	12.91	5.7735
	8	Chloroethane	0.209	0.223	0.239	0.233	0.210	0.202	0.209	0.197	0.184	0.165	0.207	10.58	6.0466
	9	Dichlorofluoromethane	0.670	0.653	0.680	0.650	0.648	0.592	0.632	0.621	0.635	0.625	0.641	3.96	6.5916
	10	Trichlorofluoromethane	0.321	0.351	0.385	0.402	0.365	0.363	0.384	0.376	0.364	0.363	0.367	5.95	6.6749
5	11	Acrolein	0.012	0.010	0.011	0.011	0.012	0.013	0.013	0.013	0.013	0.013	0.012	9.23	7.7679
	12	1,1,2-Trichloro-1,2,2-trifluoroethane	0.214	0.199	0.207	0.193	0.190	0.173	0.180	0.176	0.185	0.180	0.190	7.16	7.8901
	13	1,1-Dichloroethene	0.613	0.612	0.620	0.579	0.570	0.534	0.548	0.523	0.543	0.514	0.566	6.97	7.9392
5	14	Acetone	------	------	0.045	0.035	0.032	0.031	0.029	0.027	0.029	0.028	0.032	18.18	8.1020
	15	Iodomethane	0.553	0.519	0.566	0.525	0.512	0.471	0.490	0.476	0.484	0.486	0.508	6.41	8.3338
	16	Carbon disulfide	1.259	1.220	1.291	1.367	1.204	1.194	1.218	1.179	1.183	1.151	1.227	5.20	8.4588
	17	Methyl acetate	------	------	------	------	------	------	------	------	------	------	0.000	0.00	0.0000
	18	Methylene chloride	------	------	0.548	0.484	0.450	0.419	0.422	0.397	0.422	0.401	0.443	11.51	9.0085
5	19	tert-Butyl alcohol	0.009	0.009	0.011	0.010	0.010	0.009	0.010	0.009	0.010	0.009	0.010	6.11	9.2093
	20	tert-Butyl methyl ether (MTBE)	0.430	0.405	0.440	0.420	0.409	0.367	0.381	0.371	0.404	0.374	0.400	6.43	9.4267
	21	trans-1,2-Dichloroethene	0.681	0.638	0.664	0.629	0.618	0.585	0.584	0.553	0.577	0.535	0.606	7.83	9.4834
5	22	Acrylonitrile	0.036	0.036	0.041	0.040	0.038	0.039	0.037	0.037	0.038	0.036	0.038	5.13	9.5161
	23	Isopropyl ether (DIPE)	1.387	1.263	1.335	1.285	1.234	1.171	1.151	1.110	1.121	1.024	1.208	9.29	10.2472
	24	1,1-Dichloroethane	0.768	0.739	0.749	0.730	0.706	0.676	0.668	0.644	0.653	0.605	0.694	7.62	10.2785
	25	Vinyl acetate	------	0.332	0.283	0.324	0.337	0.355	0.379	0.413	0.347	0.317	0.343	10.92	10.3003
	26	tert-Butyl ethyl ether (ETBE)	0.796	0.755	0.728	0.707	0.718	0.694	0.681	0.696	0.732	0.705	0.721	4.69	10.8667
	27	2,2-Dichloropropane	0.395	0.372	0.378	0.353	0.339	0.345	0.323	0.310	0.300	0.263	0.338	11.78	11.2345
5	28	2-Butanone	0.083	0.072	0.068	0.069	0.064	0.064	0.055	0.056	0.058	0.053	0.064	14.51	11.2761
	29	cis-1,2-Dichloroethene	0.469	0.440	0.442	0.430	0.415	0.405	0.384	0.379	0.390	0.365	0.412	8.05	11.2687
5	30	2-Butanol	------	------	------	------	------	------	------	------	------	------	0.000	0.00	0.0000
	31	Bromochloromethane	0.307	0.309	0.315	0.309	0.309	0.274	0.277	0.276	0.288	0.257	0.292	6.89	11.6797
	32	Tetrahydrofuran	------	------	0.048	0.045	0.037	0.034	0.033	0.036	0.036	0.034	0.038	13.93	11.7372
	33	Chloroform	0.705	0.690	0.687	0.691	0.672	0.607	0.605	0.606	0.620	0.579	0.646	7.24	11.7705
	34	Dibromofluoromethane	0.326	0.367	0.356	0.342	0.340	0.327	0.311	0.315	0.311	0.294	0.329	6.83	12.0326
	35	1,1,1-Trichloroethane	0.523	0.515	0.500	0.484	0.512	0.471	0.477	0.472	0.470	0.435	0.486	5.50	12.0386
	36	Cyclohexane	------	------	------	------	------	------	------	------	------	------	0.000	0.00	0.0000
	37	1,1-Dichloropropene	0.209	0.194	0.192	0.189	0.183	0.178	0.181	0.182	0.174	0.159	0.184	7.23	12.2738
	38	Carbon tetrachloride	0.467	0.452	0.446	0.423	0.441	0.427	0.429	0.426	0.426	0.403	0.434	4.16	12.2857
	39	1,2-Dichloroethane-d4	0.270	0.266	0.275	0.269	0.258	0.251	0.225	------	------	------	0.259	6.60	12.5581
	40	Benzene	1.724	1.622	1.501	1.421	1.497	1.348	1.382	1.392	1.393	------	1.476	8.50	12.6150
	41	tert-Amyl methyl ether (TAME)	0.100	0.103	0.107	0.100	0.109	0.098	0.097	0.102	0.105	0.098	0.102	4.11	12.6595
	42	1,2-Dichloroethane	0.299	0.308	0.290	0.294	0.303	0.287	0.279	0.277	0.287	0.256	0.288	5.20	12.6729
	43	Trichloroethene	0.428	0.404	0.405	0.389	0.419	0.382	0.382	0.375	0.400	0.366	0.395	4.98	13.5291
	44	Methylcyclohexane	------	------	------	------	------	------	------	------	------	------	0.000	0.00	0.0000
	45	1,2-Dichloropropane	0.387	0.398	0.375	0.376	0.407	0.377	0.381	0.361	0.376	0.342	0.378	4.76	13.8776
20	46	1,4-Dioxane	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	9.47	14.0562
	47	Dibromomethane	0.163	0.146	0.158	0.146	0.166	0.142	0.149	0.144	0.158	0.145	0.152	5.80	14.0935
	48	Bromodichloromethane	0.438	0.407	0.437	0.429	0.470	0.419	0.416	0.430	0.448	0.413	0.431	4.33	14.2617

Figure 3 (cont.): **TYPICAL ICAL SUMMARY**

	49	2-Chloroethyl vinyl ether	------	0.052	0.053	0.059	0.064	0.062	0.064	0.067	0.077	0.073	0.063	13.09	14.5606
	50	cis-1,3-Dichloropropene	0.511	0.509	0.493	0.489	0.553	0.509	0.513	0.510	0.537	0.492	0.512	3.91	14.8291
5	51	4-Methyl-2-pentanone	0.182	0.169	0.170	0.164	0.180	0.168	0.154	0.160	0.170	0.144	0.166	6.86	14.9541
	52	CHLOROBENZENE-D5	1	1	1	1	1	1	1	1	1	1	1	0	17.1073
	53	Toluene-d8	1.471	1.484	1.407	1.468	1.417	1.414	1.426	1.350	1.404	------	1.427	2.94	15.1712
	54	Toluene	1.975	1.822	1.622	1.764	1.814	1.638	1.732	1.646	1.710	------	1.747	6.46	15.2622
	55	Ethyl methacrylate	0.274	0.248	0.237	0.247	0.287	0.268	0.263	0.270	0.286	0.266	0.264	6.15	15.5111
	56	trans-1,3-Dichloropropene	0.383	0.368	0.358	0.376	0.420	0.392	0.406	0.404	0.429	0.403	0.394	5.77	15.5483
	57	1,1,2-Trichloroethane	0.222	0.209	0.198	0.196	0.213	0.196	0.195	0.206	0.217	0.201	0.205	4.79	15.8267
	58	Tetrachloroethene	0.438	0.389	0.368	0.385	0.382	0.355	0.371	0.366	0.383	0.352	0.379	6.42	15.9995
5	59	2-Hexanone	0.119	0.137	0.116	0.121	0.117	0.125	0.112	0.121	0.125	0.106	0.120	6.87	16.0248
	60	1,3-Dichloropropane	0.416	0.397	0.392	0.417	0.411	0.384	0.385	0.389	0.415	0.377	0.398	3.79	16.0531
	61	Dibromochloromethane	0.252	0.234	0.233	0.261	0.259	0.256	0.262	0.267	0.287	0.268	0.258	6.22	16.3941
	62	1,2-Dibromoethane	0.207	0.208	0.195	0.197	0.212	0.193	0.202	0.205	0.224	0.208	0.205	4.47	16.5847
	63	1-Chlorohexane	0.897	0.862	0.785	0.803	0.835	0.761	0.806	0.779	0.829	0.757	0.811	5.53	16.9495
	64	Chlorobenzene	1.152	1.065	0.937	0.954	0.990	0.958	0.962	0.991	1.007	0.911	0.993	7.08	17.1475
	65	Ethylbenzene	2.251	2.178	2.021	1.994	2.182	1.965	2.014	2.014	1.839	------	2.051	6.29	17.1930
	66	1,1,1,2-Tetrachloroethane	0.319	0.317	0.311	0.307	0.333	0.304	0.308	0.319	0.318	0.294	0.313	3.37	17.2264
2	67	m-Xylene & p-Xylene	1.713	1.626	1.515	1.469	1.497	1.439	1.490	1.387	------	------	1.517	6.90	17.3227
	68	o-Xylene	1.694	1.653	1.478	1.477	1.519	1.428	1.437	1.428	1.440	------	1.506	6.65	17.8581
	69	Styrene	1.028	1.012	0.971	0.933	1.027	0.971	0.981	0.978	0.998	0.874	0.977	4.73	17.8787
	70	1,2-DICHLOROBENZENE-D4	1	1	1	1	1	1	1	1	1	1	1	0	20.6245
	71	Bromoform	0.330	0.326	0.329	0.333	0.339	0.334	0.362	0.385	0.425	0.401	0.356	9.92	18.2613
	72	Isopropylbenzene	5.562	5.517	5.180	5.026	5.022	4.609	5.010	5.013	5.337	------	5.142	5.76	18.2767
	73	4-Bromofluorobenzene	1.603	1.546	1.384	1.356	1.335	1.258	1.308	1.333	1.419	1.324	1.386	7.83	18.5621
	74	1,1,2,2-Tetrachloroethane	0.746	0.756	0.716	0.675	0.696	0.618	0.665	0.707	0.749	0.704	0.703	6.08	18.7036
	75	trans-1,4-Dichloro-2-butene	0.187	0.180	0.176	0.186	0.198	0.177	0.197	0.205	0.223	0.201	0.193	7.69	18.7438
	76	n-Propylbenzene	8.651	8.030	7.852	7.211	7.500	6.892	7.592	7.274	------	------	7.625	7.21	18.7857
	77	1,2,3-Trichloropropane	0.177	0.170	0.160	0.153	0.158	0.140	0.147	0.149	0.157	0.138	0.155	7.93	18.8019
	78	Bromobenzene	1.165	1.071	1.055	1.014	1.052	0.931	0.983	1.022	1.109	1.010	1.041	6.31	18.8227
	79	1,3,5-Trimethylbenzene	4.694	4.553	4.332	4.080	4.256	3.733	4.106	4.10	4.355	3.299	4.151	9.67	18.9612
	80	2-Chlorotoluene	5.150	4.552	4.413	4.224	4.372	3.923	4.126	4.108	4.517	3.691	4.308	9.28	18.9999
	81	4-Chlorotoluene	4.441	3.866	3.719	3.646	3.838	3.506	3.604	3.728	4.047	3.296	3.769	8.31	19.1265
	82	tert-Butylbenzene	1.011	0.999	0.944	0.893	0.936	0.837	0.894	0.889	0.955	0.865	0.922	6.14	19.4213
	83	1,2,4-Trimethylbenzene	4.627	4.271	3.973	4.095	4.026	3.564	3.677	3.874	4.208	3.401	3.972	9.12	19.4794
	84	sec-Butylbenzene	6.845	6.467	6.537	6.165	6.138	5.570	5.934	5.860	6.013	------	6.170	6.32	19.6962
	85	p-Isopropyltoluene	4.982	4.670	4.483	4.208	4.407	4.011	4.268	4.060	4.454	------	4.394	6.93	19.8402
	86	1,3-Dichlorobenzene	2.358	2.168	2.115	2.002	2.047	1.927	2.037	1.985	2.204	2.008	2.085	6.15	19.9961
	87	1,4-Dichlorobenzene	2.379	2.019	1.958	1.903	1.942	1.756	1.873	1.837	2.027	1.854	1.955	8.73	20.1063
	88	n-Butylbenzene	5.550	4.899	5.079	4.650	4.817	4.593	4.886	4.619	4.980	------	4.897	6.06	20.3928
	89	1,2-Dichlorobenzene	1.816	1.636	1.646	1.560	1.576	1.448	1.505	1.471	1.578	1.464	1.570	7.08	20.6528
	90	1,2-Dibromo-3-chloropropane	0.063	0.069	0.073	0.072	0.076	0.068	0.073	0.073	0.078	0.074	0.072	6.04	21.7696
	91	1,2,4-Trichlorobenzene	0.972	0.844	0.786	0.841	0.831	0.798	0.763	0.733	0.817	0.766	0.815	8.11	23.0070
	92	Hexachlorobutadiene	------	0.740	0.722	0.700	0.678	0.604	0.560	0.503	0.559	0.527	0.621	14.43	23.1360
	93	Naphthalene	1.249	1.099	1.013	1.042	1.036	0.961	0.917	0.843	0.957	0.895	1.001	11.58	23.4983
	94	1,2,3-Trichlorobenzene	0.700	0.631	0.619	0.614	0.617	0.556	0.499	0.460	0.505	0.476	0.568	14.08	23.9168

Spike Amount = Nominal Amount * M
Ave_%RSD : 7.5 Max_%RSD : 18.2

Use Least Square Linear Regression with weighting factor of inverse concentration for comps with %_RSD > 15
Resp_Ratio = xo + x1 * Amt_Ratio

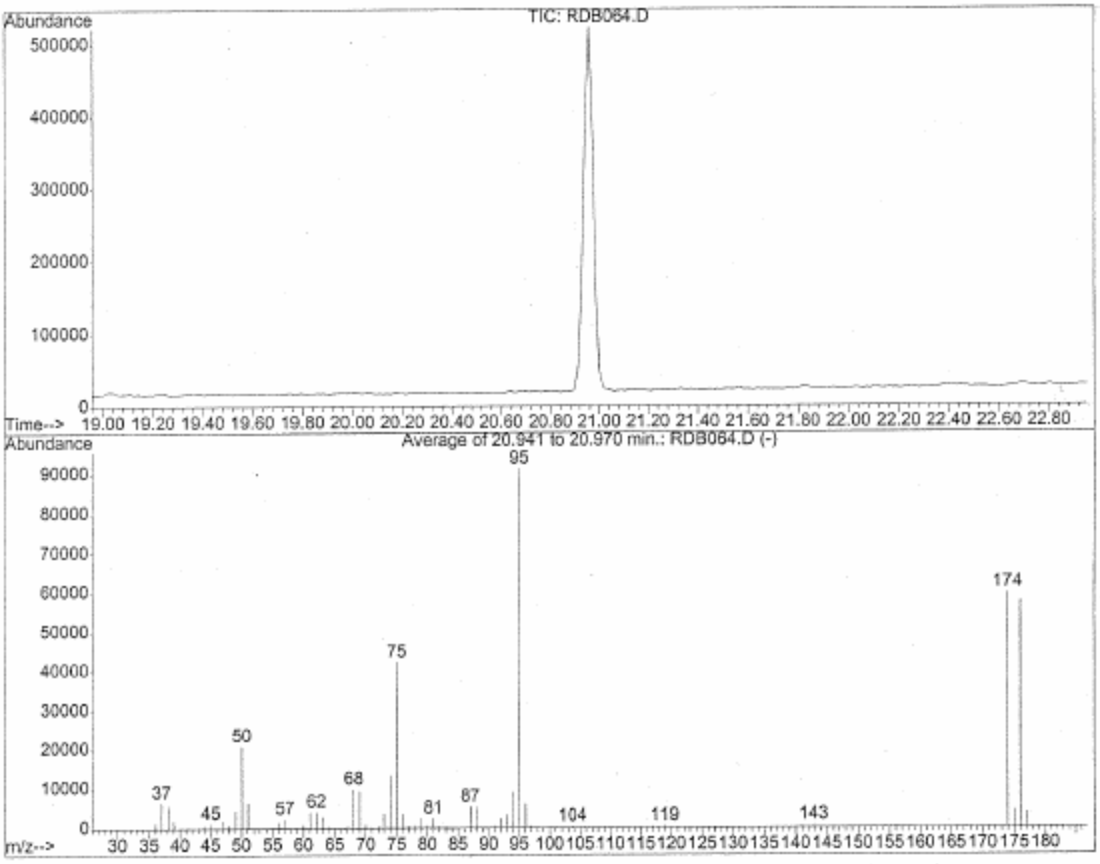
IDX	Parameter	x0	x1	CCF
14	Acetone	0.00872	0.02772	0.9996

Figure 4: TYPICAL INSTRUMENT PERFORMANCE CHECK (TUNING)

BFB

Data File : D:\HPCHEM\1\DATA\11D07\RDB064.D
Acq On : 7 Apr 2011 7:43 pm
Sample : BFB03D04
Misc : T/CHECK
MS Integration Params: 524INT.P
Method : D:\HPCHEM\1\METHODS\VO03D07.M (RTE Integrator)
Title : METHOD 8260 25mL

Vial: 2
Operator: MW
Inst : TO03
Multiplr: 1.00



AutoFind: Scans 1163, 1164, 1165; Background Corrected with Scan 1156

Target Mass	Rel. to Mass	Lower Limit%	Upper Limit%	Rel. Abn%	Raw Abn	Result Pass/Fail
50	95	15	40	22.9	20916	PASS
75	95	30	60	46.4	42347	PASS
95	95	100	100	100.0	91301	PASS
96	95	5	9	6.6	6055	PASS
173	174	0.00	2	0.0	0	PASS
174	95	50	100	65.3	59619	PASS
175	174	5	9	7.4	4406	PASS
176	174	95	101	96.7	57635	PASS
177	176	5	9	6.7	3884	PASS

RDB064.D VO03D07.M Fri Apr 08 09:01:53 2011

Figure 5: TYPICAL INSTRUMENT PERFORMANCE CHECK (TUNING) SUMMARY

5A
VOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
BROMOFLUOROBENZENE (BFB)

Lab Name: EMAX Inc Contract: CLEAN WATER PROJECT
Lab Code: EMXT Case No.: SAS No.: SDG No.: YYMNNN
Lab File ID: RDC521 BFB Injection Date : 04/29/14
Instrument ID: 67 BFB Injection Time : 09:52
GC Column:RTX502.2ID:0.25mm (mm) Heated Purge: (Y/N) N

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	15.0 - 40.0% of mass 95	20.69
75	30.0 - 60.0% of mass 95	45.82
95	Base peak, 100% relative abundance	100.00
96	5.0 - 9.0% of mass 95	6.39
173	Less than 2.0% of mass 174	0.00(0.0)1
174	Greater than 50% of mass 95	70.43
175	5.0 - 9.0% of mass 174	5.04(7.2)1
176	95.0 - 101.0% of mass 174	67.25(95.5)1
177	5.0 - 9.0% of mass 176	4.57(6.8)2

1-Value is % mass 174 2-Value is % mass 176

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD,BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
1	VSTD010	CVO67D0914	RDC523	04/29/14	11:14
2	MBLK1W	VO67D21B	RDC527	04/29/14	13:15
3	LCS1W	VO67D21L	RDC524	04/29/14	11:44
4	LCD1W	VO67D21C	RDC525	04/29/14	12:15
5	XXX-59XX001	MNNN-02	RDC534	04/29/14	16:55
6	XXX-59XX001MS	MNNN-02M	RDC535	04/29/14	17:26
7	XXX-59XX001MSD	MNNN-02S	RDC536	04/29/14	18:57

Figure 6: TYPICAL INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

8A
VOLATILE INTERNAL STANDARD AREA AND RT SUMMARY

Lab Name : EMAX INC. Project : CLEAN WATER PROJECT
Lab Code : EMXT SDG No. : YYMNNN
Lab File ID : RDC168 Date Analyzed : 04/09/14
Instrument ID: 67 Time Analyzed : 18:54
GC Column : RTX502.2ID:0.25mm (mm) Heated Purge : No

		IS1(DBF)		IS2(CBZ)		IS3(DCB)	
		AREA #	RT #	AREA #	RT #	AREA #	RT #
	12 HOUR STD	1321331	8.08	1022177	13.17	321226	18.40
	UPPER LIMIT	2642662	8.58	2044354	13.67	642452	18.90
	LOWER LIMIT	660666	7.58	511089	12.67	160613	17.90
	SAMPLE ID						
1	VSTD010	1155410	8.07	908594	13.15	276831	18.38
2	MBLK1W	1259632	8.07	956984	13.15	261376	18.38
3	LCS1W	1216852	8.07	957974	13.15	290568	18.38
4	LCD1W	1262335	8.07	983468	13.15	300886	18.38
5	XXX-59GW001	1202358	8.07	934767	13.16	277693	18.38
6	XXX-59GW001MS	1216852	8.07	957974	13.17	290568	18.38
7	XXX-59GW001MSD	1262335	8.07	983468	13.17	300886	18.38

IS1 (DFB) = 1,4-Difluorobenzene
IS2 (CBZ) = Chlorobenzene-d5
IS3 (DCB) = 1,2-Dichlorobenzene-d4

AREA UPPER LIMIT = + 100% of internal standard area
AREA LOWER LIMIT = - 50% of internal standard area
RT UPPER LIMIT = + 0.5 minutes (30 sec) of internal standard RT
RT LOWER LIMIT = - 0.5 minutes (30 sec) of internal standard RT

Column used to flag internal standard area values with an asterisk
* Values outside of QC limits.

Figure 7: **TYPICAL SAMPLE RESULT SUMMARY**

METHOD SW5030C/8260B
VOLATILE ORGANICS BY GC/MS

Client : XYZ INC.	Date Collected: 04/28/14
Project : CLEAN WATER PROJECT	Date Received: 04/29/14
Batch No. : YYMNNN	Date Extracted: 04/29/14 16:55
Sample ID: XX-59XX001	Date Analyzed: 04/29/14 16:55
Lab Samp ID: MNNN-02	Dilution Factor: 1
Lab File ID: RDC534	Matrix : WATER
Ext Btch ID: VO67D21	% Moisture : NA
Calib. Ref.: RDC168	Instrument ID : 67

PARAMETERS	RESULTS (ug/L)	LOQ (ug/L)	DL (ug/L)	LOD (ug/L)
BENZENE	0.11J	1.0	0.10	0.20
BROMODICHLOROMETHANE	ND	1.0	0.10	0.20
BROMOFORM	1.5	1.0	0.15	0.30
BROMOMETHANE	ND	1.0	0.16	0.30
CARBON TETRACHLORIDE	ND	1.0	0.10	0.20
CHLOROBENZENE	ND	1.0	0.10	0.20
CHLOROETHANE	ND	1.0	0.27	0.30
CHLOROFORM	ND	1.0	0.10	0.20
CHLOROMETHANE	ND	2.0	0.15	0.30
DIBROMOCHLOROMETHANE	0.20J	1.0	0.10	0.20
1,2-DICHLOROBENZENE	ND	1.0	0.10	0.20
1,3-DICHLOROBENZENE	ND	1.0	0.11	0.20
1,4-DICHLOROBENZENE	ND	1.0	0.10	0.20
DICHLORODIFLUOROMETHANE (FREON 12)	ND	1.0	0.15	0.30
1,1-DICHLOROETHANE	ND	1.0	0.10	0.20
1,2-DICHLOROETHANE	ND	1.0	0.10	0.20
1,1-DICHLOROETHENE	ND	1.0	0.10	0.20
1,2-DICHLOROETHENE (TOTAL)	0.30J	1.0	0.10	0.20
1,2-DICHLOROPROPANE	ND	1.0	0.10	0.20
TRANS-1,3-DICHLOROPROPENE	ND	1.0	0.11	0.20
CIS-1,3-DICHLOROPROPENE	ND	1.0	0.10	0.20
ETHYLBENZENE	ND	1.0	0.10	0.20
METHYLENE CHLORIDE	ND	5.0	0.25	0.50
1,1,2,2-TETRACHLOROETHANE	ND	1.0	0.11	0.20
TETRACHLOROETHENE	0.19J	1.0	0.15	0.20
TOLUENE	62	1.0	0.10	0.20
1,1,1-TRICHLOROETHANE	ND	1.0	0.10	0.20
1,1,2-TRICHLOROETHANE	ND	1.0	0.10	0.20
TRICHLOROFLUOROMETHANE (FREON 11)	ND	1.0	0.15	0.30
TRICHLOROETHENE	14	1.0	0.10	0.20
VINYL CHLORIDE	ND	2.0	0.12	0.20
XYLENES (TOTAL)	ND	1.0	0.10	0.50

SURROGATE PARAMETERS	RESULTS	SPK_AMT	% RECOVERY	QC LIMIT
1,2-DICHLOROETHANE-D4	8.44	10.00	84.4	70-120
4-BROMOFLUOROBENZENE	9.41	10.00	94.1	75-120
TOLUENE-D8	10.3	10.00	103	85-120
DIBROMOFLUOROMETHANE	9.95	10.00	99.5	85-115

Figure 8: TYPICAL LCS/LCSD SUMMARY

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: XYZ INC.
PROJECT: CLEAN WATER PROJECT
BATCH NO.: YYMNNN
METHOD: SW5030C/8260B

MATRIX:	WATER			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	MBLK1W				
LAB SAMP ID:	VO67D21B	VO67D21L	VO67D21C		
LAB FILE ID:	RDC527	RDC524	RDC525		
DATE EXTRACTED:	04/29/1413:15	04/29/1411:44	04/29/1412:15	DATE COLLECTED:	NA
DATE ANALYZED:	04/29/1413:15	04/29/1411:44	04/29/1412:15	DATE RECEIVED:	04/29/14
PREP. BATCH:	VO67D21	VO67D21	VO67D21		
CALIB. REF:	RDC168	RDC168	RDC168		

ACCESSION:

PARAMETER	BLNK RSLT (ug/L)	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
Benzene	ND	10.0	9.32	93	10.0	9.17	92	2	80-120	30
Bromodichloromethane	ND	10.0	9.65	97	10.0	9.37	94	3	75-120	30
Bromoform	ND	10.0	10.1	101	10.0	9.80	98	3	70-130	30
Bromomethane	ND	10.0	10.6	106	10.0	9.80	98	7	30-145	30
Carbon Tetrachloride	ND	10.0	8.35	83	10.0	8.20	82	2	65-140	30
Chlorobenzene	ND	10.0	9.78	98	10.0	9.68	97	1	80-120	30
Chloroethane	ND	10.0	11.0	110	10.0	10.1	101	8	60-135	30
Chloroform	ND	10.0	9.84	98	10.0	9.56	96	3	65-135	30
Chloromethane	ND	10.0	10.2	102	10.0	9.58	96	7	40-125	30
Dibromochloromethane	ND	10.0	9.64	96	10.0	9.49	95	2	60-135	30
1,2-Dichlorobenzene	ND	10.0	10.3	103	10.0	10.1	101	2	70-120	30
1,3-Dichlorobenzene	ND	10.0	10.1	101	10.0	9.91	99	2	75-125	30
1,4-Dichlorobenzene	ND	10.0	10.0	100	10.0	9.87	99	1	75-125	30
Dichlorodifluoromethane (Freon 12)	ND	10.0	9.93	99	10.0	9.39	94	6	30-155	30
1,1-Dichloroethane	ND	10.0	9.27	93	10.0	8.99	90	3	70-135	30
1,2-Dichloroethane	ND	10.0	7.97	80	10.0	7.88	79	1	70-130	30
1,1-Dichloroethene	ND	10.0	7.58	76	10.0	7.41	74	2	70-130	30
1,2-Dichloroethene (Total)	ND	20.0	17.1	85	20.0	16.6	83	3	70-125	30
1,2-Dichloropropane	ND	10.0	9.90	99	10.0	9.70	97	2	75-125	30
Trans-1,3-Dichloropropene	ND	10.0	8.39	84	10.0	8.49	85	1	55-140	30
cis-1,3-Dichloropropene	ND	10.0	9.23	92	10.0	8.93	89	3	70-130	30
Ethylbenzene	ND	10.0	9.84	98	10.0	9.67	97	2	75-125	30
Methylene Chloride	ND	10.0	8.28	83	10.0	8.40	84	1	55-140	30
1,1,2,2-Tetrachloroethane	ND	10.0	10.5	105	10.0	10.3	103	2	65-130	30
Tetrachloroethene	ND	10.0	9.31	93	10.0	9.20	92	1	45-150	30
Toluene	ND	10.0	9.57	96	10.0	9.47	95	1	75-120	30
1,1,1-Trichloroethane	ND	10.0	8.74	87	10.0	8.56	86	2	65-130	30
1,1,2-Trichloroethane	ND	10.0	10.3	103	10.0	10.3	103	0	75-125	30
Trichlorofluoromethane (Freon 11)	ND	10.0	10.8	108	10.0	9.93	99	9	60-145	30
Trichloroethene	ND	10.0	9.46	95	10.0	9.19	92	3	70-125	30
Vinyl Chloride	ND	10.0	10.3	103	10.0	9.61	96	7	50-145	30
Xylenes (Total)	ND	30.0	28.5	95	30.0	28.0	93	2	80-120	30

SURROGATE PARAMETER	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	QC LIMIT (%)
1,2-Dichloroethane-d4	10.0	8.20	82	10.0	8.24	82	70-120
4-Bromofluorobenzene	10.0	9.69	97	10.0	9.70	97	75-120
Toluene-d8	10.0	10.4	104	10.0	10.4	104	85-120
Dibromofluoromethane	10.0	9.92	99	10.0	9.85	98	85-115

Figure 9: TYPICAL MS/MSD SUMMARY

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT: XYZ INC.
PROJECT: CLEAN WATER PROJECT
BATCH NO.: YYMNNN
METHOD: SW5030C/8260B

MATRIX:	WATER			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	XXX-59XX001	XXX-59XX001MS	XXX-59XX001MSD		
LAB SAMP ID:	MNNN-02	MNNN-02M	MNNN-02S		
LAB FILE ID:	RDC534	RDC535	RDC536		
DATE EXTRACTED:	04/29/1416:55	04/29/1417:26	04/29/1418:15	DATE COLLECTED:	NA
DATE ANALYZED:	04/29/1416:55	04/29/1417:26	04/29/1418:15	DATE RECEIVED:	04/29/14
PREP. BATCH:	VO67D21	VO67D21	VO67D21		
CALIB. REF:	RDC168	RDC168	RDC168		

ACCESSION:

PARAMETER	BLNK RSLT (ug/L)	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
Benzene	ND	10.0	9.32	93	10.0	9.17	92	2	80-120	30
Bromodichloromethane	ND	10.0	9.65	97	10.0	9.37	94	3	75-120	30
Bromoform	ND	10.0	10.1	101	10.0	9.80	98	3	70-130	30
Bromomethane	ND	10.0	10.6	106	10.0	9.80	98	7	30-145	30
Carbon Tetrachloride	ND	10.0	8.35	83	10.0	8.20	82	2	65-140	30
Chlorobenzene	ND	10.0	9.78	98	10.0	9.68	97	1	80-120	30
Chloroethane	ND	10.0	11.0	110	10.0	10.1	101	8	60-135	30
Chloroform	ND	10.0	9.84	98	10.0	9.56	96	3	65-135	30
Chloromethane	ND	10.0	10.2	102	10.0	9.58	96	7	40-125	30
Dibromochloromethane	ND	10.0	9.64	96	10.0	9.49	95	2	60-135	30
1,2-Dichlorobenzene	ND	10.0	10.3	103	10.0	10.1	101	2	70-120	30
1,3-Dichlorobenzene	ND	10.0	10.1	101	10.0	9.91	99	2	75-125	30
1,4-Dichlorobenzene	ND	10.0	10.0	100	10.0	9.87	99	1	75-125	30
Dichlorodifluoromethane (Freon 12)	ND	10.0	9.93	99	10.0	9.39	94	6	30-155	30
1,1-Dichloroethane	ND	10.0	9.27	93	10.0	8.99	90	3	70-135	30
1,2-Dichloroethane	ND	10.0	7.97	80	10.0	7.88	79	1	70-130	30
1,1-Dichloroethene	ND	10.0	7.58	76	10.0	7.41	74	2	70-130	30
1,2-Dichloroethene (Total)	ND	20.0	17.1	85	20.0	16.6	83	3	70-125	30
1,2-Dichloropropane	ND	10.0	9.90	99	10.0	9.70	97	2	75-125	30
Trans-1,3-Dichloropropene	ND	10.0	8.39	84	10.0	8.49	85	1	55-140	30
cis-1,3-Dichloropropene	ND	10.0	9.23	92	10.0	8.93	89	3	70-130	30
Ethylbenzene	ND	10.0	9.84	98	10.0	9.67	97	2	75-125	30
Methylene Chloride	ND	10.0	8.28	83	10.0	8.40	84	1	55-140	30
1,1,2,2-Tetrachloroethane	ND	10.0	10.5	105	10.0	10.3	103	2	65-130	30
Tetrachloroethene	ND	10.0	9.31	93	10.0	9.20	92	1	45-150	30
Toluene	ND	10.0	9.57	96	10.0	9.47	95	1	75-120	30
1,1,1-Trichloroethane	ND	10.0	8.74	87	10.0	8.56	86	2	65-130	30
1,1,2-Trichloroethane	ND	10.0	10.3	103	10.0	10.3	103	0	75-125	30
Trichlorofluoromethane (Freon 11)	ND	10.0	10.8	108	10.0	9.93	99	9	60-145	30
Trichloroethene	ND	10.0	9.46	95	10.0	9.19	92	3	70-125	30
Vinyl Chloride	ND	10.0	10.3	103	10.0	9.61	96	7	50-145	30
Xylenes (Total)	ND	30.0	28.5	95	30.0	28.0	93	2	80-120	30

SURROGATE PARAMETER	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	QC LIMIT (%)
1,2-Dichloroethane-d4	10.0	8.20	82	10.0	8.24	82	70-120
4-Bromofluorobenzene	10.0	9.69	97	10.0	9.70	97	75-120
Toluene-d8	10.0	10.4	104	10.0	10.4	104	85-120
Dibromofluoromethane	10.0	9.92	99	10.0	9.85	98	85-115

Figure 10: TYPICAL CASE NARRATIVE

CASE NARRATIVE

Client : XYZ INC.

Project : CLEAN WATER PROJECT

SDG : YYDNNN

METHOD SW5030C/8260B
VOLATILE ORGANICS BY GC/MS

A total of two (2) water samples were received on 04/29/14 for Volatile Organics by GC/MS analysis, Method 5030C/8260B in accordance with USEPA SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods and Project QAPP Clean Water Project.

Holding Time
Samples were analyzed within the prescribed holding time.

Instrument Performance and Calibration
Instrument tune check was performed prior to calibration. Instrument mass ratios were within specification. Multi-calibration points were generated to establish initial calibration (ICAL). ICAL was verified using secondary source (ICV). Continuing calibration (CCV) was carried on at a frequency required by the project. All project calibration requirements were satisfied. Refer to calibration summary forms of ICAL, ICV and CCV for details.

Method Blank
Method blank was analyzed at the frequency required by the project. For this SDG, one method blank was analyzed with the samples. Results were compliant to project requirement.

Lab Control Sample
A set of LCS/LCD was analyzed with the samples in this SDG.
Percent recoveries for VO67D21L/C were all within QC limits.

Matrix QC Sample
Matrix QC sample was analyzed at the frequency prescribed by the project.
Percent recoveries and RPDs for MNNN-02M/S were within project QC limits.

Surrogate
Surrogates were added on QC and field samples. Surrogate recoveries were within project QC limits. Refer to sample result forms for details.

Sample Analysis
Samples were analyzed according to prescribed analytical procedures. All project requirements were met; otherwise, anomalies were discussed within the associated QC parameter.

Appendix 1: SUMMARY OF QUALITY CONTROL PROCEDURES

QC PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	1st Rvw	2nd Rvw
Check of mass spectral ion intensities using BFB	Prior to initial calibration and calibration verification	Refer to criteria listed in Table 5	Retune instrument and verify		
Multi point Initial Calibration(ICAL) minimum of 5 points	Initially; as needed	SPCCs : RF $\geq$ 0.1 for Bromoform, Chloromethane and 1,1-Dichloroethane RF $\geq$ 0.3 for Chlorobenzene and 1,1,2,2-Tetrachloroethane CCCs: RSD ≤ 30% for the following analytes: Chloroform, 1,1-DCE, 1,2-DCP, Ethylbenzene, Toluene and Vinyl Chloride. 1.) if RRF is applied, then RSD ≤ 15% 2.) If 1st order is applied, then r ≥ 0.995 with min 5 pt ICAL 3.) If 2nd order is applied, then r ≥ 0.99 with min 6 pt ICAL	Check for outliers. Otherwise, optimize the instrument then repeat initial calibration.		
Initial calibration verification (ICV)	After initial calibration	All analytes within ± 20% of expected value except for the following compounds due to erratic chromatographic behavior: Bromomethane, Chloroethane, Chloromethane, Dichlorodifluoromethane but must be within $\pm$ 35% of expected value.	Verify second source standard. Prepare fresh standard and rerun ICV. If that fails, Optimize instrument and repeat ICAL.		
Evaluation of relative retention times (RRT)	Each sample	Within ± 0.06 RRT units	Correct the problem then reanalyze all samples analyzed since the last retention time check		
Continuing Calibration verification (CCV)	Daily, before sample analysis and every 12 hours of analysis time	SPCCs: Min. RF same as ICAL CCC : %Diff $\leq$ 20% (when using RFs) or drift (when using least squares regression or non-linear calibration)	Correct the problem then repeat initial calibration		
Internal Standard (IS)	All samples	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard	Inspect mass spectrometer and GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning		
Method blank (MB)	One per preparation batch	No analytes detected > ½ LOQ	Rule out instrument contamination by re-analyzing the MB. If problem persist refer to PSR. In the absence of PSR, report NDs and results >10X of the MB concentration. Otherwise, cure contamination source, re-prep and re-analyze method blank and all associated samples.		
LCS	One LCS per preparation	Within project QC Limits	Re-prep and re-analyze the LCS and all associated samples		
MS/MSD	One MS/MSD per every 20 project samples per matrix	Within project QC Limits	Check if sample was properly spiked. If indicative of matrix interference, discuss in case narrative, otherwise re-prep and re-analyze the sample		
Surrogate	Every Sample, MB, LCS, MS/MSD, DCC	Within project QC Limits	Correct the problem then re-analyze		
Comments: This QCP is applicable in the absence of the PSR Report values between LOD and LOQ. Refer to PSR for Flagging Criteria.			Reviewed by: Date:		

Appendix 2: DEMONSTRATION OF CAPABILITY for 25 ml

DEMONSTRATION OF CAPABILITY
METHOD: SW 8260

Unit: µg/L
Sample Amount(ml): 25
Sample Purge(ml): 25

Date Analyzed: 01/31 & 02/01/12
Analyzed by: D. Nguyen

PARAMETER	RAY133 VOF5A10L	RAY134 VOF5A10C	RBY004 VOF5B01L	RBY005 VOF5B01C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
Acetone	46.2	49.8	45.0	49.4	50	47.6	95	2.378	5	60 - 130	Passed
Acetonitrile	83.4	86.1	88.7	83.0	100	85.3	85	2.632	3	50 - 130	Passed
Acrolein	47.0	50.2	42.0	48.0	50	46.8	94	3.502	7	10 - 160	Passed
Acrylonitrile	50.0	52.1	45.0	51.3	50	49.6	99	3.188	6	60 - 150	Passed
Benzene	9.39	10.0	9.71	9.62	10	9.69	97	0.255	3	70 - 130	Passed
Bromobenzene	9.65	10.4	9.85	10.1	10	10.0	100	0.344	3	70 - 130	Passed
Bromochloromethane	9.08	9.78	9.18	9.48	10	9.4	94	0.315	3	70 - 130	Passed
Bromodichloromethane	9.58	10.1	9.81	10.0	10	9.9	99	0.239	2	70 - 130	Passed
Bromoform	9.70	10.3	9.00	10.0	10	9.76	98	0.568	6	60 - 130	Passed
Bromomethane	9.49	10.2	10.6	10.3	10	10.14	101	0.465	5	50 - 140	Passed
tert-Butyl alcohol	51.8	54.4	42.6	48.4	50	49.3	99	5.096	10	50 - 150	Passed
2-Butanone (MEK)	49.3	51.8	42.1	50.5	50	48.4	97	4.344	9	70 - 130	Passed
n-Butylbenzene	10.0	10.8	11.1	10.4	10	10.6	106	0.472	4	70 - 130	Passed
sec-Butylbenzene	9.94	10.8	10.8	10.5	10	10.5	105	0.397	4	70 - 130	Passed
tert-Butylbenzene	8.78	9.46	9.31	8.95	10	9.1	91	0.315	3	70 - 130	Passed
Carbon disulfide	9.24	10.2	8.45	8.74	10	9.15	92	0.755	8	50 - 130	Passed
Carbon tetrachloride	9.24	10.0	10.0	9.65	10	9.7	97	0.343	4	60 - 130	Passed
Chlorobenzene	9.08	9.68	9.39	9.22	10	9.3	93	0.257	3	70 - 130	Passed
2-Chloroethyl vinyl ether	9.55	9.91	8.16	9.38	10	9.3	93	0.760	8	10 - 160	Passed
Chloroethane	9.11	9.81	9.89	10.1	10	9.72	97	0.414	4	60 - 130	Passed
Chloroform	9.02	9.65	9.54	9.39	10	9.4	94	0.272	3	70 - 130	Passed
1-Chlorohexane	8.77	9.38	9.10	8.85	10	9.0	90	0.278	3	70 - 130	Passed
Chloromethane	9.12	9.52	9.39	9.53	10	9.39	94	0.191	2	50 - 130	Passed
2-Chlorotoluene	9.86	10.7	10.1	10.7	10	10.3	103	0.433	4	70 - 130	Passed
4-Chlorotoluene	9.70	10.4	11.1	9.9	10	10.3	103	0.611	6	70 - 130	Passed
Isopropyl ether (DIPE)	9.76	10.4	9.33	9.68	10	9.8	98	0.435	4	70 - 130	Passed
Dibromochloromethane	9.85	10.4	9.62	10.2	10	10.0	100	0.346	3	70 - 130	Passed
1,2-Dibromo-3-chloropropane	9.14	9.80	8.25	8.90	10	9.02	90	0.641	7	60 - 130	Passed
1,2-Dibromoethane	9.90	10.5	9.39	10.2	10	10.0	100	0.487	5	70 - 130	Passed
Dibromomethane	9.82	10.3	8.87	9.58	10	9.6	96	0.584	6	70 - 130	Passed
1,1-Dichloroethane	9.15	9.83	9.42	9.31	10	9.4	94	0.292	3	70 - 130	Passed
1,2-Dichloroethane	9.45	10.0	9.52	9.89	10	9.7	97	0.261	3	70 - 130	Passed
1,2-Dichlorobenzene	8.98	9.68	9.33	9.26	10	9.3	93	0.290	3	70 - 130	Passed
1,3-Dichlorobenzene	9.61	10.4	9.92	9.88	10	9.9	99	0.327	3	70 - 130	Passed
trans-1,4-Dichloro-2-Butene	10.6	11.5	9.58	10.8	10	10.6	106	0.812	8	50 - 140	Passed
1,4-Dichlorobenzene	9.82	10.6	10.1	10.1	10	10.2	102	0.340	3	70 - 130	Passed
Dichlorodifluoromethane	9.14	10.0	9.22	9.67	10	9.50	95	0.383	4	50 - 140	Passed
1,1-Dichloroethene	9.17	9.8	9.40	9.27	10	9.4	94	0.289	3	60 - 130	Passed
cis-1,2-Dichloroethene	9.40	10.1	9.71	9.60	10	9.7	97	0.285	3	70 - 130	Passed
trans-1,2-Dichloroethene	9.27	9.83	9.34	9.21	10	9.4	94	0.282	3	60 - 130	Passed
Dichlorofluoromethane	8.27	9.12	9.84	9.25	10	9.12	91	0.646	7	70 - 130	Passed
1,1-Dichloropropene	9.42	10.2	9.79	9.72	10	9.8	98	0.319	3	70 - 130	Passed
1,2-Dichloropropane	9.43	10.0	9.48	9.68	10	9.6	96	0.256	3	70 - 130	Passed
1,3-Dichloropropane	9.82	10.4	9.54	10.1	10	10.0	100	0.359	4	70 - 130	Passed

Appendix 2 (cont.): DEMONSTRATION OF CAPABILITY for 25 ml

DEMONSTRATION OF CAPABILITY
METHOD: SW 8260

Unit: µg/L
Sample Amount(ml): 25
Sample Purge(ml): 25

Date Analyzed: 01/31 & 02/01/12
Analyzed by: D. Nguyen

PARAMETER	RAY133 VOF5A10L	RAY134 VOF5A10C	RBY004 VOF5B01L	RBY005 VOF5B01C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
2,2-Dichloropropane	9.07	10.4	10.2	9.65	10	9.8	98	0.598	6	60 - 140	Passed
cis-1,3-Dichloropropene	10.0	10.7	10.0	10.3	10	10.3	103	0.339	3	70 - 130	Passed
trans-1,3-Dichloropropene	9.30	9.75	9.06	9.42	10	9.4	94	0.288	3	70 - 130	Passed
tert-Butyl ethyl ether (ETB	11.1	11.8	10.1	10.8	10	11.0	110	0.685	6	70 - 130	Passed
Ethyl Methacrylate	9.30	9.68	8.15	9.21	10	9.1	91	0.656	7	70 - 130	Passed
Ethylbenzene	9.47	10.1	10.0	9.68	10	9.8	98	0.300	3	70 - 130	Passed
2-Hexanone (MBK)	50.6	52.3	42.7	50.6	50	49.0	98	4.298	9	70 - 140	Passed
Hexachlorobutadiene	8.21	8.92	8.99	8.08	10	8.6	86	0.469	5	70 - 130	Passed
Iodomethane	9.16	10.0	9.31	9.21	10	9.43	94	0.417	4	50 - 150	Passed
Isopropylbenzene	10.4	11.2	11.0	10.8	10	10.9	109	0.380	3	70 - 130	Passed
p-Isopropyltoluene	10.1	11.0	11.0	10.4	10	10.6	106	0.423	4	70 - 130	Passed
Methylene Chloride	8.56	9.09	8.74	8.87	10	8.8	88	0.225	3	60 - 130	Passed
4-Methyl-2-pentanone (MIBK)	52.9	54.7	45.5	53.6	50	51.7	103	4.184	8	70 - 130	Passed
tert-Butyl methyl ether	10.1	10.7	8.99	10.1	10	10.0	100	0.723	7	60 - 130	Passed
Naphthalene	10.3	10.7	9.41	9.88	10	10.07	101	0.565	6	50 - 140	Passed
n-Propylbenzene	10.6	11.4	11.2	11.1	10	11.1	111	0.369	3	70 - 130	Passed
Styrene	9.63	10.4	10.0	9.8	10	10.0	100	0.311	3	70 - 130	Passed
tert-Amyl methyl ether (TAME)	11.3	12.0	10.2	11.1	10	11.1	111	0.747	7	60 - 140	Passed
1,1,1,2-Tetrachloroethane	9.32	9.91	9.59	9.54	10	9.6	96	0.246	3	70 - 130	Passed
1,1,2,2-Tetrachloroethane	9.92	10.6	9.52	10.5	10	10.1	101	0.501	5	60 - 130	Passed
Tetrachloroethene	9.08	9.77	9.50	9.01	10	9.3	93	0.356	4	60 - 130	Passed
Toluene	9.68	10.3	10.1	9.94	10	10.0	100	0.262	3	70 - 130	Passed
1,1,1-Trichloroethane	8.83	10.0	10.2	9.52	10	9.6	96	0.591	6	70 - 130	Passed
1,1,2-Trichloroethane	9.67	10.1	9.45	10.1	10	9.8	98	0.346	4	70 - 130	Passed
1,2,3-Trichlorobenzene	8.77	9.14	8.46	8.40	10	8.7	87	0.339	4	60 - 130	Passed
1,2,4-Trichlorobenzene	9.04	9.63	8.93	8.60	10	9.1	91	0.432	5	60 - 140	Passed
Trichloroethene	9.21	9.93	9.42	9.29	10	9.5	95	0.326	3	70 - 130	Passed
Trichlorofluoromethane	9.06	9.62	10.1	10.3	10	9.76	98	0.544	6	60 - 140	Passed
1,2,3-Trichloropropane	9.93	10.5	9.45	10.6	10	10.1	101	0.524	5	70 - 130	Passed
1,1,2-Trichloro1,2,2-trifluoroethane	8.70	9.49	9.45	9.05	10	9.2	92	0.376	4	60 - 150	Passed
1,2,4-Trimethylbenzene	9.8	10.6	10.6	10.2	10	10.3	103	0.374	4	70 - 130	Passed
1,3,5-Trimethylbenzene	9.9	10.7	10.5	10.2	10	10.3	103	0.335	3	70 - 130	Passed
Vinyl Acetate	10.9	11.0	9.68	11.1	10	10.66	107	0.662	6	40 - 150	Passed
Vinyl Chloride	8.26	8.56	9.02	9.01	10	8.71	87	0.372	4	60 - 130	Passed
m-Xylene & p-xylene	19.2	20.6	20.4	19.6	20	19.9	100	0.633	3	60 - 140	Passed
o-Xylene	8.80	9.41	9.18	8.93	10	9.1	91	0.270	3	70 - 130	Passed
1,2-Dichloroethane-d4	10.0	10.0	9.9	10.3	10	10.05	101	0.200	2	70 - 130	Passed
Toluene-d8	10.3	10.3	10.4	10.3	10	10.32	103	0.046	0.5	70 - 130	Passed
4-Bromofluorobenzene	10.6	10.6	10.5	10.9	10	10.68	107	0.189	2	70 - 130	Passed
Dibromofluoromethane	10.0	9.93	10.1	10.2	10	10.06	101	0.106	1	70 - 130	Passed

Appendix 3: DEMONSTRATION OF CAPABILITY for 5 ml

DEMONSTRATION OF CAPABILITY
METHOD: SW 8260

Unit: µg/L
Sample Amount(ml): 5
Sample Purge(ml): 5

Date Analyzed: 01/07/13 & 01/08/13
Analyzed by: C. Mendoza

PARAMETER	RAN044 VSF4A07L	RAN045 VSF4A07C	RAN058 VSF4A08L	RAN059 VSF4A08C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
Acetone	261	261	275	272	250	267	107	7.569	3	60 130	Passed
Acetonitrile	540	546	510	533	500	532	106	15.685	3	30 160	Passed
Acrolein	334	330	337	325	250	331	133	5.396	2	30 160	Passed
Acrylonitrile	269	270	278	271	250	272	109	4.119	2	70 130	Passed
Benzene	51.0	52.3	48.2	49.6	50	50.3	101	1.744	3	70 130	Passed
Bromobenzene	46.8	48.0	45.4	46.2	50	46.6	93	1.104	2	70 130	Passed
Bromochloromethane	51.7	52.2	50.7	51.2	50	51.5	103	0.611	1	70 130	Passed
Bromodichloromethane	49.5	50.8	48.4	49.2	50	49.5	99	1.022	2	70 130	Passed
Bromoform	47.8	48.6	45.6	47.5	50	47.4	95	1.282	3	70 130	Passed
Bromomethane	54.8	51.5	50.4	50.5	50	51.8	104	2.076	4	60 130	Passed
tert-Butyl alcohol	281	286	255	271	250	273	109	13.989	5	60 140	Passed
2-Butanone (MEK)	279	278	284	282	250	281	112	3.049	1	70 130	Passed
n-Butylbenzene	53.8	54.5	49.7	50.6	50	52.2	104	2.387	5	70 130	Passed
sec-Butylbenzene	52.0	52.5	47.9	49.4	50	50.5	101	2.181	4	70 130	Passed
tert-Butylbenzene	52.4	52.3	48.2	49.6	50	50.6	101	2.047	4	70 130	Passed
Carbon disulfide	48.2	46.9	44.2	46.0	50	46.4	93	1.669	4	60 130	Passed
Carbon tetrachloride	52.9	53.1	49.7	51.2	50	51.7	103	1.588	3	70 130	Passed
Chlorobenzene	49.3	50.2	47.1	47.9	50	48.6	97	1.402	3	70 130	Passed
2-Chloroethyl vinyl ether	50.1	49.7	36.4	38.4	50	43.7	87	7.258	17	50 150	Passed
Chloroethane	58.5	52.1	53.0	53.1	50	54.2	108	2.944	5	70 130	Passed
Chloroform	52.1	52.6	50.9	51.3	50	51.7	103	0.749	1	70 130	Passed
1-Chlorohexane	56.0	56.6	50.6	51.8	50	53.7	107	2.974	6	70 130	Passed
Chloromethane	53.8	48.8	48.5	50.0	50	50.3	101	2.456	5	60 130	Passed
2-Chlorotoluene	49.0	48.9	45.9	46.6	50	47.6	95	1.619	3	70 130	Passed
4-Chlorotoluene	51.9	53.0	49.5	49.8	50	51.1	102	1.675	3	70 130	Passed
2-Chloro-1,1,1-trifluoroethane	54.6	53.8	51.2	54.3	50	53.5	107	1.562	3	30 160	Passed
Chlorotrifluoroethylene	46.4	44.7	41.6	45.6	50	44.6	89	2.093	5	30 160	Passed
Dibromochloromethane	48.4	49.7	47.4	47.9	50	48.4	97	1.017	2	70 130	Passed
1,2-Dibromo-3-chloropropane	47.1	47.9	44.3	45.6	50	46.2	92	1.577	3	60 130	Passed
1,2-Dibromoethane	49.2	50.7	47.3	48.4	50	48.9	98	1.452	3	70 130	Passed
Dibromomethane	48.1	49.6	47.1	48.3	50	48.3	97	1.022	2	70 130	Passed
1,1-Dichloroethane	55.3	55.9	52.7	53.4	50	54.3	109	1.554	3	70 130	Passed
1,2-Dichloroethane	49.5	50.1	48.7	49.8	50	49.5	99	0.593	1	70 130	Passed
1,2-Dichlorobenzene	47.0	47.6	45.5	45.6	50	46.4	93	1.084	2	70 130	Passed
1,3-Dichlorobenzene	48.6	49.3	45.9	46.2	50	47.5	95	1.704	4	70 130	Passed
trans-1,4-Dichloro-2-Butene	51.0	50.7	48.7	50.0	50	50.1	100	1.012	2	70 130	Passed
1,4-Dichlorobenzene	49.0	49.7	46.6	46.7	50	48.0	96	1.599	3	70 130	Passed
Dichlorodifluoromethane	51.3	47.0	46.7	47.4	50	48.1	96	2.151	4	60 130	Passed
1,1-Dichloroethene	58.3	58.5	54.2	55.1	50	56.5	113	2.189	4	70 130	Passed
cis-1,2-Dichloroethene	53.3	53.5	50.9	51.2	50	52.2	104	1.358	3	70 130	Passed
trans-1,2-Dichloroethene	55.7	55.7	51.9	52.8	50	54.0	108	1.960	4	70 130	Passed
Dichlorofluoromethane	56.9	57.0	54.7	55.1	50	55.9	112	1.234	2	70 130	Passed
1,1-Dichloropropene	53.1	53.5	48.5	49.7	50	51.2	102	2.483	5	70 130	Passed
1,2-Dichloropropane	51.0	52.2	48.8	50.4	50	50.6	101	1.413	3	70 130	Passed

Appendix 3 (cont.): DEMONSTRATION OF CAPABILITY for 5 ml

DEMONSTRATION OF CAPABILITY
METHOD: SW 8260

Unit: µg/L
Sample Amount(ml): 5
Sample Purge(ml): 5

Date Analyzed: 01/07/13 & 01/08/13
Analyzed by: C. Mendoza

PARAMETER	RAN044 VSF4A07L	RAN045 VSF4A07C	RAN058 VSF4A08L	RAN059 VSF4A08C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
1,3-Dichloropropane	49.4	50.8	47.8	49.3	50	49.3	99	1.251	3	70 130	Passed
2,2-Dichloropropane	57.2	57.1	54.0	54.5	50	55.7	111	1.706	3	70 140	Passed
cis-1,3-Dichloropropene	51.3	52.8	49.1	50.4	50	50.9	102	1.548	3	70 130	Passed
trans-1,3-Dichloropropene	51.2	52.4	49.6	50.5	50	50.9	102	1.191	2	70 130	Passed
tert-Butyl ethyl ether (ETB	56.5	57.2	53.8	55.1	50	55.7	111	1.523	3	70 130	Passed
Ethyl Methacrylate	52.9	53.6	49.9	51.0	50	52	104	1.679	3	30 160	Passed
Ethylbenzene	51.6	52.9	48.5	49.6	50	50.7	101	1.946	4	70 130	Passed
2-Hexanone (MBK)	275	275	284	277	250	278.0	111	4.403	2	70 130	Passed
Hexachlorobutadiene	47.3	49.2	45.7	45.1	50	46.8	94	1.814	4	70 130	Passed
Iodomethane	40.7	39.4	36.9	39.0	50	39.0	78	1.595	4	60 130	Passed
Isopropyl ether (DIPE)	57.2	58.2	54.5	56.0	50	56.5	113	1.595	3	70 130	Passed
Isopropylbenzene	52.1	52.3	48.0	49.5	50	50.5	101	2.093	4	70 130	Passed
p-Isopropyltoluene	52.4	53.0	48.7	49.2	50	51	102	2.199	4	70 130	Passed
Methyl acetate	52.9	52.1	54.2	55.6	50	53.7	107	1.525	3	30 160	Passed
Methylene Chloride	50.4	51.6	49.6	50.2	50	50.5	101	0.856	2	70 130	Passed
4-Methyl-2-pentanone (MIBK)	278	279	283	276	250	278.7	111	2.713	1	70 130	Passed
tert-Butyl methyl ether	54.7	55.3	52.6	53.8	50	54.1	108	1.140	2	70 130	Passed
Naphthalene	43.7	44.3	40.8	39.8	50	42.2	84	2.180	5	60 140	Passed
n-Propylbenzene	51.9	52.3	47.9	49.3	50	50.4	101	2.098	4	70 130	Passed
Styrene	51.6	53.2	49.6	50.4	50	51.2	102	1.553	3	70 130	Passed
tert-Amyl methyl ether (TAME)	55.3	56.0	53.3	54.2	50	54.7	109	1.212	2	70 130	Passed
1,1,1,2-Tetrachloroethane	48.7	50.4	47.5	48.2	50	48.7	97	1.250	3	30 160	Passed
1,1,2,2-Tetrachloroethane	49.1	49.2	45.7	47.4	50	47.9	96	1.652	3	30 160	Passed
Tetrachloroethene	50.6	51.2	47.0	48.0	50	49.2	98	2.014	4	70 130	Passed
Toluene	51.3	52.4	48.6	49.7	50	50.5	101	1.718	3	70 130	Passed
1,1,1-Trichloroethane	55.0	55.2	52.6	52.9	50	53.9	108	1.405	3	30 160	Passed
1,1,2-Trichloroethane	48.3	50.1	46.3	48.0	50	48.2	96	1.553	3	30 160	Passed
1,2,3-Trichlorobenzene	48.0	49.6	46.0	44.8	50	47.1	94	2.140	5	70 130	Passed
1,2,4-Trichlorobenzene	50.8	51.5	46.7	45.5	50	48.6	97	2.965	6	70 130	Passed
Trichloroethene	50.7	51.5	47.7	48.3	50	49.5	99	1.834	4	70 130	Passed
Trichlorofluoromethane	61.7	55.1	54.8	55.3	50	56.7	113	3.322	6	70 140	Passed
1,2,3-Trichloropropane	47.8	47.7	45.6	47.4	50	47.1	94	1.036	2	70 130	Passed
1,1,2-Trichloro1,2,2-trifluoroethane	57.4	56.8	52.9	53.6	50	55.2	110	2.264	4	70 - 130	Passed
1,2,4-Trimethylbenzene	51.5	52.0	48.2	49.2	50	50.2	100	1.810	4	70 130	Passed
1,3,5-Trimethylbenzene	51.7	52.3	48.0	49.2	50	50.3	101	2.016	4	70 130	Passed
Vinyl Acetate	65.3	59.2	58.1	58.5	50	60.3	121	3.366	6	50 140	Passed
Vinyl Chloride	59.8	52.9	54.5	54.5	50	55.4	111	3.040	5	70 140	Passed
m-Xylene & p-xylene	103	105	97.0	98.7	100	101.0	101	3.765	4	70 130	Passed
o-Xylene	52.3	53.5	49.4	50.7	50	51.5	103	1.786	3	70 130	Passed
Allyl Chloride	57.3	58.3	54.1	55.5	50	56.3	113	1.869	3	30 160	Passed

Appendix 4: DEMONSTRATION OF CAPABILITY for 5 g

DEMONSTRATION OF CAPABILITY
METHOD: SW 8260

Unit: µg/Kg
Sample Amount(g): 5
Sample Purge(ml): 5

Date Analyzed: 03/20 & 03/21/12
Analyzed by: C. Mendoza

PARAMETER	RCP061 VO02C04L	RCP062 VO02C04C	RCP086 VO02C06L	RCP087 VO02C06C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
Acetone	259	264	288	281	250	273	109	14.006	5	40 - 140	Passed
Acetonitrile	480	506	528	546	500	515	103	28.361	6	50 - 150	Passed
Acrylonitrile	240	245	275	268	250	257	103	17.133	7	10 - 160	Passed
Benzene	50.1	49.3	49.9	49.6	50	49.7	99	0.364	1	70 - 130	Passed
Bromobenzene	49.3	47.4	48.9	49.1	50	48.7	97	0.838	2	70 - 130	Passed
Bromochloromethane	52.6	53.3	55.0	56.1	50	54.2	108	1.592	3	70 - 130	Passed
Bromodichloromethane	50.1	49.8	51.8	52.2	50	51.0	102	1.207	2	70 - 130	Passed
Bromoform	49.2	49.2	50.3	49.6	50	49.6	99	0.501	1	70 - 130	Passed
Bromomethane	46.4	46.6	45.4	46.7	50	46.3	93	0.585	1	60 - 130	Passed
tert-Butyl alcohol	254	266	274	285	250	270	108	13.169	5	40 - 150	Passed
2-Butanone (MEK)	246	251	271	260	250	257	103	11.327	4	60 - 140	Passed
n-Butylbenzene	53.2	51.3	52.5	53.9	50	52.7	105	1.105	2	70 - 130	Passed
sec-Butylbenzene	52.1	51.3	51.9	52.3	50	51.9	104	0.441	1	70 - 130	Passed
tert-Butylbenzene	48.4	48.0	48.7	49.4	50	48.6	97	0.572	1	70 - 130	Passed
Carbon disulfide	48.1	49.8	52.1	42.5	50	48.1	96	4.087	8	60 - 130	Passed
Carbon tetrachloride	52.5	51.2	52.2	51.2	50	51.8	104	0.666	1	70 - 130	Passed
Chlorobenzene	51.3	51.3	49.8	51.2	50	50.9	102	0.728	1	70 - 130	Passed
2-Chloroethyl vinyl ether	57.8	57.8	51.8	51.2	50	54.6	109	3.681	7	50 - 140	Passed
Chloroethane	55.0	56.1	52.3	53.3	50	54.2	108	1.696	3	70 - 140	Passed
Chloroform	55.4	55.5	53.0	54.3	50	54.5	109	1.171	2	70 - 130	Passed
1-Chlorohexane	53.3	51.9	51.8	52.2	50	52.3	105	0.678	1	70 - 130	Passed
Chloromethane	49.5	51.4	50.8	52.4	50	51.0	102	1.201	2	60 - 130	Passed
2-Chlorotoluene	44.7	48.4	45.5	48.0	50	46.6	93	1.814	4	70 - 130	Passed
4-Chlorotoluene	57.2	51.0	56.4	52.5	50	54.3	109	3.031	6	60 - 130	Passed
Dibromochloromethane	49.5	49.7	51.1	52.9	50	50.8	102	1.574	3	70 - 130	Passed
1,2-Dibromo-3-chloropropane	44.9	46.0	47.8	48.2	50	46.7	93	1.570	3	60 - 130	Passed
1,2-Dibromoethane	47.2	48.1	50.3	50.4	50	49.0	98	1.600	3	70 - 130	Passed
Dibromomethane	48.8	48.5	49.8	50.6	50	49.4	99	0.957	2	70 - 130	Passed
1,1-Dichloroethane	55.4	55.2	54.5	55.8	50	55.2	110	0.518	1	70 - 130	Passed
1,2-Dichloroethane	51.3	50.9	51.7	51.1	50	51.3	103	0.310	1	70 - 130	Passed
1,2-Dichlorobenzene	50.3	50.3	49.0	50.0	50	49.9	100	0.602	1	70 - 130	Passed
1,3-Dichlorobenzene	50.6	50.0	50.0	50.8	50	50.3	101	0.429	1	70 - 130	Passed
trans-1,4-Dichloro-2-Butene	48.8	47.7	53.8	52.2	50	50.6	101	2.848	6	60 - 140	Passed
1,4-Dichlorobenzene	51.7	51.0	49.8	50.8	50	50.8	102	0.775	2	70 - 130	Passed
Dichlorodifluoromethane	66.9	67.2	58.9	59.2	50	63.1	126	4.620	7	60 - 130	Passed
1,1-Dichloroethene	51.9	53.0	52.1	54.3	50	52.8	106	1.104	2	60 - 130	Passed
cis-1,2-Dichloroethene	49.5	49.2	53.0	54.8	50	51.6	103	2.725	5	70 - 130	Passed
trans-1,2-Dichloroethene	53.2	52.2	54.2	55.1	50	53.7	107	1.267	2	70 - 130	Passed
Dichlorofluoromethane	49.3	51.4	53.2	56.7	50	52.6	105	3.134	6	70 - 130	Passed
1,1-Dichloropropene	51.5	49.7	50.8	50.5	50	50.6	101	0.753	1	70 - 130	Passed
1,2-Dichloropropane	50.5	49.7	52.0	51.8	50	51.0	102	1.108	2	70 - 130	Passed
1,3-Dichloropropane	47.6	47.9	50.9	51.5	50	49.5	99	2.010	4	70 - 130	Passed
2,2-Dichloropropane	56.3	55.0	54.4	55.9	50	55.4	111	0.857	2	60 - 140	Passed
cis-1,3-Dichloropropene	51.7	51.3	52.3	52.4	50	52.0	104	0.517	1	70 - 130	Passed

Appendix 4 (cont.): DEMONSTRATION OF CAPABILITY for 5 g

DEMONSTRATION OF CAPABILITY
METHOD: SW 8260

Unit: µg/Kg
Sample Amount(g): 5
Sample Purge(ml): 5

Date Analyzed: 03/20 & 03/21/12
Analyzed by: C. Mendoza

PARAMETER	RCP061 VO02C04L	RCP062 VO02C04C	RCP086 VO02C06L	RCP087 VO02C06C	True Value	Ave. Conc.	Ave. % Rec.	Std. Dev.	RSD	QC Criteria	Comments
trans-1,3-Dichloropropene	52.6	52.3	53.1	53.7	50	52.9	106	0.623	1	70 - 130	Passed
1,4-Dioxane	878	878	947	958	1000	915	92	43.314	5	50 - 150	Passed
tert-Butyl ethyl ether (ETBE)	54.0	53.9	54.2	55.2	50	54.3	109	0.617	1	70 - 130	Passed
Ethyl Methacrylate	49.5	49.8	51.2	51.4	50	50.5	101	0.964	2	70 - 130	Passed
Ethylbenzene	50.5	50.8	50.7	51.3	50	50.8	102	0.355	1	70 - 130	Passed
2-Hexanone (MBK)	241	247	270	256	250	253	101	12.291	5	20 - 160	Passed
Hexachlorobutadiene	52.6	48.4	49.6	49.2	50	49.9	100	1.873	4	70 - 130	Passed
Iodomethane	61.3	61.7	50.7	52.5	50	56.6	113	5.760	10	60 - 140	Passed
Isopropyl ether (DIPE)	53.2	53.2	54.7	55.5	50	54.2	108	1.156	2	70 - 130	Passed
Isopropylbenzene	55.9	53.8	51.7	50.4	50	52.9	106	2.417	5	70 - 130	Passed
p-Isopropyltoluene	53.6	52.7	51.5	51.5	50	52.3	105	1.040	2	70 - 130	Passed
Methylene Chloride	48.6	49.4	49.9	51.6	50	49.9	100	1.276	3	70 - 130	Passed
4-Methyl-2-pentanone (MIBK)	243	249	266	253	250	253	101	9.792	4	50 - 150	Passed
tert-Butyl methyl ether	51.2	51.8	52.3	53.4	50	52.2	104	0.957	2	70 - 130	Passed
Naphthalene	49.7	47.2	48.9	48.7	50	48.6	97	1.018	2	60 - 140	Passed
n-Propylbenzene	50.2	48.4	51.1	49.9	50	49.9	100	1.136	2	70 - 130	Passed
Styrene	52.6	53.1	51.7	53.0	50	52.6	105	0.637	1	70 - 130	Passed
tert-Amyl methyl ether (TAME)	51.9	52.9	52.4	53.9	50	52.8	106	0.850	2	70 - 130	Passed
1,1,1,2-Tetrachloroethane	50.7	51.8	50.8	52.0	50	51.3	103	0.670	1	70 - 130	Passed
1,1,2,2-Tetrachloroethane	48.3	48.6	50.5	49.7	50	49.3	99	1.013	2	70 - 130	Passed
Tetrachloroethene	52.5	50.5	50.0	50.2	50	50.8	102	1.184	2	70 - 130	Passed
Toluene	49.9	49.3	50.1	50.1	50	49.9	100	0.359	1	70 - 130	Passed
1,1,1-Trichloroethane	55.4	55.0	53.7	54.8	50	54.7	109	0.756	1	70 - 130	Passed
1,1,2-Trichloroethane	49.6	49.4	50.3	51.7	50	50.2	100	1.049	2	70 - 130	Passed
1,2,3-Trichlorobenzene	52.9	49.1	50.9	50.8	50	50.9	102	1.545	3	70 - 130	Passed
1,2,4-Trichlorobenzene	56.6	52.9	52.3	54.2	50	54.0	108	1.911	4	70 - 140	Passed
Trichloroethene	51.4	50.6	49.6	49.4	50	50.3	101	0.955	2	70 - 130	Passed
Trichlorofluoromethane	63.3	61.5	57.5	55.8	50	59.6	119	3.486	6	70 - 140	Passed
1,2,3-Trichloropropane	45.2	45.3	48.9	48.3	50	46.9	94	1.942	4	70 - 130	Passed
1,1,2-Trichloro1,2,2-trifluoroethane	57.2	58.5	50.7	54.4	50	55.2	110	3.450	6	70 - 140	Passed
1,2,4-Trimethylbenzene	52.6	51.3	51.3	51.4	50	51.7	103	0.647	1	70 - 130	Passed
1,3,5-Trimethylbenzene	50.7	49.9	51.0	51.1	50	50.7	101	0.516	1	70 - 130	Passed
Vinyl Acetate	50.9	47.8	59.8	57.1	50	53.9	108	5.524	10	20 - 160	Passed
Vinyl Chloride	55.2	57.3	51.7	52.9	50	54.3	109	2.495	5	60 - 140	Passed
m-Xylene & p-xylene	102	101	101	104	100	102.0	102	1.343	1	70 - 130	Passed
o-Xylene	49.9	50.3	51.3	52.6	50	51.0	102	1.217	2	70 - 130	Passed

8260FS: **SAMPLE PREPARATION LOG**

EMAX LABORATORIES, INC.

PRESERVATION LOG FOR VOLATILES

VP.xls

PrepBatchID	Lab Sample ID	W1 (g)	DateTime	Wf (g)	DateTime	ExpWs(g)	Ws(g)	Prep□Factor	Comments

☐ EMAX-5035 Rev. ☐ Balance Calibration Check performed prior to use — Surrogate ID: — Prepared By:

☐ Encore+$NaHSO_4 \cdot H_2O$ ☐ BalanceID 25451062 — BlankSoil Lot#: — Standard Added By:

☐ Frozen Sample ☐ BalanceID 25650797 — NaHSO4H2O: — Witnessed By:

☐ Pre-weighed vial — Expected Ws(g): 5 — Extract Rcvd By:

☐ Volumetric dispenser was checked with 5-ml volumetric flask — Sample Location:

W1=Weight of Vial + Stirrer+NaHSO4•H2O+Solvent Wf=W1 + Sample

8260FA: **ANALYTICAL RUN LOG**

EMAX LABORATORIES, INC.

Page 1

ANALYSIS LOG FOR VOLATILES

SOP ☐ EMAX-8260 Rev.No. _ ☐ EMAX-624 Rev.No. _ ☐ EMAX-8260SIM Rev.No. _ ☐ EMAX-TCPSIM Rev.No. _ ☐ EMAX-M8260SIM Rev.No. _ ☐ EMAX-8260C Rev. No. _

Start Date: ☐ 5-mL Purge ☐ 10-mL Purge ☐ 25-mL Purge Book # A06 -053

BATCH _____

	Sample Prep ID	Data File Name	Lab Sample ID	Sample Amount	DF	Matrix W pH < 2	Matrix W O_2 < 5ppm	Matrix S	Notes
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

Instrument No.	06
INITIAL CALIBRATION REFERENCE	
DATE	
ICAL ID	

STANDARDS			
NAME	ID	Amount (µl)	Conc. (mg/L)
DCC			
DCC			
DCC			
DCC			
BFB			
IS/SURR.			
ICV/LCS			
ICV/LCS			
ICV/LCS			
ICV/LCS			
Data File Folder			
	LOT #		
pH strip			
Chlorine strip			
Methanol			
$NaHSO_4$			
Reagent Water			
Sand			

Electronic Data Archival Location	Date
HPCHEM_VOA/TO06	

Comments: _____

☐ Refer to sample weight log

Analyzed By: _____

Date Disposed: _____ Disposed By: _____

8260FM: INSTRUMENT MAINTENANCE LOG

EMAX LABORATORIES, INC.

Page 1

INSTRUMENT MAINTENANCE LOG

Instrument No: 05 Month: Year: 201_ Book # : MD3-005

DATE						
Bake Trap (210°C-260°C)						
Column Head Pressure (2-60 psi)						
Injector Port Temperature (160°C-220°C)						
Interface Temperature (250°C-280°C)						
Verify Computer Date and Time						
Check Gas Pressure (Daily)						
Check IS/Surrogate auto injection vial as appropriate (Daily)						
Check the foreline pump oil level (Weekly)						
AutoTune the MSD (As needed)						
Analyst's initial						
Trouble Shooting						
Problem(s) Encountered						
Return-to-Control (Analyst Initial)						

Code	Problems Encountered	Code	Corrrective Action

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889
Fax: (310) 618-0818

ERRATUM TO	
Document	EMAX-8260
Revision Number	10
Section	5.1.3 & 5.1.4
Date	May 11, 2017
Reference Number	8260.10.1

Section 5.1.3 and 5.1.4 shall be revised as follows:

5.1.3. Samples preserved with HCl to pH<2 must be analyzed within 14 days from the date of sampling. Samples that are not preserved with HCl or with pH≥2 must be analyzed within 7 days from the date of sampling.

5.1.4. If Acrolein and Acrylonitrile are target analytes, samples must be analyzed within 14 days if preserved with $Na_2S_2O_3$ to pH 4-5. Otherwise, analyze within 3 days from sampling date.

PREPARED BY: _____ Date: 05-11-17
Name Tu Nisamaneepong
Title Operations Manager

APPROVED BY: _____ Date: 05-11-17
Name Kenette Pimentel
Title QA Manager

APPROVED BY: _____ Date: 05-11-17
Name Caspar Pang
Title Laboratory Director

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889

ADDENDUM TO	
Document	ALL ANALYTICAL SOPS
Revision Number	CURRENT REVISIONS
Section	10.2 Instrument Parameters
Date	11 September 2019
Reference Number	AA.7

This applies to all GC/MS, GC, HPLC-MS, HPLC, ICP-MS, ICP and IC Method SOPs

Section 10.2 shall include:

10.2. **Instrument Parameters**

10.2.1. Instrument parameters setup stipulated in the SOPs, are instrument suggested parameters. Fine tune the instrument to obtain optimum instrument condition.

10.2.2. Print and staple a copy of the current instrument parameter on the instrument log for easy access when performing daily instrument routine check.

10.2.3. In the event that instrument parameters necessitate a change, replace the instrument parameter printout with the new parameter setup. Archive the previous instrument parameters at the back of the instrument maintenance log.

PREPARED BY: _____ Date: 9/11/19

Name Farina Madamba

Title QA / QC Coordinator

APPROVED BY: _____ Date: 09.11.19

Name Kenette Pimentel

Title QA Manager

APPROVED BY: _____ Date: 09-11-19

Name Caspar Pang

Title Laboratory Director

ANNUAL REVIEW FORM

VOLATILE ORGANIC COMPOUNDS BY GC/MS

SOP#: EMAX-8260 **Rev** 10 **Effective Date:** 06-Jun-14

COMMENTS	Reviewed By	Review Date
DRF (6/4/15)	gl	6/9/15
No revision needed	QA-fm	6/21/16
None	IR	05/12/17
None (DRF 04/03/18)	gl	8/6/18
No update needed per DRF by DNguyen dtd 6/12/19		6/12/19
No update needed per DRF by DNguyen dated 6/2/20		6/2/20

ATTACHMENT B-3
LABORATORY CERTIFICATIONS

This page intentionally blank

THE STATE of ALASKA
GOVERNOR MICHAEL J. DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program
Laboratory Approval Program

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.465.5390
Fax: 907.269.7649
cs.lab.cert@alaska.gov

January 21, 2020

Caspar J. Pang
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

RE: Amendment 1 to Contaminated Sites Laboratory Approval **18-004**

Dear Mr. Pang,
On January 10, 2020, EMAX Laboratories, Inc. received an approval letter from the Alaska Department of Environmental Conservation's Contaminated Sites Laboratory Approval Program (CS-LAP). That approval inadvertently omitted the following compounds:

- Bromomethane in water by 8260C
- 2-chlorophenol in water by 625
- 1,4-dioxane in soil by 8270C-SIM
- Methyl tert-Butyl Ether (MTBE) in soil by 8260C

Please note that for the compounds added to your approval, the effective date is January 10, 2020. These compounds are retroactively added to cover the period between January 10, 2020, and January 21, 2020.

Please attach this letter to your original approval letter and Scope of Approval issued January 10, 2020. The two combined letters and the Scope of Approval are the documentation of your approval through the CS-LAP.

If you have any questions, please contact me at (907) 269-7526, or by email at brian.englund@alaska.gov.

Respectfully,

Brian Englund

Brian Englund
Alaska CS Lab Approval Officer

THE STATE of ALASKA
GOVERNOR MICHAEL J. DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program
Laboratory Approval Program

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.465.5390
Fax: 907.269.7649
cs.lab.cert@alaska.gov

January 10, 2020

Caspar J. Pang
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501

RE: Contaminated Sites Laboratory Approval **18-004**

Dear Mr. Pang,
Thank you for submitting an application to the Alaska Department of Environmental Conservation's Contaminated Sites Laboratory Approval Program (CS-LAP), on January 3, 2020. Based on your lab's Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) approval through the ANSI-ASQ National Accreditation Board (ANAB), EMAX Laboratories, Inc., located at the above address, is granted ***Approved*** status to perform the analyses listed in the attached *Scope of Approval*, for Alaska contaminated sites projects, including underground storage tanks and leaking underground storage tank sites (UST/LUST), under the July 1, 2017 amendments to 18 AAC 78. This approval is effective January 10, 2020, and expires on ***February 10, 2023***.

Be aware that **any** changes in your DoD-ELAP approval status must be reported to the CS program within 3 business days. Failure to do so will result in revocation of **all** CS-LAP approvals for a period of one year. Notification should be in writing sent to cs.lab.cert@alaska.gov. We recommend also contacting the CS-LAP by telephone to verify that the message was received.

Please remember to include the laboratory's ID number, listed above, on all correspondence concerning the laboratory. To apply for renewal of your approval, please complete the application found on the CS-LAP webpage and submit to cs.submittals@alaska.gov. The required documentation must be submitted for renewal no later than 30 days before your date of expiration.

If you have any questions, please contact the CS-LAP at (907) 465-5390, or by email at cs.lab.cert@alaska.gov. Labs are also highly encouraged to join the CS-LAP listserv by going to http://list.state.ak.us/mailman/listinfo/cs.lab.approval.

Respectfully,

Brian Englund

Brian Englund

Attachment: Scope of Approval

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
83-32-9	Water	Acenaphthene	625	ANAB
83-32-9	Soil	Acenaphthene	8310	ANAB
83-32-9	Water	Acenaphthene	8310	ANAB
83-32-9	Soil	Acenaphthene	8270C	ANAB
83-32-9	Water	Acenaphthene	8270C	ANAB
83-32-9	Soil	Acenaphthene	8270C-SIM	ANAB
83-32-9	Water	Acenaphthene	8270C-SIM	ANAB
83-32-9	Soil	Acenaphthene	8270D	ANAB
83-32-9	Water	Acenaphthene	8270D	ANAB
83-32-9	Soil	Acenaphthene	8270D-SIM	ANAB
83-32-9	Water	Acenaphthene	8270D-SIM	ANAB
208-96-8	Water	Acenaphthylene	625	ANAB
208-96-8	Soil	Acenaphthylene	8310	ANAB
208-96-8	Water	Acenaphthylene	8310	ANAB
208-96-8	Soil	Acenaphthylene	8270C	ANAB
208-96-8	Water	Acenaphthylene	8270C	ANAB
208-96-8	Soil	Acenaphthylene	8270C-SIM	ANAB
208-96-8	Water	Acenaphthylene	8270C-SIM	ANAB
208-96-8	Soil	Acenaphthylene	8270D	ANAB
208-96-8	Water	Acenaphthylene	8270D	ANAB
208-96-8	Soil	Acenaphthylene	8270D-SIM	ANAB
208-96-8	Water	Acenaphthylene	8270D-SIM	ANAB
67-64-1	Soil	Acetone	8260B	ANAB
67-64-1	Water	Acetone	8260B	ANAB
67-64-1	Soil	Acetone	8260C	ANAB
67-64-1	Water	Acetone	8260C	ANAB
67-64-1	Air	Acetone	TO-15	ANAB
309-00-2	Water	Aldrin	608	ANAB
309-00-2	Soil	Aldrin	8081A	ANAB
309-00-2	Water	Aldrin	8081A	ANAB
309-00-2	Soil	Aldrin	8081B	ANAB
309-00-2	Water	Aldrin	8081B	ANAB
120-12-7	Water	Anthracene	625	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
120-12-7	Soil	Anthracene	8310	ANAB
120-12-7	Water	Anthracene	8310	ANAB
120-12-7	Soil	Anthracene	8270C	ANAB
120-12-7	Water	Anthracene	8270C	ANAB
120-12-7	Soil	Anthracene	8270C-SIM	ANAB
120-12-7	Water	Anthracene	8270C-SIM	ANAB
120-12-7	Soil	Anthracene	8270D	ANAB
120-12-7	Water	Anthracene	8270D	ANAB
120-12-7	Soil	Anthracene	8270D-SIM	ANAB
120-12-7	Water	Anthracene	8270D-SIM	ANAB
7440-36-0	Water	Antimony (metallic)	200.7	ANAB
7440-36-0	Water	Antimony (metallic)	200.8	ANAB
7440-36-0	Soil	Antimony (metallic)	6010B	ANAB
7440-36-0	Water	Antimony (metallic)	6010B	ANAB
7440-36-0	Soil	Antimony (metallic)	6010C	ANAB
7440-36-0	Water	Antimony (metallic)	6010C	ANAB
7440-36-0	Soil	Antimony (metallic)	6020A	ANAB
7440-36-0	Water	Antimony (metallic)	6020A	ANAB
7440-38-2	Water	Arsenic, Inorganic	200.7	ANAB
7440-38-2	Water	Arsenic, Inorganic	200.8	ANAB
7440-38-2	Soil	Arsenic, Inorganic	6010B	ANAB
7440-38-2	Water	Arsenic, Inorganic	6010B	ANAB
7440-38-2	Soil	Arsenic, Inorganic	6010C	ANAB
7440-38-2	Water	Arsenic, Inorganic	6010C	ANAB
7440-38-2	Soil	Arsenic, Inorganic	6020A	ANAB
7440-38-2	Water	Arsenic, Inorganic	6020A	ANAB
7440-39-3	Water	Barium	200.7	ANAB
7440-39-3	Water	Barium	200.8	ANAB
7440-39-3	Soil	Barium	6010B	ANAB
7440-39-3	Water	Barium	6010B	ANAB
7440-39-3	Soil	Barium	6010C	ANAB
7440-39-3	Water	Barium	6010C	ANAB
7440-39-3	Soil	Barium	6020A	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
7440-39-3	Water	Barium	6020A	ANAB
56-55-3	Water	Benz[a]anthracene	625	ANAB
56-55-3	Soil	Benz[a]anthracene	8310	ANAB
56-55-3	Water	Benz[a]anthracene	8310	ANAB
56-55-3	Soil	Benz[a]anthracene	8270C	ANAB
56-55-3	Water	Benz[a]anthracene	8270C	ANAB
56-55-3	Soil	Benz[a]anthracene	8270C-SIM	ANAB
56-55-3	Water	Benz[a]anthracene	8270C-SIM	ANAB
56-55-3	Soil	Benz[a]anthracene	8270D	ANAB
56-55-3	Water	Benz[a]anthracene	8270D	ANAB
56-55-3	Soil	Benz[a]anthracene	8270D-SIM	ANAB
56-55-3	Water	Benz[a]anthracene	8270D-SIM	ANAB
71-43-2	Water	Benzene	524.2	ANAB
71-43-2	Water	Benzene	624	ANAB
71-43-2	Soil	Benzene	8260B	ANAB
71-43-2	Water	Benzene	8260B	ANAB
71-43-2	Soil	Benzene	8260C	ANAB
71-43-2	Water	Benzene	8260C	ANAB
71-43-2	Air	Benzene	TO-15	ANAB
50-32-8	Water	Benzo[a]pyrene	625	ANAB
50-32-8	Soil	Benzo[a]pyrene	8310	ANAB
50-32-8	Water	Benzo[a]pyrene	8310	ANAB
50-32-8	Soil	Benzo[a]pyrene	8270C	ANAB
50-32-8	Water	Benzo[a]pyrene	8270C	ANAB
50-32-8	Soil	Benzo[a]pyrene	8270C-SIM	ANAB
50-32-8	Water	Benzo[a]pyrene	8270C-SIM	ANAB
50-32-8	Soil	Benzo[a]pyrene	8270D	ANAB
50-32-8	Water	Benzo[a]pyrene	8270D	ANAB
50-32-8	Soil	Benzo[a]pyrene	8270D-SIM	ANAB
50-32-8	Water	Benzo[a]pyrene	8270D-SIM	ANAB
205-99-2	Water	Benzo[b]fluoranthene	625	ANAB
205-99-2	Soil	Benzo[b]fluoranthene	8310	ANAB
205-99-2	Water	Benzo[b]fluoranthene	8310	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
205-99-2	Soil	Benzo[b]fluoranthene	8270C	ANAB
205-99-2	Water	Benzo[b]fluoranthene	8270C	ANAB
205-99-2	Soil	Benzo[b]fluoranthene	8270C-SIM	ANAB
205-99-2	Water	Benzo[b]fluoranthene	8270C-SIM	ANAB
205-99-2	Soil	Benzo[b]fluoranthene	8270D	ANAB
205-99-2	Water	Benzo[b]fluoranthene	8270D	ANAB
205-99-2	Soil	Benzo[b]fluoranthene	8270D-SIM	ANAB
205-99-2	Water	Benzo[b]fluoranthene	8270D-SIM	ANAB
191-24-2	Water	Benzo[g,h,i]perylene	625	ANAB
191-24-2	Soil	Benzo[g,h,i]perylene	8310	ANAB
191-24-2	Water	Benzo[g,h,i]perylene	8310	ANAB
191-24-2	Soil	Benzo[g,h,i]perylene	8270C	ANAB
191-24-2	Water	Benzo[g,h,i]perylene	8270C	ANAB
191-24-2	Soil	Benzo[g,h,i]perylene	8270C-SIM	ANAB
191-24-2	Water	Benzo[g,h,i]perylene	8270C-SIM	ANAB
191-24-2	Soil	Benzo[g,h,i]perylene	8270D	ANAB
191-24-2	Water	Benzo[g,h,i]perylene	8270D	ANAB
191-24-2	Soil	Benzo[g,h,i]perylene	8270D-SIM	ANAB
191-24-2	Water	Benzo[g,h,i]perylene	8270D-SIM	ANAB
207-08-9	Water	Benzo[k]fluoranthene	625	ANAB
207-08-9	Soil	Benzo[k]fluoranthene	8310	ANAB
207-08-9	Water	Benzo[k]fluoranthene	8310	ANAB
207-08-9	Soil	Benzo[k]fluoranthene	8270C	ANAB
207-08-9	Water	Benzo[k]fluoranthene	8270C	ANAB
207-08-9	Soil	Benzo[k]fluoranthene	8270C-SIM	ANAB
207-08-9	Water	Benzo[k]fluoranthene	8270C-SIM	ANAB
207-08-9	Soil	Benzo[k]fluoranthene	8270D	ANAB
207-08-9	Water	Benzo[k]fluoranthene	8270D	ANAB
207-08-9	Soil	Benzo[k]fluoranthene	8270D-SIM	ANAB
207-08-9	Water	Benzo[k]fluoranthene	8270D-SIM	ANAB
65-85-0	Soil	Benzoic Acid	8270C	ANAB
65-85-0	Water	Benzoic Acid	8270C	ANAB
65-85-0	Soil	Benzoic Acid	8270D	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
65-85-0	Water	Benzoic Acid	8270D	ANAB
100-51-6	Soil	Benzyl Alcohol	8270C	ANAB
100-51-6	Water	Benzyl Alcohol	8270C	ANAB
100-51-6	Soil	Benzyl Alcohol	8270D	ANAB
100-51-6	Water	Benzyl Alcohol	8270D	ANAB
7440-41-7	Water	Beryllium and compounds	200.7	ANAB
7440-41-7	Water	Beryllium and compounds	200.8	ANAB
7440-41-7	Soil	Beryllium and compounds	6010B	ANAB
7440-41-7	Water	Beryllium and compounds	6010B	ANAB
7440-41-7	Soil	Beryllium and compounds	6010C	ANAB
7440-41-7	Water	Beryllium and compounds	6010C	ANAB
7440-41-7	Soil	Beryllium and compounds	6020A	ANAB
7440-41-7	Water	Beryllium and compounds	6020A	ANAB
111-44-4	Soil	Bis(2-chloroethyl)ether	8270C	ANAB
111-44-4	Water	Bis(2-chloroethyl)ether	8270C	ANAB
111-44-4	Soil	Bis(2-chloroethyl)ether	8270C-SIM	ANAB
111-44-4	Water	Bis(2-chloroethyl)ether	8270C-SIM	ANAB
111-44-4	Soil	Bis(2-chloroethyl)ether	8270D	ANAB
111-44-4	Water	Bis(2-chloroethyl)ether	8270D	ANAB
111-44-4	Soil	Bis(2-chloroethyl)ether	8270D-SIM	ANAB
111-44-4	Water	Bis(2-chloroethyl)ether	8270D-SIM	ANAB
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270C	ANAB
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270C	ANAB
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270C-SIM	ANAB
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270C-SIM	ANAB
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270D	ANAB
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270D	ANAB
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270D-SIM	ANAB
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270D-SIM	ANAB
108-86-1	Water	Bromobenzene	524.2	ANAB
108-86-1	Soil	Bromobenzene	8260B	ANAB
108-86-1	Water	Bromobenzene	8260B	ANAB
108-86-1	Soil	Bromobenzene	8260C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
108-86-1	Water	Bromobenzene	8260C	ANAB
75-27-4	Water	Bromodichloromethane	524.2	ANAB
75-27-4	Water	Bromodichloromethane	624	ANAB
75-27-4	Soil	Bromodichloromethane	8260B	ANAB
75-27-4	Water	Bromodichloromethane	8260B	ANAB
75-27-4	Soil	Bromodichloromethane	8260C	ANAB
75-27-4	Water	Bromodichloromethane	8260C	ANAB
75-27-4	Air	Bromodichloromethane	TO-15	ANAB
75-25-2	Water	Bromoform	524.2	ANAB
75-25-2	Water	Bromoform	624	ANAB
75-25-2	Soil	Bromoform	8260B	ANAB
75-25-2	Water	Bromoform	8260B	ANAB
75-25-2	Soil	Bromoform	8260C	ANAB
75-25-2	Water	Bromoform	8260C	ANAB
75-25-2	Air	Bromoform	TO-15	ANAB
74-83-9	Water	Bromomethane	524.2	ANAB
74-83-9	Water	Bromomethane	624	ANAB
74-83-9	Soil	Bromomethane	8260B	ANAB
74-83-9	Water	Bromomethane	8260B	ANAB
74-83-9	Water	Bromomethane	8260C	ANAB
74-83-9	Air	Bromomethane	TO-15	ANAB
106-99-0	Air	Butadiene, 1,3-	TO-15	ANAB
85-68-7	Soil	Butyl Benzyl Phthalate	8270C	ANAB
85-68-7	Water	Butyl Benzyl Phthalate	8270C	ANAB
85-68-7	Soil	Butyl Benzyl Phthalate	8270C-SIM	ANAB
85-68-7	Water	Butyl Benzyl Phthalate	8270C-SIM	ANAB
85-68-7	Soil	Butyl Benzyl Phthalate	8270D	ANAB
85-68-7	Water	Butyl Benzyl Phthalate	8270D	ANAB
85-68-7	Soil	Butyl Benzyl Phthalate	8270D-SIM	ANAB
85-68-7	Water	Butyl Benzyl Phthalate	8270D-SIM	ANAB
104-51-8	Water	Butylbenzene, n-	524.2	ANAB
104-51-8	Soil	Butylbenzene, n-	8260B	ANAB
104-51-8	Water	Butylbenzene, n-	8260B	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
104-51-8	Soil	Butylbenzene, n-	8260C	ANAB
104-51-8	Water	Butylbenzene, n-	8260C	ANAB
135-98-8	Water	Butylbenzene, sec-	524.2	ANAB
135-98-8	Soil	Butylbenzene, sec-	8260B	ANAB
135-98-8	Water	Butylbenzene, sec-	8260B	ANAB
135-98-8	Soil	Butylbenzene, sec-	8260C	ANAB
135-98-8	Water	Butylbenzene, sec-	8260C	ANAB
98-06-6	Water	Butylbenzene, tert-	524.2	ANAB
98-06-6	Soil	Butylbenzene, tert-	8260B	ANAB
98-06-6	Water	Butylbenzene, tert-	8260B	ANAB
98-06-6	Soil	Butylbenzene, tert-	8260C	ANAB
98-06-6	Water	Butylbenzene, tert-	8260C	ANAB
7440-43-9	Water	Cadmium	200.7	ANAB
7440-43-9	Water	Cadmium	200.8	ANAB
7440-43-9	Soil	Cadmium	6010B	ANAB
7440-43-9	Water	Cadmium	6010B	ANAB
7440-43-9	Soil	Cadmium	6010C	ANAB
7440-43-9	Water	Cadmium	6010C	ANAB
7440-43-9	Soil	Cadmium	6020A	ANAB
7440-43-9	Water	Cadmium	6020A	ANAB
75-15-0	Soil	Carbon Disulfide	8260B	ANAB
75-15-0	Water	Carbon Disulfide	8260B	ANAB
75-15-0	Soil	Carbon Disulfide	8260C	ANAB
75-15-0	Water	Carbon Disulfide	8260C	ANAB
75-15-0	Air	Carbon Disulfide	TO-15	ANAB
56-23-5	Water	Carbon Tetrachloride	524.2	ANAB
56-23-5	Water	Carbon Tetrachloride	624	ANAB
56-23-5	Soil	Carbon Tetrachloride	8260B	ANAB
56-23-5	Water	Carbon Tetrachloride	8260B	ANAB
56-23-5	Soil	Carbon Tetrachloride	8260C	ANAB
56-23-5	Water	Carbon Tetrachloride	8260C	ANAB
56-23-5	Air	Carbon Tetrachloride	TO-15	ANAB
5103-71-9	Water	Chlordane, α-	608	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
5103-71-9	Soil	Chlordane, α-	8081A	ANAB
5103-71-9	Water	Chlordane, α-	8081A	ANAB
5103-71-9	Soil	Chlordane, α-	8081B	ANAB
5103-71-9	Water	Chlordane, α-	8081B	ANAB
5103-74-2	Water	Chlordane, γ-	608	ANAB
5103-74-2	Soil	Chlordane, γ-	8081A	ANAB
5103-74-2	Water	Chlordane, γ-	8081A	ANAB
5103-74-2	Soil	Chlordane, γ-	8081B	ANAB
5103-74-2	Water	Chlordane, γ-	8081B	ANAB
12789-03-6	Water	Chlordane, Total	608	ANAB
12789-03-6	Soil	Chlordane, Total	8081A	ANAB
12789-03-6	Water	Chlordane, Total	8081A	ANAB
12789-03-6	Soil	Chlordane, Total	8081B	ANAB
12789-03-6	Water	Chlordane, Total	8081B	ANAB
143-50-0	Soil	Chlordecone (Kepone)	8270C	ANAB
143-50-0	Water	Chlordecone (Kepone)	8270C	ANAB
143-50-0	Soil	Chlordecone (Kepone)	8270D	ANAB
143-50-0	Water	Chlordecone (Kepone)	8270D	ANAB
106-47-8	Soil	Chloroaniline, p-	8270C	ANAB
106-47-8	Water	Chloroaniline, p-	8270C	ANAB
106-47-8	Soil	Chloroaniline, p-	8270D	ANAB
106-47-8	Water	Chloroaniline, p-	8270D	ANAB
108-90-7	Water	Chlorobenzene	524.2	ANAB
108-90-7	Water	Chlorobenzene	624	ANAB
108-90-7	Soil	Chlorobenzene	8260B	ANAB
108-90-7	Water	Chlorobenzene	8260B	ANAB
108-90-7	Soil	Chlorobenzene	8260C	ANAB
108-90-7	Water	Chlorobenzene	8260C	ANAB
108-90-7	Air	Chlorobenzene	TO-15	ANAB
67-66-3	Water	Chloroform	524.2	ANAB
67-66-3	Water	Chloroform	624	ANAB
67-66-3	Soil	Chloroform	8260B	ANAB
67-66-3	Water	Chloroform	8260B	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
67-66-3	Soil	Chloroform	8260C	ANAB
67-66-3	Water	Chloroform	8260C	ANAB
67-66-3	Air	Chloroform	TO-15	ANAB
74-87-3	Water	Chloromethane	524.2	ANAB
74-87-3	Water	Chloromethane	624	ANAB
74-87-3	Soil	Chloromethane	8260B	ANAB
74-87-3	Water	Chloromethane	8260B	ANAB
74-87-3	Soil	Chloromethane	8260C	ANAB
74-87-3	Water	Chloromethane	8260C	ANAB
74-87-3	Air	Chloromethane	TO-15	ANAB
91-58-7	Water	Chloronaphthalene, Beta-	625	ANAB
91-58-7	Soil	Chloronaphthalene, Beta-	8270C	ANAB
91-58-7	Water	Chloronaphthalene, Beta-	8270C	ANAB
91-58-7	Soil	Chloronaphthalene, Beta-	8270D	ANAB
91-58-7	Water	Chloronaphthalene, Beta-	8270D	ANAB
95-57-8	Soil	Chlorophenol, 2-	8270C	ANAB
95-57-8	Water	Chlorophenol, 2-	8270C	ANAB
95-57-8	Soil	Chlorophenol, 2-	8270C-SIM	ANAB
95-57-8	Water	Chlorophenol, 2-	8270C-SIM	ANAB
95-57-8	Soil	Chlorophenol, 2-	8270D	ANAB
95-57-8	Water	Chlorophenol, 2-	8270D	ANAB
95-57-8	Soil	Chlorophenol, 2-	8270D-SIM	ANAB
95-57-8	Water	Chlorophenol, 2-	8270D-SIM	ANAB
7440-47-3	Water	Chromium (Total)	200.7	ANAB
7440-47-3	Water	Chromium (Total)	200.8	ANAB
7440-47-3	Soil	Chromium (Total)	6010B	ANAB
7440-47-3	Water	Chromium (Total)	6010B	ANAB
7440-47-3	Soil	Chromium (Total)	6010C	ANAB
7440-47-3	Water	Chromium (Total)	6010C	ANAB
7440-47-3	Soil	Chromium (Total)	6020A	ANAB
7440-47-3	Water	Chromium (Total)	6020A	ANAB
18540-29-9	Soil	Chromium (VI)	7199	ANAB
18540-29-9	Water	Chromium (VI)	7199	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
18540-29-9	Soil	Chromium (VI)	7196A	ANAB
18540-29-9	Water	Chromium (VI)	7196A	ANAB
218-01-9	Water	Chrysene	625	ANAB
218-01-9	Soil	Chrysene	8310	ANAB
218-01-9	Water	Chrysene	8310	ANAB
218-01-9	Soil	Chrysene	8270C	ANAB
218-01-9	Water	Chrysene	8270C	ANAB
218-01-9	Soil	Chrysene	8270C-SIM	ANAB
218-01-9	Water	Chrysene	8270C-SIM	ANAB
218-01-9	Soil	Chrysene	8270D	ANAB
218-01-9	Water	Chrysene	8270D	ANAB
218-01-9	Soil	Chrysene	8270D-SIM	ANAB
218-01-9	Water	Chrysene	8270D-SIM	ANAB
7440-50-8	Water	Copper	200.7	ANAB
7440-50-8	Water	Copper	200.8	ANAB
7440-50-8	Soil	Copper	6010B	ANAB
7440-50-8	Water	Copper	6010B	ANAB
7440-50-8	Soil	Copper	6010C	ANAB
7440-50-8	Water	Copper	6010C	ANAB
7440-50-8	Soil	Copper	6020A	ANAB
7440-50-8	Water	Copper	6020A	ANAB
108-39-4	Soil	Cresol, m- (3-Methylphenol) + Cresol, p- (4-Methylphenol)	8270C	ANAB
108-39-4	Water	Cresol, m- (3-Methylphenol) + Cresol, p- (4-Methylphenol)	8270C	ANAB
108-39-4	Soil	Cresol, m- (3-Methylphenol) + Cresol, p- (4-Methylphenol)	8270D	ANAB
108-39-4	Water	Cresol, m- (3-Methylphenol) + Cresol, p- (4-Methylphenol)	8270D	ANAB
95-48-7	Water	Cresol, o- (2-Methylphenol)	625	ANAB
95-48-7	Soil	Cresol, o- (2-Methylphenol)	8270C	ANAB
95-48-7	Water	Cresol, o- (2-Methylphenol)	8270C	ANAB
95-48-7	Soil	Cresol, o- (2-Methylphenol)	8270D	ANAB
95-48-7	Water	Cresol, o- (2-Methylphenol)	8270D	ANAB
106-44-5	Water	Cresol, p- (4-Methylphenol)	625	ANAB
98-82-8	Soil	Cumene (Isopropylbenzene)	8260B	ANAB
98-82-8	Water	Cumene (Isopropylbenzene)	8260B	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
98-82-8	Soil	Cumene (Isopropylbenzene)	8260C	ANAB
98-82-8	Water	Cumene (Isopropylbenzene)	8260C	ANAB
57-12-5	Soil	Cyanide (CN-)	9010/9014	ANAB
57-12-5	Water	Cyanide (CN-)	9010/9014	ANAB
110-82-7	Soil	Cyclohexane	8260B	ANAB
110-82-7	Water	Cyclohexane	8260B	ANAB
110-82-7	Soil	Cyclohexane	8260C	ANAB
110-82-7	Water	Cyclohexane	8260C	ANAB
110-82-7	Air	Cyclohexane	TO-15	ANAB
72-54-8	Water	DDD, 4,4'-	608	ANAB
72-54-8	Soil	DDD, 4,4'-	8081A	ANAB
72-54-8	Water	DDD, 4,4'-	8081A	ANAB
72-54-8	Soil	DDD, 4,4'-	8081B	ANAB
72-54-8	Water	DDD, 4,4'-	8081B	ANAB
72-55-9	Water	DDE, 4,4'-	608	ANAB
72-55-9	Soil	DDE, 4,4'-	8081A	ANAB
72-55-9	Water	DDE, 4,4'-	8081A	ANAB
72-55-9	Soil	DDE, 4,4'-	8081B	ANAB
72-55-9	Water	DDE, 4,4'-	8081B	ANAB
50-29-3	Water	DDT, 4,4'-	608	ANAB
50-29-3	Soil	DDT, 4,4'-	8081A	ANAB
50-29-3	Water	DDT, 4,4'-	8081A	ANAB
50-29-3	Soil	DDT, 4,4'-	8081B	ANAB
50-29-3	Water	DDT, 4,4'-	8081B	ANAB
53-70-3	Water	Dibenz[a,h]anthracene	625	ANAB
53-70-3	Soil	Dibenz[a,h]anthracene	8310	ANAB
53-70-3	Water	Dibenz[a,h]anthracene	8310	ANAB
53-70-3	Soil	Dibenz[a,h]anthracene	8270C	ANAB
53-70-3	Water	Dibenz[a,h]anthracene	8270C	ANAB
53-70-3	Soil	Dibenz[a,h]anthracene	8270C-SIM	ANAB
53-70-3	Water	Dibenz[a,h]anthracene	8270C-SIM	ANAB
53-70-3	Soil	Dibenz[a,h]anthracene	8270D	ANAB
53-70-3	Water	Dibenz[a,h]anthracene	8270D	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
53-70-3	Soil	Dibenz[a,h]anthracene	8270D-SIM	ANAB
53-70-3	Water	Dibenz[a,h]anthracene	8270D-SIM	ANAB
132-64-9	Soil	Dibenzofuran	8270C	ANAB
132-64-9	Water	Dibenzofuran	8270C	ANAB
132-64-9	Soil	Dibenzofuran	8270D	ANAB
132-64-9	Water	Dibenzofuran	8270D	ANAB
124-48-1	Water	Dibromochloromethane	524.2	ANAB
124-48-1	Water	Dibromochloromethane	624	ANAB
124-48-1	Soil	Dibromochloromethane	8260B	ANAB
124-48-1	Water	Dibromochloromethane	8260B	ANAB
124-48-1	Soil	Dibromochloromethane	8260C	ANAB
124-48-1	Water	Dibromochloromethane	8260C	ANAB
124-48-1	Air	Dibromochloromethane	TO-15	ANAB
106-93-4	Soil	Dibromoethane, 1,2- (Ethylene Dibromide)	8011	ANAB
106-93-4	Water	Dibromoethane, 1,2- (Ethylene Dibromide)	8011	ANAB
106-93-4	Soil	Dibromoethane, 1,2- (Ethylene Dibromide)	8260B	ANAB
106-93-4	Water	Dibromoethane, 1,2- (Ethylene Dibromide)	8260B	ANAB
106-93-4	Soil	Dibromoethane, 1,2- (Ethylene Dibromide)	8260C	ANAB
106-93-4	Water	Dibromoethane, 1,2- (Ethylene Dibromide)	8260C	ANAB
106-93-4	Air	Dibromoethane, 1,2- (Ethylene Dibromide)	TO-15	ANAB
74-95-3	Water	Dibromomethane (Methylene Bromide)	524.2	ANAB
74-95-3	Soil	Dibromomethane (Methylene Bromide)	8260B	ANAB
74-95-3	Water	Dibromomethane (Methylene Bromide)	8260B	ANAB
74-95-3	Soil	Dibromomethane (Methylene Bromide)	8260C	ANAB
74-95-3	Water	Dibromomethane (Methylene Bromide)	8260C	ANAB
84-74-2	Soil	Dibutyl Phthalate	8270C	ANAB
84-74-2	Water	Dibutyl Phthalate	8270C	ANAB
84-74-2	Soil	Dibutyl Phthalate	8270C-SIM	ANAB
84-74-2	Water	Dibutyl Phthalate	8270C-SIM	ANAB
84-74-2	Soil	Dibutyl Phthalate	8270D	ANAB
84-74-2	Water	Dibutyl Phthalate	8270D	ANAB
84-74-2	Soil	Dibutyl Phthalate	8270D-SIM	ANAB
84-74-2	Water	Dibutyl Phthalate	8270D-SIM	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
95-50-1	Water	Dichlorobenzene, 1,2-	524.2	ANAB
95-50-1	Water	Dichlorobenzene, 1,2-	624	ANAB
95-50-1	Water	Dichlorobenzene, 1,2-	625	ANAB
95-50-1	Soil	Dichlorobenzene, 1,2-	8260B	ANAB
95-50-1	Water	Dichlorobenzene, 1,2-	8260B	ANAB
95-50-1	Soil	Dichlorobenzene, 1,2-	8260C	ANAB
95-50-1	Water	Dichlorobenzene, 1,2-	8260C	ANAB
95-50-1	Soil	Dichlorobenzene, 1,2-	8270C	ANAB
95-50-1	Water	Dichlorobenzene, 1,2-	8270C	ANAB
95-50-1	Soil	Dichlorobenzene, 1,2-	8270D	ANAB
95-50-1	Water	Dichlorobenzene, 1,2-	8270D	ANAB
95-50-1	Air	Dichlorobenzene, 1,2-	TO-15	ANAB
541-73-1	Water	Dichlorobenzene, 1,3-	524.2	ANAB
541-73-1	Water	Dichlorobenzene, 1,3-	624	ANAB
541-73-1	Water	Dichlorobenzene, 1,3-	625	ANAB
541-73-1	Soil	Dichlorobenzene, 1,3-	8260B	ANAB
541-73-1	Water	Dichlorobenzene, 1,3-	8260B	ANAB
541-73-1	Soil	Dichlorobenzene, 1,3-	8260C	ANAB
541-73-1	Water	Dichlorobenzene, 1,3-	8260C	ANAB
541-73-1	Soil	Dichlorobenzene, 1,3-	8270C	ANAB
541-73-1	Water	Dichlorobenzene, 1,3-	8270C	ANAB
541-73-1	Soil	Dichlorobenzene, 1,3-	8270D	ANAB
541-73-1	Water	Dichlorobenzene, 1,3-	8270D	ANAB
541-73-1	Air	Dichlorobenzene, 1,3-	TO-15	ANAB
106-46-7	Water	Dichlorobenzene, 1,4-	524.2	ANAB
106-46-7	Water	Dichlorobenzene, 1,4-	624	ANAB
106-46-7	Water	Dichlorobenzene, 1,4-	625	ANAB
106-46-7	Soil	Dichlorobenzene, 1,4-	8260B	ANAB
106-46-7	Water	Dichlorobenzene, 1,4-	8260B	ANAB
106-46-7	Soil	Dichlorobenzene, 1,4-	8260C	ANAB
106-46-7	Water	Dichlorobenzene, 1,4-	8260C	ANAB
106-46-7	Soil	Dichlorobenzene, 1,4-	8270C	ANAB
106-46-7	Water	Dichlorobenzene, 1,4-	8270C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
106-46-7	Soil	Dichlorobenzene, 1,4-	8270D	ANAB
106-46-7	Water	Dichlorobenzene, 1,4-	8270D	ANAB
106-46-7	Air	Dichlorobenzene, 1,4-	TO-15	ANAB
91-94-1	Water	Dichlorobenzidine, 3,3'-	625	ANAB
91-94-1	Soil	Dichlorobenzidine, 3,3'-	8270C	ANAB
91-94-1	Water	Dichlorobenzidine, 3,3'-	8270C	ANAB
91-94-1	Soil	Dichlorobenzidine, 3,3'-	8270D	ANAB
91-94-1	Water	Dichlorobenzidine, 3,3'-	8270D	ANAB
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	524.2	ANAB
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	624	ANAB
75-71-8	Soil	Dichlorodifluoromethane (Freon-12)	8260B	ANAB
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	8260B	ANAB
75-71-8	Soil	Dichlorodifluoromethane (Freon-12)	8260C	ANAB
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	8260C	ANAB
75-71-8	Air	Dichlorodifluoromethane (Freon-12)	TO-15	ANAB
75-34-3	Water	Dichloroethane, 1,1-	524.2	ANAB
75-34-3	Water	Dichloroethane, 1,1-	624	ANAB
75-34-3	Soil	Dichloroethane, 1,1-	8260B	ANAB
75-34-3	Water	Dichloroethane, 1,1-	8260B	ANAB
75-34-3	Soil	Dichloroethane, 1,1-	8260C	ANAB
75-34-3	Water	Dichloroethane, 1,1-	8260C	ANAB
75-34-3	Air	Dichloroethane, 1,1-	TO-15	ANAB
107-06-2	Water	Dichloroethane, 1,2-	524.2	ANAB
107-06-2	Water	Dichloroethane, 1,2-	624	ANAB
107-06-2	Soil	Dichloroethane, 1,2-	8260B	ANAB
107-06-2	Water	Dichloroethane, 1,2-	8260B	ANAB
107-06-2	Soil	Dichloroethane, 1,2-	8260C	ANAB
107-06-2	Water	Dichloroethane, 1,2-	8260C	ANAB
107-06-2	Air	Dichloroethane, 1,2-	TO-15	ANAB
75-35-4	Water	Dichloroethylene, 1,1-	524.2	ANAB
75-35-4	Water	Dichloroethylene, 1,1-	624	ANAB
75-35-4	Soil	Dichloroethylene, 1,1-	8260B	ANAB
75-35-4	Water	Dichloroethylene, 1,1-	8260B	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
75-35-4	Soil	Dichloroethylene, 1,1-	8260C	ANAB
75-35-4	Water	Dichloroethylene, 1,1-	8260C	ANAB
75-35-4	Air	Dichloroethylene, 1,1-	TO-15	ANAB
156-59-2	Water	Dichloroethylene, 1,2-cis-	524.2	ANAB
156-59-2	Water	Dichloroethylene, 1,2-cis-	624	ANAB
156-59-2	Soil	Dichloroethylene, 1,2-cis-	8260B	ANAB
156-59-2	Water	Dichloroethylene, 1,2-cis-	8260B	ANAB
156-59-2	Soil	Dichloroethylene, 1,2-cis-	8260C	ANAB
156-59-2	Water	Dichloroethylene, 1,2-cis-	8260C	ANAB
156-59-2	Air	Dichloroethylene, 1,2-cis-	TO-15	ANAB
156-60-5	Water	Dichloroethylene, 1,2-trans-	524.2	ANAB
156-60-5	Water	Dichloroethylene, 1,2-trans-	624	ANAB
156-60-5	Soil	Dichloroethylene, 1,2-trans-	8260B	ANAB
156-60-5	Water	Dichloroethylene, 1,2-trans-	8260B	ANAB
156-60-5	Soil	Dichloroethylene, 1,2-trans-	8260C	ANAB
156-60-5	Water	Dichloroethylene, 1,2-trans-	8260C	ANAB
156-60-5	Air	Dichloroethylene, 1,2-trans-	TO-15	ANAB
120-83-2	Water	Dichlorophenol, 2,4-	625	ANAB
120-83-2	Soil	Dichlorophenol, 2,4-	8270C	ANAB
120-83-2	Water	Dichlorophenol, 2,4-	8270C	ANAB
120-83-2	Soil	Dichlorophenol, 2,4-	8270C-SIM	ANAB
120-83-2	Water	Dichlorophenol, 2,4-	8270C-SIM	ANAB
120-83-2	Soil	Dichlorophenol, 2,4-	8270D	ANAB
120-83-2	Water	Dichlorophenol, 2,4-	8270D	ANAB
120-83-2	Soil	Dichlorophenol, 2,4-	8270D-SIM	ANAB
120-83-2	Water	Dichlorophenol, 2,4-	8270D-SIM	ANAB
94-75-7	Soil	Dichlorophenoxy Acetic Acid, 2,4- (2,4-D)	8151A	ANAB
94-75-7	Water	Dichlorophenoxy Acetic Acid, 2,4- (2,4-D)	8151A	ANAB
78-87-5	Water	Dichloropropane, 1,2-	524.2	ANAB
78-87-5	Water	Dichloropropane, 1,2-	624	ANAB
78-87-5	Soil	Dichloropropane, 1,2-	8260B	ANAB
78-87-5	Water	Dichloropropane, 1,2-	8260B	ANAB
78-87-5	Soil	Dichloropropane, 1,2-	8260C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
78-87-5	Water	Dichloropropane, 1,2-	8260C	ANAB
78-87-5	Air	Dichloropropane, 1,2-	TO-15	ANAB
542-75-6	Soil	Dichloropropene, 1,3- (cis + trans)	8260B	ANAB
542-75-6	Water	Dichloropropene, 1,3- (cis + trans)	8260B	ANAB
542-75-6	Soil	Dichloropropene, 1,3- (cis + trans)	8260C	ANAB
542-75-6	Water	Dichloropropene, 1,3- (cis + trans)	8260C	ANAB
60-57-1	Water	Dieldrin	608	ANAB
60-57-1	Soil	Dieldrin	8081A	ANAB
60-57-1	Water	Dieldrin	8081A	ANAB
60-57-1	Soil	Dieldrin	8081B	ANAB
60-57-1	Water	Dieldrin	8081B	ANAB
N/A	Soil	Diesel Range Organics (C10 – C25)	AK 102	ANAB
N/A	Water	Diesel Range Organics (C10 – C25)	AK 102	ANAB
84-66-2	Water	Diethyl Phthalate	625	ANAB
84-66-2	Soil	Diethyl Phthalate	8270C	ANAB
84-66-2	Water	Diethyl Phthalate	8270C	ANAB
84-66-2	Soil	Diethyl Phthalate	8270C-SIM	ANAB
84-66-2	Water	Diethyl Phthalate	8270C-SIM	ANAB
84-66-2	Soil	Diethyl Phthalate	8270D	ANAB
84-66-2	Water	Diethyl Phthalate	8270D	ANAB
84-66-2	Soil	Diethyl Phthalate	8270D-SIM	ANAB
84-66-2	Water	Diethyl Phthalate	8270D-SIM	ANAB
105-67-9	Water	Dimethylphenol, 2,4-	625	ANAB
105-67-9	Soil	Dimethylphenol, 2,4-	8270C	ANAB
105-67-9	Water	Dimethylphenol, 2,4-	8270C	ANAB
105-67-9	Soil	Dimethylphenol, 2,4-	8270C-SIM	ANAB
105-67-9	Water	Dimethylphenol, 2,4-	8270C-SIM	ANAB
105-67-9	Soil	Dimethylphenol, 2,4-	8270D	ANAB
105-67-9	Water	Dimethylphenol, 2,4-	8270D	ANAB
105-67-9	Soil	Dimethylphenol, 2,4-	8270D-SIM	ANAB
105-67-9	Water	Dimethylphenol, 2,4-	8270D-SIM	ANAB
131-11-3	Water	Dimethylphthalate	625	ANAB
131-11-3	Soil	Dimethylphthalate	8270C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
131-11-3	Water	Dimethylphthalate	8270C	ANAB
131-11-3	Soil	Dimethylphthalate	8270C-SIM	ANAB
131-11-3	Water	Dimethylphthalate	8270C-SIM	ANAB
131-11-3	Soil	Dimethylphthalate	8270D	ANAB
131-11-3	Water	Dimethylphthalate	8270D	ANAB
131-11-3	Soil	Dimethylphthalate	8270D-SIM	ANAB
131-11-3	Water	Dimethylphthalate	8270D-SIM	ANAB
99-65-0	Soil	Dinitrobenzene, 1,3-	8270C	ANAB
99-65-0	Water	Dinitrobenzene, 1,3-	8270C	ANAB
99-65-0	Soil	Dinitrobenzene, 1,3-	8270D	ANAB
99-65-0	Water	Dinitrobenzene, 1,3-	8270D	ANAB
51-28-5	Water	Dinitrophenol, 2,4-	625	ANAB
51-28-5	Soil	Dinitrophenol, 2,4-	8270C	ANAB
51-28-5	Water	Dinitrophenol, 2,4-	8270C	ANAB
51-28-5	Soil	Dinitrophenol, 2,4-	8270D	ANAB
51-28-5	Water	Dinitrophenol, 2,4-	8270D	ANAB
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	625	ANAB
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8270C	ANAB
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8270C	ANAB
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8270D	ANAB
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8270D	ANAB
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8330A	ANAB
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8330A	ANAB
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8330B	ANAB
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	625	ANAB
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8270C	ANAB
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8270C	ANAB
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8270D	ANAB
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8270D	ANAB
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8330A	ANAB
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8330A	ANAB
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8330B	ANAB
35572-78-2	Soil	Dinitrotoluene, 2-Amino-4,6-	8330A	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
35572-78-2	Water	Dinitrotoluene, 2-Amino-4,6-	8330A	ANAB
35572-78-2	Water	Dinitrotoluene, 2-Amino-4,6-	8330B	ANAB
19406-51-0	Soil	Dinitrotoluene, 4-Amino-2,6-	8330A	ANAB
19406-51-0	Water	Dinitrotoluene, 4-Amino-2,6-	8330A	ANAB
19406-51-0	Water	Dinitrotoluene, 4-Amino-2,6-	8330B	ANAB
123-91-1	Soil	Dioxane, 1,4-	8260B	ANAB
123-91-1	Water	Dioxane, 1,4-	8260B	ANAB
123-91-1	Soil	Dioxane, 1,4-	8260B-SIM	ANAB
123-91-1	Water	Dioxane, 1,4-	8260B-SIM	ANAB
123-91-1	Soil	Dioxane, 1,4-	8260C	ANAB
123-91-1	Water	Dioxane, 1,4-	8260C	ANAB
123-91-1	Soil	Dioxane, 1,4-	8260C-SIM	ANAB
123-91-1	Water	Dioxane, 1,4-	8260C-SIM	ANAB
123-91-1	Water	Dioxane, 1,4-	8270C-SIM	ANAB
123-91-1	Soil	Dioxane, 1,4-	8270D-SIM	ANAB
123-91-1	Water	Dioxane, 1,4-	8270D-SIM	ANAB
123-91-1	Air	Dioxane, 1,4-	TO-15	ANAB
959-98-8	Water	Endosulfan I	608	ANAB
959-98-8	Soil	Endosulfan I	8081A	ANAB
959-98-8	Water	Endosulfan I	8081A	ANAB
959-98-8	Soil	Endosulfan I	8081B	ANAB
959-98-8	Water	Endosulfan I	8081B	ANAB
33213-65-9	Water	Endosulfan II	608	ANAB
33213-65-9	Soil	Endosulfan II	8081A	ANAB
33213-65-9	Water	Endosulfan II	8081A	ANAB
33213-65-9	Soil	Endosulfan II	8081B	ANAB
33213-65-9	Water	Endosulfan II	8081B	ANAB
1031-07-8	Water	Endosulfan sulfate	608	ANAB
1031-07-8	Soil	Endosulfan sulfate	8081A	ANAB
1031-07-8	Water	Endosulfan sulfate	8081A	ANAB
1031-07-8	Soil	Endosulfan sulfate	8081B	ANAB
1031-07-8	Water	Endosulfan sulfate	8081B	ANAB
72-20-8	Water	Endrin	608	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
72-20-8	Soil	Endrin	8081A	ANAB
72-20-8	Water	Endrin	8081A	ANAB
72-20-8	Soil	Endrin	8081B	ANAB
72-20-8	Water	Endrin	8081B	ANAB
75-00-3	Soil	Ethyl Chloride	8260B	ANAB
75-00-3	Water	Ethyl Chloride	8260B	ANAB
75-00-3	Soil	Ethyl Chloride	8260C	ANAB
75-00-3	Water	Ethyl Chloride	8260C	ANAB
75-00-3	Air	Ethyl Chloride	TO-15	ANAB
100-41-4	Water	Ethylbenzene	524.2	ANAB
100-41-4	Water	Ethylbenzene	624	ANAB
100-41-4	Soil	Ethylbenzene	8260B	ANAB
100-41-4	Water	Ethylbenzene	8260B	ANAB
100-41-4	Soil	Ethylbenzene	8260C	ANAB
100-41-4	Water	Ethylbenzene	8260C	ANAB
100-41-4	Air	Ethylbenzene	TO-15	ANAB
107-21-1	Soil	Ethylene Glycol	8015B	ANAB
107-21-1	Water	Ethylene Glycol	8015B	ANAB
107-21-1	Soil	Ethylene Glycol	8015C	ANAB
107-21-1	Water	Ethylene Glycol	8015C	ANAB
206-44-0	Water	Fluoranthene	625	ANAB
206-44-0	Soil	Fluoranthene	8310	ANAB
206-44-0	Water	Fluoranthene	8310	ANAB
206-44-0	Soil	Fluoranthene	8270C	ANAB
206-44-0	Water	Fluoranthene	8270C	ANAB
206-44-0	Soil	Fluoranthene	8270C-SIM	ANAB
206-44-0	Water	Fluoranthene	8270C-SIM	ANAB
206-44-0	Soil	Fluoranthene	8270D	ANAB
206-44-0	Water	Fluoranthene	8270D	ANAB
206-44-0	Soil	Fluoranthene	8270D-SIM	ANAB
206-44-0	Water	Fluoranthene	8270D-SIM	ANAB
86-73-7	Water	Fluorene	625	ANAB
86-73-7	Soil	Fluorene	8310	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
86-73-7	Water	Fluorene	8310	ANAB
86-73-7	Soil	Fluorene	8270C	ANAB
86-73-7	Water	Fluorene	8270C	ANAB
86-73-7	Soil	Fluorene	8270C-SIM	ANAB
86-73-7	Water	Fluorene	8270C-SIM	ANAB
86-73-7	Soil	Fluorene	8270D	ANAB
86-73-7	Water	Fluorene	8270D	ANAB
86-73-7	Soil	Fluorene	8270D-SIM	ANAB
86-73-7	Water	Fluorene	8270D-SIM	ANAB
N/A	Soil	Gasoline Range Organics (C6 – C10)	AK 101	ANAB
N/A	Water	Gasoline Range Organics (C6 – C10)	AK 101	ANAB
76-44-8	Water	Heptachlor	608	ANAB
76-44-8	Soil	Heptachlor	8081A	ANAB
76-44-8	Water	Heptachlor	8081A	ANAB
76-44-8	Soil	Heptachlor	8081B	ANAB
76-44-8	Water	Heptachlor	8081B	ANAB
1024-57-3	Water	Heptachlor Epoxide	608	ANAB
1024-57-3	Soil	Heptachlor Epoxide	8081A	ANAB
1024-57-3	Water	Heptachlor Epoxide	8081A	ANAB
1024-57-3	Soil	Heptachlor Epoxide	8081B	ANAB
1024-57-3	Water	Heptachlor Epoxide	8081B	ANAB
118-74-1	Water	Hexachlorobenzene	625	ANAB
118-74-1	Soil	Hexachlorobenzene	8270C	ANAB
118-74-1	Water	Hexachlorobenzene	8270C	ANAB
118-74-1	Soil	Hexachlorobenzene	8270C-SIM	ANAB
118-74-1	Water	Hexachlorobenzene	8270C-SIM	ANAB
118-74-1	Soil	Hexachlorobenzene	8270D	ANAB
118-74-1	Water	Hexachlorobenzene	8270D	ANAB
118-74-1	Soil	Hexachlorobenzene	8270D-SIM	ANAB
118-74-1	Water	Hexachlorobenzene	8270D-SIM	ANAB
87-68-3	Water	Hexachlorobutadiene	524.2	ANAB
87-68-3	Water	Hexachlorobutadiene	625	ANAB
87-68-3	Soil	Hexachlorobutadiene	8260B	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
87-68-3	Water	Hexachlorobutadiene	8260B	ANAB
87-68-3	Soil	Hexachlorobutadiene	8260C	ANAB
87-68-3	Water	Hexachlorobutadiene	8260C	ANAB
87-68-3	Soil	Hexachlorobutadiene	8270C	ANAB
87-68-3	Water	Hexachlorobutadiene	8270C	ANAB
87-68-3	Soil	Hexachlorobutadiene	8270D	ANAB
87-68-3	Water	Hexachlorobutadiene	8270D	ANAB
87-68-3	Air	Hexachlorobutadiene	TO-15	ANAB
319-84-6	Water	Hexachlorocyclohexane, Alpha- (α-BHC)	608	ANAB
319-84-6	Soil	Hexachlorocyclohexane, Alpha- (α-BHC)	8081A	ANAB
319-84-6	Water	Hexachlorocyclohexane, Alpha- (α-BHC)	8081A	ANAB
319-84-6	Soil	Hexachlorocyclohexane, Alpha- (α-BHC)	8081B	ANAB
319-84-6	Water	Hexachlorocyclohexane, Alpha- (α-BHC)	8081B	ANAB
319-85-7	Water	Hexachlorocyclohexane, Beta- (β-BHC)	608	ANAB
319-85-7	Soil	Hexachlorocyclohexane, Beta- (β-BHC)	8081A	ANAB
319-85-7	Water	Hexachlorocyclohexane, Beta- (β-BHC)	8081A	ANAB
319-85-7	Soil	Hexachlorocyclohexane, Beta- (β-BHC)	8081B	ANAB
319-85-7	Water	Hexachlorocyclohexane, Beta- (β-BHC)	8081B	ANAB
319-86-8	Water	Hexachlorocyclohexane, Delta- (δ-BHC)	608	ANAB
319-86-8	Soil	Hexachlorocyclohexane, Delta- (δ-BHC)	8081A	ANAB
319-86-8	Water	Hexachlorocyclohexane, Delta- (δ-BHC)	8081A	ANAB
319-86-8	Soil	Hexachlorocyclohexane, Delta- (δ-BHC)	8081B	ANAB
319-86-8	Water	Hexachlorocyclohexane, Delta- (δ-BHC)	8081B	ANAB
58-89-9	Water	Hexachlorocyclohexane, Gamma- (Lindane)	608	ANAB
58-89-9	Soil	Hexachlorocyclohexane, Gamma- (Lindane)	8081A	ANAB
58-89-9	Water	Hexachlorocyclohexane, Gamma- (Lindane)	8081A	ANAB
58-89-9	Soil	Hexachlorocyclohexane, Gamma- (Lindane)	8081B	ANAB
58-89-9	Water	Hexachlorocyclohexane, Gamma- (Lindane)	8081B	ANAB
77-47-4	Water	Hexachlorocyclopentadiene	625	ANAB
77-47-4	Soil	Hexachlorocyclopentadiene	8270C	ANAB
77-47-4	Water	Hexachlorocyclopentadiene	8270C	ANAB
77-47-4	Soil	Hexachlorocyclopentadiene	8270D	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
77-47-4	Water	Hexachlorocyclopentadiene	8270D	ANAB
67-72-1	Water	Hexachloroethane	625	ANAB
67-72-1	Soil	Hexachloroethane	8270C	ANAB
67-72-1	Water	Hexachloroethane	8270C	ANAB
67-72-1	Soil	Hexachloroethane	8270D	ANAB
67-72-1	Water	Hexachloroethane	8270D	ANAB
121-82-4	Soil	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330A	ANAB
121-82-4	Water	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330A	ANAB
121-82-4	Water	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330B	ANAB
110-54-3	Air	Hexane, N-	TO-15	ANAB
591-78-6	Soil	Hexanone, 2-	8260B	ANAB
591-78-6	Water	Hexanone, 2-	8260B	ANAB
591-78-6	Soil	Hexanone, 2-	8260C	ANAB
591-78-6	Water	Hexanone, 2-	8260C	ANAB
193-39-5	Water	Indeno[1,2,3-cd]pyrene	625	ANAB
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8310	ANAB
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8310	ANAB
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270C	ANAB
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270C	ANAB
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270C-SIM	ANAB
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270C-SIM	ANAB
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270D	ANAB
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270D	ANAB
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270D-SIM	ANAB
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270D-SIM	ANAB
78-59-1	Water	Isophorone	625	ANAB
78-59-1	Soil	Isophorone	8270C	ANAB
78-59-1	Water	Isophorone	8270C	ANAB
78-59-1	Soil	Isophorone	8270D	ANAB
78-59-1	Water	Isophorone	8270D	ANAB
67-63-0	Soil	Isopropanol	8260B	ANAB
67-63-0	Water	Isopropanol	8260B	ANAB
67-63-0	Soil	Isopropanol	8260C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
67-63-0	Water	Isopropanol	8260C	ANAB
7439-92-1	Water	Lead, Total	200.7	ANAB
7439-92-1	Water	Lead, Total	200.8	ANAB
7439-92-1	Soil	Lead, Total	6010B	ANAB
7439-92-1	Water	Lead, Total	6010B	ANAB
7439-92-1	Soil	Lead, Total	6010C	ANAB
7439-92-1	Water	Lead, Total	6010C	ANAB
7439-92-1	Soil	Lead, Total	6020A	ANAB
7439-92-1	Water	Lead, Total	6020A	ANAB
7439-97-6	Water	Mercury (elemental)	245.1	ANAB
7439-97-6	Water	Mercury (elemental)	7470A	ANAB
7439-97-6	Soil	Mercury (elemental)	7471A	ANAB
7439-97-6	Soil	Mercury (elemental)	7471B	ANAB
67-56-1	Soil	Methanol	8015B	ANAB
67-56-1	Water	Methanol	8015B	ANAB
67-56-1	Soil	Methanol	8015C	ANAB
67-56-1	Water	Methanol	8015C	ANAB
72-43-5	Water	Methoxychlor	608	ANAB
72-43-5	Soil	Methoxychlor	8081A	ANAB
72-43-5	Water	Methoxychlor	8081A	ANAB
72-43-5	Soil	Methoxychlor	8081B	ANAB
72-43-5	Water	Methoxychlor	8081B	ANAB
78-93-3	Soil	Methyl Ethyl Ketone (2-Butanone)	8260B	ANAB
78-93-3	Water	Methyl Ethyl Ketone (2-Butanone)	8260B	ANAB
78-93-3	Soil	Methyl Ethyl Ketone (2-Butanone)	8260C	ANAB
78-93-3	Water	Methyl Ethyl Ketone (2-Butanone)	8260C	ANAB
108-10-1	Soil	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260B	ANAB
108-10-1	Water	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260B	ANAB
108-10-1	Soil	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260C	ANAB
108-10-1	Water	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260C	ANAB
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	524.2	ANAB
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	624	ANAB
1634-04-4	Soil	Methyl tert-Butyl Ether (MTBE)	8260B	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	8260B	ANAB
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	8260C	ANAB
1634-04-4	Air	Methyl tert-Butyl Ether (MTBE)	TO-15	ANAB
75-09-2	Water	Methylene Chloride	524.2	ANAB
75-09-2	Water	Methylene Chloride	624	ANAB
75-09-2	Soil	Methylene Chloride	8260B	ANAB
75-09-2	Water	Methylene Chloride	8260B	ANAB
75-09-2	Soil	Methylene Chloride	8260C	ANAB
75-09-2	Water	Methylene Chloride	8260C	ANAB
75-09-2	Air	Methylene Chloride	TO-15	ANAB
90-12-0	Soil	Methylnaphthalene, 1-	8310	ANAB
90-12-0	Water	Methylnaphthalene, 1-	8310	ANAB
90-12-0	Soil	Methylnaphthalene, 1-	8270C	ANAB
90-12-0	Water	Methylnaphthalene, 1-	8270C	ANAB
90-12-0	Soil	Methylnaphthalene, 1-	8270C-SIM	ANAB
90-12-0	Water	Methylnaphthalene, 1-	8270C-SIM	ANAB
90-12-0	Soil	Methylnaphthalene, 1-	8270D	ANAB
90-12-0	Water	Methylnaphthalene, 1-	8270D	ANAB
90-12-0	Soil	Methylnaphthalene, 1-	8270D-SIM	ANAB
90-12-0	Water	Methylnaphthalene, 1-	8270D-SIM	ANAB
91-57-6	Soil	Methylnaphthalene, 2-	8310	ANAB
91-57-6	Water	Methylnaphthalene, 2-	8310	ANAB
91-57-6	Soil	Methylnaphthalene, 2-	8270C	ANAB
91-57-6	Water	Methylnaphthalene, 2-	8270C	ANAB
91-57-6	Soil	Methylnaphthalene, 2-	8270C-SIM	ANAB
91-57-6	Water	Methylnaphthalene, 2-	8270C-SIM	ANAB
91-57-6	Soil	Methylnaphthalene, 2-	8270D	ANAB
91-57-6	Water	Methylnaphthalene, 2-	8270D	ANAB
91-57-6	Soil	Methylnaphthalene, 2-	8270D-SIM	ANAB
91-57-6	Water	Methylnaphthalene, 2-	8270D-SIM	ANAB
91-20-3	Water	Naphthalene	524.2	ANAB
91-20-3	Water	Naphthalene	625	ANAB
91-20-3	Soil	Naphthalene	8310	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
91-20-3	Water	Naphthalene	8310	ANAB
91-20-3	Soil	Naphthalene	8260B	ANAB
91-20-3	Water	Naphthalene	8260B	ANAB
91-20-3	Soil	Naphthalene	8260C	ANAB
91-20-3	Water	Naphthalene	8260C	ANAB
91-20-3	Soil	Naphthalene	8270C	ANAB
91-20-3	Water	Naphthalene	8270C	ANAB
91-20-3	Soil	Naphthalene	8270C-SIM	ANAB
91-20-3	Water	Naphthalene	8270C-SIM	ANAB
91-20-3	Soil	Naphthalene	8270D	ANAB
91-20-3	Water	Naphthalene	8270D	ANAB
91-20-3	Soil	Naphthalene	8270D-SIM	ANAB
91-20-3	Water	Naphthalene	8270D-SIM	ANAB
7440-02-0	Water	Nickel, Total	200.7	ANAB
7440-02-0	Water	Nickel, Total	200.8	ANAB
7440-02-0	Soil	Nickel, Total	6010B	ANAB
7440-02-0	Water	Nickel, Total	6010B	ANAB
7440-02-0	Soil	Nickel, Total	6010C	ANAB
7440-02-0	Water	Nickel, Total	6010C	ANAB
7440-02-0	Soil	Nickel, Total	6020A	ANAB
7440-02-0	Water	Nickel, Total	6020A	ANAB
98-95-3	Water	Nitrobenzene	625	ANAB
98-95-3	Soil	Nitrobenzene	8270C	ANAB
98-95-3	Water	Nitrobenzene	8270C	ANAB
98-95-3	Soil	Nitrobenzene	8270D	ANAB
98-95-3	Water	Nitrobenzene	8270D	ANAB
98-95-3	Soil	Nitrobenzene	8330A	ANAB
98-95-3	Water	Nitrobenzene	8330A	ANAB
98-95-3	Water	Nitrobenzene	8330B	ANAB
55-63-0	Soil	Nitroglycerin	8332	ANAB
55-63-0	Water	Nitroglycerin	8332	ANAB
62-75-9	Water	Nitrosodimethylamine, N-	625	ANAB
62-75-9	Soil	Nitrosodimethylamine, N-	8270C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
62-75-9	Water	Nitrosodimethylamine, N-	8270C	ANAB
62-75-9	Soil	Nitrosodimethylamine, N-	8270C-SIM	ANAB
62-75-9	Water	Nitrosodimethylamine, N-	8270C-SIM	ANAB
62-75-9	Soil	Nitrosodimethylamine, N-	8270D	ANAB
62-75-9	Water	Nitrosodimethylamine, N-	8270D	ANAB
62-75-9	Soil	Nitrosodimethylamine, N-	8270D-SIM	ANAB
62-75-9	Water	Nitrosodimethylamine, N-	8270D-SIM	ANAB
621-64-7	Water	Nitroso-di-N-propylamine, N-	625	ANAB
621-64-7	Soil	Nitroso-di-N-propylamine, N-	8270C	ANAB
621-64-7	Water	Nitroso-di-N-propylamine, N-	8270C	ANAB
621-64-7	Soil	Nitroso-di-N-propylamine, N-	8270C-SIM	ANAB
621-64-7	Water	Nitroso-di-N-propylamine, N-	8270C-SIM	ANAB
621-64-7	Soil	Nitroso-di-N-propylamine, N-	8270D	ANAB
621-64-7	Water	Nitroso-di-N-propylamine, N-	8270D	ANAB
621-64-7	Soil	Nitroso-di-N-propylamine, N-	8270D-SIM	ANAB
621-64-7	Water	Nitroso-di-N-propylamine, N-	8270D-SIM	ANAB
86-30-6	Water	Nitrosodiphenylamine, N-	625	ANAB
86-30-6	Soil	Nitrosodiphenylamine, N-	8270C	ANAB
86-30-6	Water	Nitrosodiphenylamine, N-	8270C	ANAB
86-30-6	Soil	Nitrosodiphenylamine, N-	8270D	ANAB
86-30-6	Water	Nitrosodiphenylamine, N-	8270D	ANAB
99-08-1	Soil	Nitrotoluene, m-	8330A	ANAB
99-08-1	Water	Nitrotoluene, m-	8330A	ANAB
99-08-1	Water	Nitrotoluene, m-	8330B	ANAB
88-72-2	Soil	Nitrotoluene, o-	8330A	ANAB
88-72-2	Water	Nitrotoluene, o-	8330A	ANAB
88-72-2	Water	Nitrotoluene, o-	8330B	ANAB
99-99-0	Soil	Nitrotoluene, p-	8330A	ANAB
99-99-0	Water	Nitrotoluene, p-	8330A	ANAB
99-99-0	Water	Nitrotoluene, p-	8330B	ANAB
2691-41-0	Soil	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330A	ANAB
2691-41-0	Water	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330A	ANAB
2691-41-0	Water	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330B	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
117-84-0	Water	Octyl Phthalate, di-N-	625	ANAB
117-84-0	Soil	Octyl Phthalate, di-N-	8270C	ANAB
117-84-0	Water	Octyl Phthalate, di-N-	8270C	ANAB
117-84-0	Soil	Octyl Phthalate, di-N-	8270C-SIM	ANAB
117-84-0	Water	Octyl Phthalate, di-N-	8270C-SIM	ANAB
117-84-0	Soil	Octyl Phthalate, di-N-	8270D	ANAB
117-84-0	Water	Octyl Phthalate, di-N-	8270D	ANAB
117-84-0	Soil	Octyl Phthalate, di-N-	8270D-SIM	ANAB
117-84-0	Water	Octyl Phthalate, di-N-	8270D-SIM	ANAB
12674-11-2	Water	PCB - Aroclor-1016	608	ANAB
12674-11-2	Soil	PCB - Aroclor-1016	8082A	ANAB
12674-11-2	Water	PCB - Aroclor-1016	8082A	ANAB
11104-28-2	Water	PCB - Aroclor-1221	608	ANAB
11104-28-2	Soil	PCB - Aroclor-1221	8082A	ANAB
11104-28-2	Water	PCB - Aroclor-1221	8082A	ANAB
11141-16-5	Water	PCB - Aroclor-1232	608	ANAB
11141-16-5	Soil	PCB - Aroclor-1232	8082A	ANAB
11141-16-5	Water	PCB - Aroclor-1232	8082A	ANAB
53469-21-9	Water	PCB - Aroclor-1242	608	ANAB
53469-21-9	Soil	PCB - Aroclor-1242	8082A	ANAB
53469-21-9	Water	PCB - Aroclor-1242	8082A	ANAB
12672-29-6	Water	PCB - Aroclor-1248	608	ANAB
12672-29-6	Soil	PCB - Aroclor-1248	8082A	ANAB
12672-29-6	Water	PCB - Aroclor-1248	8082A	ANAB
11097-69-1	Water	PCB - Aroclor-1254	608	ANAB
11097-69-1	Soil	PCB - Aroclor-1254	8082A	ANAB
11097-69-1	Water	PCB - Aroclor-1254	8082A	ANAB
11096-82-5	Water	PCB - Aroclor-1260	608	ANAB
11096-82-5	Soil	PCB - Aroclor-1260	8082A	ANAB
11096-82-5	Water	PCB - Aroclor-1260	8082A	ANAB
37324-23-5	Water	PCB - Aroclor-1262	608	ANAB
37324-23-5	Soil	PCB - Aroclor-1262	8082A	ANAB
37324-23-5	Water	PCB - Aroclor-1262	8082A	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
11100-14-4	Water	PCB - Aroclor-1268	608	ANAB
11100-14-4	Soil	PCB - Aroclor-1268	8082A	ANAB
11100-14-4	Water	PCB - Aroclor-1268	8082A	ANAB
N/A	Water	PCB – Total	608	ANAB
N/A	Soil	PCB – Total	8082A	ANAB
N/A	Water	PCB – Total	8082A	ANAB
87-86-5	Water	Pentachlorophenol	625	ANAB
87-86-5	Soil	Pentachlorophenol	8151A	ANAB
87-86-5	Water	Pentachlorophenol	8151A	ANAB
87-86-5	Soil	Pentachlorophenol	8270C	ANAB
87-86-5	Water	Pentachlorophenol	8270C	ANAB
87-86-5	Soil	Pentachlorophenol	8270C-SIM	ANAB
87-86-5	Water	Pentachlorophenol	8270C-SIM	ANAB
87-86-5	Soil	Pentachlorophenol	8270D	ANAB
87-86-5	Water	Pentachlorophenol	8270D	ANAB
87-86-5	Soil	Pentachlorophenol	8270D-SIM	ANAB
87-86-5	Water	Pentachlorophenol	8270D-SIM	ANAB
78-11-5	Soil	Pentaerythritol tetranitrate (PETN)	8332	ANAB
78-11-5	Water	Pentaerythritol tetranitrate (PETN)	8332	ANAB
14797-73-0	Water	Perchlorate and Perchlorate Salts	314	ANAB
14797-73-0	Soil	Perchlorate and Perchlorate Salts	6850	ANAB
14797-73-0	Water	Perchlorate and Perchlorate Salts	6850	ANAB
85-01-8	Water	Phenanthrene	625	ANAB
85-01-8	Soil	Phenanthrene	8310	ANAB
85-01-8	Water	Phenanthrene	8310	ANAB
85-01-8	Soil	Phenanthrene	8270C	ANAB
85-01-8	Water	Phenanthrene	8270C	ANAB
85-01-8	Soil	Phenanthrene	8270C-SIM	ANAB
85-01-8	Water	Phenanthrene	8270C-SIM	ANAB
85-01-8	Soil	Phenanthrene	8270D	ANAB
85-01-8	Water	Phenanthrene	8270D	ANAB
85-01-8	Soil	Phenanthrene	8270D-SIM	ANAB
85-01-8	Water	Phenanthrene	8270D-SIM	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
108-95-2	Water	Phenol	625	ANAB
108-95-2	Soil	Phenol	8270C	ANAB
108-95-2	Water	Phenol	8270C	ANAB
108-95-2	Soil	Phenol	8270C-SIM	ANAB
108-95-2	Water	Phenol	8270C-SIM	ANAB
108-95-2	Soil	Phenol	8270D	ANAB
108-95-2	Water	Phenol	8270D	ANAB
108-95-2	Soil	Phenol	8270D-SIM	ANAB
108-95-2	Water	Phenol	8270D-SIM	ANAB
103-65-1	Water	Propyl benzene	524.2	ANAB
103-65-1	Soil	Propyl benzene	8260B	ANAB
103-65-1	Water	Propyl benzene	8260B	ANAB
103-65-1	Soil	Propyl benzene	8260C	ANAB
103-65-1	Water	Propyl benzene	8260C	ANAB
129-00-0	Water	Pyrene	625	ANAB
129-00-0	Soil	Pyrene	8310	ANAB
129-00-0	Water	Pyrene	8310	ANAB
129-00-0	Soil	Pyrene	8270C	ANAB
129-00-0	Water	Pyrene	8270C	ANAB
129-00-0	Soil	Pyrene	8270C-SIM	ANAB
129-00-0	Water	Pyrene	8270C-SIM	ANAB
129-00-0	Soil	Pyrene	8270D	ANAB
129-00-0	Water	Pyrene	8270D	ANAB
129-00-0	Soil	Pyrene	8270D-SIM	ANAB
129-00-0	Water	Pyrene	8270D-SIM	ANAB
N/A	Soil	Residual Range Organics (C25 – C36)	AK 103	ANAB
N/A	Water	Residual Range Organics (C25 – C36)	AK 103	ANAB
7782-49-2	Water	Selenium	200.7	ANAB
7782-49-2	Water	Selenium	200.8	ANAB
7782-49-2	Soil	Selenium	6010B	ANAB
7782-49-2	Water	Selenium	6010B	ANAB
7782-49-2	Soil	Selenium	6010C	ANAB
7782-49-2	Water	Selenium	6010C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
7782-49-2	Soil	Selenium	6020A	ANAB
7782-49-2	Water	Selenium	6020A	ANAB
7440-22-4	Water	Silver	200.7	ANAB
7440-22-4	Water	Silver	200.8	ANAB
7440-22-4	Soil	Silver	6010B	ANAB
7440-22-4	Water	Silver	6010B	ANAB
7440-22-4	Soil	Silver	6010C	ANAB
7440-22-4	Water	Silver	6010C	ANAB
7440-22-4	Soil	Silver	6020A	ANAB
7440-22-4	Water	Silver	6020A	ANAB
100-42-5	Water	Styrene	524.2	ANAB
100-42-5	Water	Styrene	624	ANAB
100-42-5	Soil	Styrene	8260B	ANAB
100-42-5	Water	Styrene	8260B	ANAB
100-42-5	Soil	Styrene	8260C	ANAB
100-42-5	Water	Styrene	8260C	ANAB
100-42-5	Air	Styrene	TO-15	ANAB
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	524.2	ANAB
630-20-6	Soil	Tetrachloroethane, 1,1,1,2-	8260B	ANAB
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	8260B	ANAB
630-20-6	Soil	Tetrachloroethane, 1,1,1,2-	8260C	ANAB
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	8260C	ANAB
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	524.2	ANAB
79-34-5	Soil	Tetrachloroethane, 1,1,2,2-	8260B	ANAB
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	8260B	ANAB
79-34-5	Soil	Tetrachloroethane, 1,1,2,2-	8260C	ANAB
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	8260C	ANAB
79-34-5	Air	Tetrachloroethane, 1,1,2,2-	TO-15	ANAB
127-18-4	Water	Tetrachloroethylene	524.2	ANAB
127-18-4	Water	Tetrachloroethylene	624	ANAB
127-18-4	Soil	Tetrachloroethylene	8260B	ANAB
127-18-4	Water	Tetrachloroethylene	8260B	ANAB
127-18-4	Soil	Tetrachloroethylene	8260C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
127-18-4	Water	Tetrachloroethylene	8260C	ANAB
127-18-4	Air	Tetrachloroethylene	TO-15	ANAB
479-45-8	Soil	Tetryl (Trinitrophenylmethylnitramine)	8330A	ANAB
479-45-8	Water	Tetryl (Trinitrophenylmethylnitramine)	8330A	ANAB
479-45-8	Water	Tetryl (Trinitrophenylmethylnitramine)	8330B	ANAB
7440-28-0	Water	Thallium, Total	200.7	ANAB
7440-28-0	Water	Thallium, Total	200.8	ANAB
7440-28-0	Soil	Thallium, Total	6010B	ANAB
7440-28-0	Water	Thallium, Total	6010B	ANAB
7440-28-0	Soil	Thallium, Total	6010C	ANAB
7440-28-0	Water	Thallium, Total	6010C	ANAB
7440-28-0	Soil	Thallium, Total	6020A	ANAB
7440-28-0	Water	Thallium, Total	6020A	ANAB
108-88-3	Water	Toluene	524.2	ANAB
108-88-3	Water	Toluene	624	ANAB
108-88-3	Soil	Toluene	8260B	ANAB
108-88-3	Water	Toluene	8260B	ANAB
108-88-3	Soil	Toluene	8260C	ANAB
108-88-3	Water	Toluene	8260C	ANAB
108-88-3	Air	Toluene	TO-15	ANAB
N/A	Water	Total Organic Carbon	9060A	ANAB
N/A	Water	Total Organic Carbon	SM 5310 B	ANAB
N/A	Soil	Total Organic Carbon	Walkley Black	ANAB
8001-35-2	Water	Toxaphene	608	ANAB
8001-35-2	Soil	Toxaphene	8081A	ANAB
8001-35-2	Water	Toxaphene	8081A	ANAB
8001-35-2	Soil	Toxaphene	8081B	ANAB
8001-35-2	Water	Toxaphene	8081B	ANAB
76-13-1	Soil	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260B	ANAB
76-13-1	Water	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260B	ANAB
76-13-1	Soil	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260C	ANAB
76-13-1	Water	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260C	ANAB
87-61-6	Water	Trichlorobenzene, 1,2,3-	524.2	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
87-61-6	Soil	Trichlorobenzene, 1,2,3-	8260B	ANAB
87-61-6	Water	Trichlorobenzene, 1,2,3-	8260B	ANAB
87-61-6	Soil	Trichlorobenzene, 1,2,3-	8260C	ANAB
87-61-6	Water	Trichlorobenzene, 1,2,3-	8260C	ANAB
120-82-1	Water	Trichlorobenzene, 1,2,4-	524.2	ANAB
120-82-1	Water	Trichlorobenzene, 1,2,4-	624	ANAB
120-82-1	Water	Trichlorobenzene, 1,2,4-	625	ANAB
120-82-1	Soil	Trichlorobenzene, 1,2,4-	8260B	ANAB
120-82-1	Water	Trichlorobenzene, 1,2,4-	8260B	ANAB
120-82-1	Soil	Trichlorobenzene, 1,2,4-	8260C	ANAB
120-82-1	Water	Trichlorobenzene, 1,2,4-	8260C	ANAB
120-82-1	Air	Trichlorobenzene, 1,2,4-	TO-15	ANAB
71-55-6	Water	Trichloroethane, 1,1,1-	524.2	ANAB
71-55-6	Water	Trichloroethane, 1,1,1-	624	ANAB
71-55-6	Soil	Trichloroethane, 1,1,1-	8260B	ANAB
71-55-6	Water	Trichloroethane, 1,1,1-	8260B	ANAB
71-55-6	Soil	Trichloroethane, 1,1,1-	8260C	ANAB
71-55-6	Water	Trichloroethane, 1,1,1-	8260C	ANAB
71-55-6	Air	Trichloroethane, 1,1,1-	TO-15	ANAB
79-00-5	Water	Trichloroethane, 1,1,2-	524.2	ANAB
79-00-5	Water	Trichloroethane, 1,1,2-	624	ANAB
79-00-5	Soil	Trichloroethane, 1,1,2-	8260B	ANAB
79-00-5	Water	Trichloroethane, 1,1,2-	8260B	ANAB
79-00-5	Soil	Trichloroethane, 1,1,2-	8260C	ANAB
79-00-5	Water	Trichloroethane, 1,1,2-	8260C	ANAB
79-00-5	Air	Trichloroethane, 1,1,2-	TO-15	ANAB
79-01-6	Water	Trichloroethylene	524.2	ANAB
79-01-6	Soil	Trichloroethylene	8260B	ANAB
79-01-6	Water	Trichloroethylene	8260B	ANAB
79-01-6	Soil	Trichloroethylene	8260C	ANAB
79-01-6	Water	Trichloroethylene	8260C	ANAB
79-01-6	Air	Trichloroethylene	TO-15	ANAB
75-69-4	Water	Trichlorofluoromethane	524.2	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
75-69-4	Water	Trichlorofluoromethane	624	ANAB
75-69-4	Soil	Trichlorofluoromethane	8260B	ANAB
75-69-4	Water	Trichlorofluoromethane	8260B	ANAB
75-69-4	Soil	Trichlorofluoromethane	8260C	ANAB
75-69-4	Water	Trichlorofluoromethane	8260C	ANAB
75-69-4	Air	Trichlorofluoromethane	TO-15	ANAB
95-95-4	Water	Trichlorophenol, 2,4,5-	625	ANAB
95-95-4	Soil	Trichlorophenol, 2,4,5-	8270C	ANAB
95-95-4	Water	Trichlorophenol, 2,4,5-	8270C	ANAB
95-95-4	Soil	Trichlorophenol, 2,4,5-	8270C-SIM	ANAB
95-95-4	Water	Trichlorophenol, 2,4,5-	8270C-SIM	ANAB
95-95-4	Soil	Trichlorophenol, 2,4,5-	8270D	ANAB
95-95-4	Water	Trichlorophenol, 2,4,5-	8270D	ANAB
95-95-4	Soil	Trichlorophenol, 2,4,5-	8270D-SIM	ANAB
95-95-4	Water	Trichlorophenol, 2,4,5-	8270D-SIM	ANAB
88-06-2	Water	Trichlorophenol, 2,4,6-	625	ANAB
88-06-2	Soil	Trichlorophenol, 2,4,6-	8270C	ANAB
88-06-2	Water	Trichlorophenol, 2,4,6-	8270C	ANAB
88-06-2	Soil	Trichlorophenol, 2,4,6-	8270C-SIM	ANAB
88-06-2	Water	Trichlorophenol, 2,4,6-	8270C-SIM	ANAB
88-06-2	Soil	Trichlorophenol, 2,4,6-	8270D	ANAB
88-06-2	Water	Trichlorophenol, 2,4,6-	8270D	ANAB
88-06-2	Soil	Trichlorophenol, 2,4,6-	8270D-SIM	ANAB
88-06-2	Water	Trichlorophenol, 2,4,6-	8270D-SIM	ANAB
93-76-5	Soil	Trichlorophenoxyacetic Acid, 2,4,5- (2,4,5-T)	8151A	ANAB
93-76-5	Water	Trichlorophenoxyacetic Acid, 2,4,5- (2,4,5-T)	8151A	ANAB
93-72-1	Soil	Trichlorophenoxypropionic acid, 2,4,5- (2,4,5-TP)	8151A	ANAB
93-72-1	Water	Trichlorophenoxypropionic acid, 2,4,5- (2,4,5-TP)	8151A	ANAB
96-18-4	Soil	Trichloropropane, 1,2,3-	8260B	ANAB
96-18-4	Water	Trichloropropane, 1,2,3-	8260B	ANAB
96-18-4	Soil	Trichloropropane, 1,2,3-	8260C	ANAB
96-18-4	Water	Trichloropropane, 1,2,3-	8260C	ANAB
95-63-6	Water	Trimethylbenzene, 1,2,4-	524.2	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
95-63-6	Soil	Trimethylbenzene, 1,2,4-	8260B	ANAB
95-63-6	Water	Trimethylbenzene, 1,2,4-	8260B	ANAB
95-63-6	Soil	Trimethylbenzene, 1,2,4-	8260C	ANAB
95-63-6	Water	Trimethylbenzene, 1,2,4-	8260C	ANAB
95-63-6	Air	Trimethylbenzene, 1,2,4-	TO-15	ANAB
108-67-8	Water	Trimethylbenzene, 1,3,5-	524.2	ANAB
108-67-8	Soil	Trimethylbenzene, 1,3,5-	8260B	ANAB
108-67-8	Water	Trimethylbenzene, 1,3,5-	8260B	ANAB
108-67-8	Soil	Trimethylbenzene, 1,3,5-	8260C	ANAB
108-67-8	Water	Trimethylbenzene, 1,3,5-	8260C	ANAB
108-67-8	Air	Trimethylbenzene, 1,3,5-	TO-15	ANAB
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270C	ANAB
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270D	ANAB
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270D	ANAB
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330A	ANAB
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330A	ANAB
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330B	ANAB
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270C	ANAB
118-96-7	Soil	Trinitrotoluene, 2,4,6-	8330A	ANAB
118-96-7	Water	Trinitrotoluene, 2,4,6-	8330A	ANAB
118-96-7	Water	Trinitrotoluene, 2,4,6-	8330B	ANAB
7440-62-2	Water	Vanadium, Total	200.7	ANAB
7440-62-2	Water	Vanadium, Total	200.8	ANAB
7440-62-2	Soil	Vanadium, Total	6010B	ANAB
7440-62-2	Water	Vanadium, Total	6010B	ANAB
7440-62-2	Soil	Vanadium, Total	6010C	ANAB
7440-62-2	Water	Vanadium, Total	6010C	ANAB
7440-62-2	Soil	Vanadium, Total	6020A	ANAB
7440-62-2	Water	Vanadium, Total	6020A	ANAB
108-05-4	Soil	Vinyl Acetate	8260B	ANAB
108-05-4	Water	Vinyl Acetate	8260B	ANAB
108-05-4	Soil	Vinyl Acetate	8260C	ANAB
108-05-4	Water	Vinyl Acetate	8260C	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
108-05-4	Air	Vinyl Acetate	TO-15	ANAB
75-01-4	Water	Vinyl Chloride	524.2	ANAB
75-01-4	Water	Vinyl Chloride	624	ANAB
75-01-4	Soil	Vinyl Chloride	8260B	ANAB
75-01-4	Water	Vinyl Chloride	8260B	ANAB
75-01-4	Soil	Vinyl Chloride	8260C	ANAB
75-01-4	Water	Vinyl Chloride	8260C	ANAB
75-01-4	Air	Vinyl Chloride	TO-15	ANAB
N/A	Water	Xylene, m+p-	524.2	ANAB
N/A	Water	Xylene, m+p-	624	ANAB
N/A	Soil	Xylene, m+p-	8260B	ANAB
N/A	Water	Xylene, m+p-	8260B	ANAB
N/A	Soil	Xylene, m+p-	8260C	ANAB
N/A	Water	Xylene, m+p-	8260C	ANAB
N/A	Air	Xylene, m+p-	TO-15	ANAB
95-47-6	Water	Xylene, o-	524.2	ANAB
95-47-6	Water	Xylene, o-	624	ANAB
95-47-6	Soil	Xylene, o-	8260B	ANAB
95-47-6	Water	Xylene, o-	8260B	ANAB
95-47-6	Soil	Xylene, o-	8260C	ANAB
95-47-6	Water	Xylene, o-	8260C	ANAB
95-47-6	Air	Xylene, o-	TO-15	ANAB
1330-20-7	Water	Xylene, Total	524.2	ANAB
1330-20-7	Water	Xylene, Total	624	ANAB
1330-20-7	Soil	Xylene, Total	8260B	ANAB
1330-20-7	Water	Xylene, Total	8260B	ANAB
1330-20-7	Soil	Xylene, Total	8260C	ANAB
1330-20-7	Water	Xylene, Total	8260C	ANAB
1330-20-7	Air	Xylene, Total	TO-15	ANAB
7440-66-6	Water	Zinc, Total	200.7	ANAB
7440-66-6	Water	Zinc, Total	200.8	ANAB
7440-66-6	Soil	Zinc, Total	6010B	ANAB
7440-66-6	Water	Zinc, Total	6010B	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
7440-66-6	Soil	Zinc, Total	6010C	ANAB
7440-66-6	Water	Zinc, Total	6010C	ANAB
7440-66-6	Soil	Zinc, Total	6020A	ANAB
7440-66-6	Water	Zinc, Total	6020A	ANAB

CERTIFICATE OF ACCREDITATION

ANSI National Accreditation Board

11617 Coldwater Road, Fort Wayne, IN 46845 USA

This is to certify that

EMAX Laboratories, Inc.

1835 W. 205th Street
Torrance, CA 90501

has been assessed by ANAB and meets the requirements of international standard

ISO/IEC 17025:2017

and the

US Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (DoD QSM V5.3)

while demonstrating technical competence in the field of

TESTING

Refer to the accompanying Scope of Accreditation for information regarding the types of activities to which this accreditation applies

L2278
Certificate Number

ANAB Approval

Certificate Valid Through: 01/10/2023
Version No. 004 Issued: 12/17/2019

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017 AND US DEPARTMENT OF DEFENSE (DOD) QUALITY SYSTEMS MANUAL FOR ENVIRONMENTAL LABORATORIES (DOD QSM V5.3)

EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501
Kenette Pimentel
310-618-8889

TESTING

Valid to: **January 10, 2023** Certificate Number: **L2278**

Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	AK101	GRO
GC	AK102	DRO
GFAA	CA 939M	Organo Lead
Platinum Electrode	EPA 120.1	Specific Conductance
Electrode	EPA 150.1	pH
Turbidimetric	EPA 180.1	Turbidity
ICP	EPA 200.7	Aluminum
ICP	EPA 200.7	Antimony
ICP	EPA 200.7	Arsenic
ICP	EPA 200.7	Barium
ICP	EPA 200.7	Beryllium
ICP	EPA 200.7	Boron
ICP	EPA 200.7	Cadmium
ICP	EPA 200.7	Calcium
ICP	EPA 200.7	Chromium
ICP	EPA 200.7	Cobalt
ICP	EPA 200.7	Copper
ICP	EPA 200.7	Iron
ICP	EPA 200.7	Lead
ICP	EPA 200.7	Lithium
ICP	EPA 200.7	Magnesium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP	EPA 200.7	Manganese
ICP	EPA 200.7	Molybdenum
ICP	EPA 200.7	Nickel
ICP	EPA 200.7	Potassium
ICP	EPA 200.7	Selenium
ICP	EPA 200.7	Silver
ICP	EPA 200.7	Sodium
ICP	EPA 200.7	Strontium
ICP	EPA 200.7	Thallium
ICP	EPA 200.7	Tin
ICP	EPA 200.7	Titanium
ICP	EPA 200.7	Vanadium
ICP	EPA 200.7	Zinc
ICP-MS	EPA 200.8	Aluminum
ICP-MS	EPA 200.8	Antimony
ICP-MS	EPA 200.8	Arsenic
ICP-MS	EPA 200.8	Barium
ICP-MS	EPA 200.8	Beryllium
ICP-MS	EPA 200.8	Boron
ICP-MS	EPA 200.8	Cadmium
ICP-MS	EPA 200.8	Calcium
ICP-MS	EPA 200.8	Chromium
ICP-MS	EPA 200.8	Cobalt
ICP-MS	EPA 200.8	Copper
ICP-MS	EPA 200.8	Iron
ICP-MS	EPA 200.8	Lead
ICP-MS	EPA 200.8	Lithium
ICP-MS	EPA 200.8	Magnesium
ICP-MS	EPA 200.8	Manganese
ICP-MS	EPA 200.8	Molybdenum
ICP-MS	EPA 200.8	Nickel
ICP-MS	EPA 200.8	Potassium
ICP-MS	EPA 200.8	Selenium
ICP-MS	EPA 200.8	Silver
ICP-MS	EPA 200.8	Sodium
ICP-MS	EPA 200.8	Strontium
ICP-MS	EPA 200.8	Thallium
ICP-MS	EPA 200.8	Tin
ICP-MS	EPA 200.8	Titanium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 200.8	Uranium
ICP-MS	EPA 200.8	Vanadium
ICP-MS	EPA 200.8	Zinc
IC	EPA 218.6	Hexavalent Chromium
COLD VAPOR	EPA 245.1	Mercury
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Chloride
IC	EPA 300.0	Nitrite
IC	EPA 300.0	Bromide
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Phosphate
IC	EPA 300.0	Sulfate
IC	EPA 300.0	Bromate
IC	EPA 300.0	Chlorate
IC	EPA 300.0	Nitrate-Nitrite
IC	EPA 300M	Lactate
IC	EPA 300M	Acetate
IC	EPA 300M	Propionate
IC	EPA 300M	Butyrate
IC	EPA 300M	Pyruvate
IC	EPA 314.0	Perchlorate
Spectrometric	EPA 410.4	COD
Spectrometric	EPA 420.1	Phenols
GC	EPA 504.1	DBCP
GC	EPA 504.1	EDB
GC	EPA 608	Aldrin
GC	EPA 608	alpha-BHC
GC	EPA 608	beta-BHC
GC	EPA 608	delta-BHC
GC	EPA 608	gamma-BHC (Lindane)
GC	EPA 608	DDD (4,4)
GC	EPA 608	DDE (4,4)
GC	EPA 608	DDT (4,4)
GC	EPA 608	Dieldrin
GC	EPA 608	Endosulfan I
GC	EPA 608	Endosulfan II
GC	EPA 608	Endosulfan sulfate
GC	EPA 608	Endrin
GC	EPA 608	Endrin Aldehyde

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 608	Heptachlor
GC	EPA 608	Heptachlor epoxide
GC	EPA 608	Methoxychlor
GC	EPA 608	alpha-Chlordane
GC	EPA 608	gamma-Chlordane
GC	EPA 608	Endrin Ketone
GC	EPA 608	Toxaphene
GC	EPA 608	Technical Chlordane
GC	EPA 608	cis-Nonachlor
GC	EPA 608	DDD (2,4)
GC	EPA 608	DDE (2,4)
GC	EPA 608	DDT (2,4)
GC	EPA 608	Mirex
GC	EPA 608	Oxychlordane
GC	EPA 608	trans-Nonachlor
GC	EPA 608	PCB1016
GC	EPA 608	PCB1221
GC	EPA 608	PCB1232
GC	EPA 608	PCB1242
GC	EPA 608	PCB1248
GC	EPA 608	PCB1254
GC	EPA 608	PCB1260
GC	EPA 608	PCB1262
GC	EPA 608	PCB1268
GC-MS	EPA 624	Acrolein
GC-MS	EPA 624	Acrylonitrile
GC-MS	EPA 624	Benzene
GC-MS	EPA 624	Bromodichloromethane
GC-MS	EPA 624	Bromoform
GC-MS	EPA 624	Bromomethane
GC-MS	EPA 624	Carbon tetrachloride
GC-MS	EPA 624	Chlorobenzene
GC-MS	EPA 624	2-Chloroethyl vinyl ether
GC-MS	EPA 624	Chloroethane
GC-MS	EPA 624	Chloroform
GC-MS	EPA 624	Chloromethane
GC-MS	EPA 624	Dibromochloromethane
GC-MS	EPA 624	1,1-Dichloroethane
GC-MS	EPA 624	1,2-Dichloroethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 624	1,2-Dichlorobenzene
GC-MS	EPA 624	1,3-Dichlorobenzene
GC-MS	EPA 624	1,4-Dichlorobenzene
GC-MS	EPA 624	Dichlorodifluoromethane
GC-MS	EPA 624	1,1-Dichloroethene
GC-MS	EPA 624	cis-1,2-Dichloroethene
GC-MS	EPA 624	trans-1,2-Dichloroethene
GC-MS	EPA 624	1,2-Dichloropropane
GC-MS	EPA 624	cis-1,3-Dichloropropene
GC-MS	EPA 624	trans-1,3-Dichloropropene
GC-MS	EPA 624	Ethylbenzene
GC-MS	EPA 624	Methylene Chloride
GC-MS	EPA 624	tert-Butyl methyl ether
GC-MS	EPA 624	Styrene
GC-MS	EPA 624	1,1,2,2-Tetrachloroethane
GC-MS	EPA 624	Tetrachloroethene
GC-MS	EPA 624	Toluene
GC-MS	EPA 624	1,1,1-Trichloroethane
GC-MS	EPA 624	1,1,2-Trichloroethane
GC-MS	EPA 624	1,2,4-Trichlorobenzene
GC-MS	EPA 624	Trichloroethene
GC-MS	EPA 624	Trichlorofluoromethane
GC-MS	EPA 624	1,1,2-Trichloro1,2,2-trifluoroethane
GC-MS	EPA 624	Vinyl Chloride
GC-MS	EPA 624	m-Xylene & p-xylene
GC-MS	EPA 624	o-Xylene
GC-MS	EPA 625	Acenaphthene
GC-MS	EPA 625	Acenaphthylene
GC-MS	EPA 625	Aniline
GC-MS	EPA 625	Anthracene
GC-MS	EPA 625	Azobenzene
GC-MS	EPA 625	Benzidine
GC-MS	EPA 625	Benzo(a)anthracene
GC-MS	EPA 625	benzo(a)pyrene
GC-MS	EPA 625	Benzo(b)fluoranthene
GC-MS	EPA 625	Benzo(e)pyrene
GC-MS	EPA 625	Benzo(g,h,i)perylene
GC-MS	EPA 625	Benzo(k)fluoranthene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 625	Benzoic Acid
GC-MS	EPA 625	Benzyl Alcohol
GC-MS	EPA 625	Biphenyl
GC-MS	EPA 625	bis(2-chloroethoxy)methane
GC-MS	EPA 625	bis(2-chloroethyl)ether
GC-MS	EPA 625	2,2-oxybis(1-chloropropane)
GC-MS	EPA 625	bis(2-Ethylhexyl)adipate
GC-MS	EPA 625	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 625	4-Bromophenyl-phenylether
GC-MS	EPA 625	Butylbenzylphthalate
GC-MS	EPA 625	Carbazole
GC-MS	EPA 625	4-Chloro-3-methylphenol
GC-MS	EPA 625	4-Chloroaniline
GC-MS	EPA 625	2-Chloronaphthalene
GC-MS	EPA 625	2-Chlorophenol
GC-MS	EPA 625	4-Chlorophenyl-phenylether
GC-MS	EPA 625	Chrysene
GC-MS	EPA 625	Dibenzo(a,h)anthracene
GC-MS	EPA 625	Dibenzofuran
GC-MS	EPA 625	1,2-Dichlorobenzene
GC-MS	EPA 625	1,3-Dichlorobenzene
GC-MS	EPA 625	1,4-Dichlorobenzene
GC-MS	EPA 625	3,3'-Dichlorobenzidine
GC-MS	EPA 625	2,4-Dichlorophenol
GC-MS	EPA 625	Diethylphthalate
GC-MS	EPA 625	2,6-Dimethylnaphthalene
GC-MS	EPA 625	2,4-Dimethylphenol
GC-MS	EPA 625	Dimethylphthalate
GC-MS	EPA 625	Di-n-butylphthalate
GC-MS	EPA 625	4,6-Dinitro-2-methylphenol
GC-MS	EPA 625	2,4-Dinitrophenol
GC-MS	EPA 625	2,4-Dinitrotoluene
GC-MS	EPA 625	2,6-Dinitrotoluene
GC-MS	EPA 625	Di-n-octylphthalate
GC-MS	EPA 625	1,2-Diphenylhydrazine
GC-MS	EPA 625	Fluoranthene
GC-MS	EPA 625	Fluorene
GC-MS	EPA 625	Hexachlorobenzene
GC-MS	EPA 625	Hexachlorobutadiene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 625	Hexachlorocyclopentadiene
GC-MS	EPA 625	Hexachloroethane
GC-MS	EPA 625	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 625	Isophorone
GC-MS	EPA 625	1-Methylnaphthalene
GC-MS	EPA 625	2-Methylnaphthalene
GC-MS	EPA 625	1-Methylphenanthrene
GC-MS	EPA 625	2-Methylphenol
GC-MS	EPA 625	4-Methylphenol
GC-MS	EPA 625	Naphthalene
GC-MS	EPA 625	2-Nitroaniline
GC-MS	EPA 625	3-Nitroaniline
GC-MS	EPA 625	4-Nitroaniline
GC-MS	EPA 625	Nitrobenzene
GC-MS	EPA 625	2-Nitrophenol
GC-MS	EPA 625	4-Nitrophenol
GC-MS	EPA 625	n-Nitrosodimethylamine
GC-MS	EPA 625	n-Nitroso-di-n-propylamine
GC-MS	EPA 625	n-Nitrosodiphenylamine
GC-MS	EPA 625	Pentachlorophenol
GC-MS	EPA 625	Perylene
GC-MS	EPA 625	Phenanthrene
GC-MS	EPA 625	Phenol
GC-MS	EPA 625	Pyrene
GC-MS	EPA 625	Pyridine
GC-MS	EPA 625	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 625	1,2,4-Trichlorobenzene
GC-MS	EPA 625	2,3,4-Trichlorophenol
GC-MS	EPA 625	2,3,5-Trichlorophenol
GC-MS	EPA 625	2,4,5-Trichlorophenol
GC-MS	EPA 625	2,4,6-Trichlorophenol
GC-MS	EPA 625	2,3,5-Trimethylnaphthalene
Gravimetric	EPA 1664A / 1664 B	Oil & Grease
Pensky-Martens	EPA 1010 / 1010A	Ignitability
ICP	EPA 6010B / 6010C	Aluminum
ICP	EPA 6010B / 6010C	Antimony
ICP	EPA 6010B / 6010C	Arsenic
ICP	EPA 6010B / 6010C	Barium
ICP	EPA 6010B / 6010C	Beryllium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP	EPA 6010B / 6010C	Boron
ICP	EPA 6010B / 6010C	Cadmium
ICP	EPA 6010B / 6010C	Calcium
ICP	EPA 6010B / 6010C	Chromium
ICP	EPA 6010B / 6010C	Cobalt
ICP	EPA 6010B / 6010C	Copper
ICP	EPA 6010B / 6010C	Iron
ICP	EPA 6010B / 6010C	Lead
ICP	EPA 6010B / 6010C	Lithium
ICP	EPA 6010B / 6010C	Magnesium
ICP	EPA 6010B / 6010C	Manganese
ICP	EPA 6010B / 6010C	Molybdenum
ICP	EPA 6010B / 6010C	Nickel
ICP	EPA 6010B / 6010C	Potassium
ICP	EPA 6010B / 6010C	Selenium
ICP	EPA 6010B / 6010C	Silver
ICP	EPA 6010B / 6010C	Sodium
ICP	EPA 6010B / 6010C	Strontium
ICP	EPA 6010B / 6010C	Thallium
ICP	EPA 6010B / 6010C	Tin
ICP	EPA 6010B / 6010C	Titanium
ICP	EPA 6010B / 6010C	Vanadium
ICP	EPA 6010B / 6010C	Zinc
ICP-MS	EPA 6020A	Aluminum
ICP-MS	EPA 6020A	Antimony
ICP-MS	EPA 6020A	Arsenic
ICP-MS	EPA 6020A	Barium
ICP-MS	EPA 6020A	Beryllium
ICP-MS	EPA 6020A	Boron
ICP-MS	EPA 6020A	Cadmium
ICP-MS	EPA 6020A	Calcium
ICP-MS	EPA 6020A	Chromium
ICP-MS	EPA 6020A	Cobalt
ICP-MS	EPA 6020A	Copper
ICP-MS	EPA 6020A	Iron
ICP-MS	EPA 6020A	Lead
ICP-MS	EPA 6020A	Lithium
ICP-MS	EPA 6020A	Magnesium
ICP-MS	EPA 6020A	Manganese

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020A	Molybdenum
ICP-MS	EPA 6020A	Nickel
ICP-MS	EPA 6020A	Potassium
ICP-MS	EPA 6020A	Selenium
ICP-MS	EPA 6020A	Silver
ICP-MS	EPA 6020A	Sodium
ICP-MS	EPA 6020A	Strontium
ICP-MS	EPA 6020A	Thallium
ICP-MS	EPA 6020A	Tin
ICP-MS	EPA 6020A	Titanium
ICP-MS	EPA 6020A	Tungsten
ICP-MS	EPA 6020A	Uranium
ICP-MS	EPA 6020A	Vanadium
ICP-MS	EPA 6020A	Zinc
HPLC-MS	EPA 6850	Perchlorate
Spectrometric	EPA 7196A	Hex. Chromium
IC	EPA 7199	Hex. Chromium
Cold-Vapor	EPA 7470A	Mercury
GC	EPA 8015B / 8015C / 8015D	GRO
GC	EPA 8015B / 8015C / 8015D	DRO
GC	EPA 8015B / 8015C / 8015D	ORO
GC	EPA 8015B / 8015C	Diethylene Glycol
GC	EPA 8015B / 8015C	Ethanol
GC	EPA 8015B / 8015C	Ethylene Glycol
GC	EPA 8015B / 8015C	Isopropanol
GC	EPA 8015B / 8015C / 8015D	JP4
GC	EPA 8015B / 8015C	Methanol
GC	EPA 8015B / 8015C	Propylene Glycol
GC	EPA 8015B / 8015C / 8015D	JP5
GC	EPA 8015B / 8015C	Triethylene Glycol
GC	EPA 8081A / 8081B	Aldrin
GC	EPA 8081A / 8081B	alpha-BHC
GC	EPA 8081A / 8081B	beta-BHC
GC	EPA 8081A / 8081B	delta-BHC
GC	EPA 8081A / 8081B	gamma-BHC (Lindane)
GC	EPA 8081A / 8081B	DDD (4,4)
GC	EPA 8081A / 8081B	DDE (4,4)
GC	EPA 8081A / 8081B	DDT (4,4)
GC	EPA 8081A / 8081B	Dieldrin

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 8081A / 8081B	Endosulfan I
GC	EPA 8081A / 8081B	Endosulfan II
GC	EPA 8081A / 8081B	Endosulfan sulfate
GC	EPA 8081A / 8081B	Endrin
GC	EPA 8081A / 8081B	Endrin Aldehyde
GC	EPA 8081A / 8081B	Heptachlor
GC	EPA 8081A / 8081B	Heptachlor epoxide
GC	EPA 8081A / 8081B	Methoxychlor
GC	EPA 8081A / 8081B	alpha-Chlordane
GC	EPA 8081A / 8081B	gamma-Chlordane
GC	EPA 8081A / 8081B	Endrin Ketone
GC	EPA 8081A / 8081B	Toxaphene
GC	EPA 8081A / 8081B	Technical Chlordane
GC	EPA 8081A / 8081B	cis-Nonachlor
GC	EPA 8081A / 8081B	DDD (2,4)
GC	EPA 8081A / 8081B	DDE (2,4)
GC	EPA 8081A / 8081B	DDT (2,4)
GC	EPA 8081A / 8081B	Mirex
GC	EPA 8081A / 8081B	Oxychlordane
GC	EPA 8081A / 8081B	trans-Nonachlor
GC	EPA 8082 / 8082A	PCB1016
GC	EPA 8082 / 8082A	PCB1221
GC	EPA 8082 / 8082A	PCB1232
GC	EPA 8082 / 8082A	PCB1242
GC	EPA 8082 / 8082A	PCB1248
GC	EPA 8082 / 8082A	PCB1254
GC	EPA 8082 / 8082A	PCB1260
GC	EPA 8082 / 8082A	PCB1262
GC	EPA 8082 / 8082A	PCB1268
GC	EPA 8082 / 8082A	PCB 8
GC	EPA 8082 / 8082A	PCB 18
GC	EPA 8082 / 8082A	PCB 28
GC	EPA 8082 / 8082A	PCB 44
GC	EPA 8082 / 8082A	PCB 52
GC	EPA 8082 / 8082A	PCB 66
GC	EPA 8082 / 8082A	PCB 77
GC	EPA 8082 / 8082A	PCB 81
GC	EPA 8082 / 8082A	PCB 101
GC	EPA 8082 / 8082A	PCB 105

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 8082 / 8082A	PCB 114
GC	EPA 8082 / 8082A	PCB 118
GC	EPA 8082 / 8082A	PCB 123
GC	EPA 8082 / 8082A	PCB 126
GC	EPA 8082 / 8082A	PCB 128
GC	EPA 8082 / 8082A	PCB 138
GC	EPA 8082 / 8082A	PCB 153
GC	EPA 8082 / 8082A	PCB 156
GC	EPA 8082 / 8082A	PCB 157
GC	EPA 8082 / 8082A	PCB 167
GC	EPA 8082 / 8082A	PCB 169
GC	EPA 8082 / 8082A	PCB 170
GC	EPA 8082 / 8082A	PCB 180
GC	EPA 8082 / 8082A	PCB 187
GC	EPA 8082 / 8082A	PCB 189
GC	EPA 8082 / 8082A	PCB 195
GC	EPA 8082 / 8082A	PCB 206
GC	EPA 8082 / 8082A	PCB 209
GC	EPA 8082 / 8082A	PCB 110
GC	EPA 8141A / 8141B	Azinphos-methyl
GC	EPA 8141A / 8141B	Bolstar
GC	EPA 8141A / 8141B	Chlorpyrifos
GC	EPA 8141A / 8141B	Coumaphos
GC	EPA 8141A / 8141B	Total Demeton
GC	EPA 8141A / 8141B	Diazinon
GC	EPA 8141A / 8141B	Dichlorvos
GC	EPA 8141A / 8141B	Disulfoton
GC	EPA 8141A / 8141B	Ethoprop
GC	EPA 8141A / 8141B	Fensulfothion
GC	EPA 8141A / 8141B	Fenthion
GC	EPA 8141A / 8141B	Merphos
GC	EPA 8141A / 8141B	Mevinphos
GC	EPA 8141A / 8141B	Naled
GC	EPA 8141A / 8141B	Methyl Parathion
GC	EPA 8141A / 8141B	Phorate
GC	EPA 8141A / 8141B	Ronnel
GC	EPA 8141A / 8141B	Stirophos
GC	EPA 8141A / 8141B	Tokuthion
GC	EPA 8141A / 8141B	Trichloronate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 8141A / 8141B	Dimethoate
GC	EPA 8141A / 8141B	EPN
GC	EPA 8141A / 8141B	Famphur
GC	EPA 8141A / 8141B	Malathion
GC	EPA 8141A / 8141B	Ethyl Parathion
GC	EPA 8141A / 8141B	O,O,O-Triethylphosphorothioate
GC	EPA 8141A / 8141B	Sulfotepp
GC	EPA 8141A / 8141B	Thionazin
GC	EPA 8141A / 8141B	Tributyl Phosphate
GC	EPA 8151A	Acifluorfen
GC	EPA 8151A	Bentazon
GC	EPA 8151A	Chloramben
GC	EPA 8151A	2,4-D
GC	EPA 8151A	2,4-DB
GC	EPA 8151A	Dacthal
GC	EPA 8151A	Dalapon
GC	EPA 8151A	Dicamba
GC	EPA 8151A	3,5-Dichlorobenzoic acid
GC	EPA 8151A	Dichlorprop
GC	EPA 8151A	Dinoseb
GC	EPA 8151A	MCPA
GC	EPA 8151A	MCPP
GC	EPA 8151A	4-Nitrophenol
GC	EPA 8151A	Pentachlorophenol
GC	EPA 8151A	Picloram
GC	EPA 8151A	Silvex
GC	EPA 8151A	2,4,5-T
GC-MS	EPA 8260B / 8260C	Acetone
GC-MS	EPA 8260B / 8260C	Acetonitrile
GC-MS	EPA 8260B / 8260C	Acrolein
GC-MS	EPA 8260B / 8260C	Acrylonitrile
GC-MS	EPA 8260B / 8260C	Benzene
GC-MS	EPA 8260B / 8260C	Bromobenzene
GC-MS	EPA 8260B / 8260C	Bromochloromethane
GC-MS	EPA 8260B / 8260C	Bromodichloromethane
GC-MS	EPA 8260B / 8260C	Bromoform
GC-MS	EPA 8260B / 8260C	Bromomethane
GC-MS	EPA 8260B / 8260C	tert-Butyl alcohol
GC-MS	EPA 8260B / 8260C	2-Butanone (MEK)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B / 8260C	n-Butylbenzene
GC-MS	EPA 8260B / 8260C	sec-Butylbenzene
GC-MS	EPA 8260B / 8260C	tert-Butylbenzene
GC-MS	EPA 8260B / 8260C	Carbon disulfide
GC-MS	EPA 8260B / 8260C	Carbon tetrachloride
GC-MS	EPA 8260B / 8260C	Chlorobenzene
GC-MS	EPA 8260B / 8260C	2-Chloroethyl vinyl ether
GC-MS	EPA 8260B / 8260C	Chloroethane
GC-MS	EPA 8260B / 8260C	Chloroform
GC-MS	EPA 8260B / 8260C	1-Chlorohexane
GC-MS	EPA 8260B / 8260C	Chloromethane
GC-MS	EPA 8260B / 8260C	2-Chlorotoluene
GC-MS	EPA 8260B / 8260C	4-Chlorotoluene
GC-MS	EPA 8260B / 8260C	Isopropyl ether (DIPE)
GC-MS	EPA 8260B / 8260C	Dibromochloromethane
GC-MS	EPA 8260B / 8260C	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B / 8260C	1,2-Dibromoethane
GC-MS	EPA 8260B / 8260C	Dibromomethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloroethane
GC-MS	EPA 8260B / 8260C	1,2-Dichloroethane
GC-MS	EPA 8260B / 8260C	1,2-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	1,3-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	trans-1,4-Dichloro-2-Butene
GC-MS	EPA 8260B / 8260C	1,4-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	Dichlorodifluoromethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloroethene
GC-MS	EPA 8260B / 8260C	cis-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C	trans-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C	Dichlorofluoromethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloropropene
GC-MS	EPA 8260B / 8260C	1,2-Dichloropropane
GC-MS	EPA 8260B / 8260C	1,3-Dichloropropane
GC-MS	EPA 8260B / 8260C	2,2-Dichloropropane
GC-MS	EPA 8260B / 8260C	cis-1,3-Dichloropropene
GC-MS	EPA 8260B / 8260C	trans-1,3-Dichloropropene
GC-MS	EPA 8260B / 8260C	tert-Butyl ethyl ether (ETBE)
GC-MS	EPA 8260B / 8260C	Ethyl Methacrylate
GC-MS	EPA 8260B / 8260C	Ethylbenzene
GC-MS	EPA 8260B / 8260C	2-Hexanone (MBK)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B / 8260C	Hexachlorobutadiene
GC-MS	EPA 8260B / 8260C	Iodomethane
GC-MS	EPA 8260B / 8260C	Isopropylbenzene
GC-MS	EPA 8260B / 8260C	p-Isopropyltoluene
GC-MS	EPA 8260B / 8260C	Methylene Chloride
GC-MS	EPA 8260B / 8260C	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B / 8260C	tert-Butyl methyl ether
GC-MS	EPA 8260B / 8260C	Naphthalene
GC-MS	EPA 8260B / 8260C	n-Propylbenzene
GC-MS	EPA 8260B / 8260C	Styrene
GC-MS	EPA 8260B / 8260C	tert-Amyl methyl ether (TAME)
GC-MS	EPA 8260B / 8260C	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C	Tetrachloroethene
GC-MS	EPA 8260B / 8260C	Toluene
GC-MS	EPA 8260B / 8260C	1,1,1-Trichloroethane
GC-MS	EPA 8260B / 8260C	1,1,2-Trichloroethane
GC-MS	EPA 8260B / 8260C	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B / 8260C	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B / 8260C	Trichloroethene
GC-MS	EPA 8260B / 8260C	Trichlorofluoromethane
GC-MS	EPA 8260B / 8260C	1,2,3-Trichloropropane
GC-MS	EPA 8260B / 8260C	1,1,2-Trichloro1,2,2-trifluoroethane
GC-MS	EPA 8260B / 8260C	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B / 8260C	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B / 8260C	Vinyl Acetate
GC-MS	EPA 8260B / 8260C	Vinyl Chloride
GC-MS	EPA 8260B / 8260C	m-Xylene & p-xylene
GC-MS	EPA 8260B / 8260C	o-Xylene
GC-MS	EPA 8260B / 8260C	Allyl Chloride
GC-MS	EPA 8260B / 8260C	Benzyl chloride
GC-MS	EPA 8260B / 8260C	Chloroprene
GC-MS	EPA 8260B / 8260C	Cyclohexane
GC-MS	EPA 8260B / 8260C	1,4-Dioxane
GC-MS	EPA 8260B / 8260C	2-Chloro-1,1,1-trifluoroethane
GC-MS	EPA 8260B / 8260C	Chlorotrifluoroethylene
GC-MS	EPA 8260B / 8260C	cis-1,4-Dichloro-2-butene
GC-MS	EPA 8260B / 8260C	Ethanol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B / 8260C	Ethyl Methacrylate
GC-MS	EPA 8260B / 8260C	Isobutyl Alcohol
GC-MS	EPA 8260B / 8260C	Methacrylonitrile
GC-MS	EPA 8260B / 8260C	Methyl Methacrylate
GC-MS	EPA 8260B / 8260C	Pentachloroethane
GC-MS	EPA 8260B / 8260C	Propionitrile
GC-MS	EPA 8260B / 8260C	Sec-Propyl alcohol
GC-MS	EPA 8260B / 8260C	Tetrahydrofuran
GC-MS	EPA 8260B / 8260C	trans-1,4-Dichloro-2-butene
GC-MS	EPA 8260B / 8260C SIM	Benzene
GC-MS	EPA 8260B / 8260C SIM	Carbon tetrachloride
GC-MS	EPA 8260B / 8260C SIM	Chloroform
GC-MS	EPA 8260B / 8260C SIM	Chloromethane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dibromoethane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dichloroethane
GC-MS	EPA 8260B / 8260C SIM	1,1-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	cis-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	trans-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C SIM	Tetrachloroethene
GC-MS	EPA 8260B / 8260C SIM	1,1,1-Trichloroethane
GC-MS	EPA 8260B / 8260C SIM	1,1,2-Trichloroethane
GC-MS	EPA 8260B / 8260C SIM	Trichloroethene
GC-MS	EPA 8260B / 8260C SIM	1,2,3-Trichloropropane
GC-MS	EPA 8260B / 8260C SIM	Vinyl Chloride
GC-MS	EPA 8260B / 8260C SIM	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	Acenaphthene
GC-MS	EPA 8270C / 8270D	Acenaphthylene
GC-MS	EPA 8270C / 8270D	Aniline
GC-MS	EPA 8270C / 8270D	Anthracene
GC-MS	EPA 8270C / 8270D	Azobenzene
GC-MS	EPA 8270C / 8270D	Benzidine
GC-MS	EPA 8270C / 8270D	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D	benzo(a)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzo(e)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(g,h,i)perylene
GC-MS	EPA 8270C / 8270D	Benzo(k)fluoranthene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	Benzoic Acid
GC-MS	EPA 8270C / 8270D	Benzyl Alcohol
GC-MS	EPA 8270C / 8270D	Biphenyl
GC-MS	EPA 8270C / 8270D	bis(2-chloroethoxy)methane
GC-MS	EPA 8270C / 8270D	bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D	2,2-oxybis(1-chloropropane)
GC-MS	EPA 8270C / 8270D	bis(2-Ethylhexyl)adipate
GC-MS	EPA 8270C / 8270D	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D	4-Bromophenyl-phenylether
GC-MS	EPA 8270C / 8270D	Butylbenzylphthalate
GC-MS	EPA 8270C / 8270D	Carbazole
GC-MS	EPA 8270C / 8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D	4-Chloroaniline
GC-MS	EPA 8270C / 8270D	2-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	2-Chlorophenol
GC-MS	EPA 8270C / 8270D	4-Chlorophenyl-phenylether
GC-MS	EPA 8270C / 8270D	Chrysene
GC-MS	EPA 8270C / 8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D	Dibenzofuran
GC-MS	EPA 8270C / 8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,3-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	3,3'-Dichlorobenzidine
GC-MS	EPA 8270C / 8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D	Diethylphthalate
GC-MS	EPA 8270C / 8270D	2,6-Dimethylnaphthalene
GC-MS	EPA 8270C / 8270D	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	Dimethylphthalate
GC-MS	EPA 8270C / 8270D	Di-n-butylphthalate
GC-MS	EPA 8270C / 8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	2,6-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	Di-n-octylphthalate
GC-MS	EPA 8270C / 8270D	Fluoranthene
GC-MS	EPA 8270C / 8270D	Fluorene
GC-MS	EPA 8270C / 8270D	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D	Hexachlorobutadiene
GC-MS	EPA 8270C / 8270D	Hexachlorocyclopentadiene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	Hexachloroethane
GC-MS	EPA 8270C / 8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D	Isophorone
GC-MS	EPA 8270C / 8270D	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	1-Methylphenanthrene
GC-MS	EPA 8270C / 8270D	2-Methylphenol
GC-MS	EPA 8270C / 8270D	3/4-Methylphenol
GC-MS	EPA 8270C / 8270D	Naphthalene
GC-MS	EPA 8270C / 8270D	2-Nitroaniline
GC-MS	EPA 8270C / 8270D	3-Nitroaniline
GC-MS	EPA 8270C / 8270D	4-Nitroaniline
GC-MS	EPA 8270C / 8270D	Nitrobenzene
GC-MS	EPA 8270C / 8270D	2-Nitrophenol
GC-MS	EPA 8270C / 8270D	4-Nitrophenol
GC-MS	EPA 8270C / 8270D	n-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D	n-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D	n-Nitrosodiphenylamine
GC-MS	EPA 8270C / 8270D	Pentachlorophenol
GC-MS	EPA 8270C / 8270D	Perylene
GC-MS	EPA 8270C / 8270D	Phenanthrene
GC-MS	EPA 8270C / 8270D	Phenol
GC-MS	EPA 8270C / 8270D	Pyrene
GC-MS	EPA 8270C / 8270D	Pyridine
GC-MS	EPA 8270C / 8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C / 8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C / 8270D	2,3,4-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5-Trimethylnaphthalene
GC-MS	EPA 8270C / 8270D	1,2,4,5-Tetrachlorobenzene
GC-MS	EPA 8270C / 8270D	1,3,5-Trinitrobenzene
GC-MS	EPA 8270C / 8270D	1,3-Dinitrobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	1,4-Naphthoquinone
GC-MS	EPA 8270C / 8270D	1-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	1-Naphthylamine
GC-MS	EPA 8270C / 8270D	2,6-Dichlorophenol

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	2-acetylaminofluorene
GC-MS	EPA 8270C / 8270D	2-Naphthylamine
GC-MS	EPA 8270C / 8270D	2-Picoline
GC-MS	EPA 8270C / 8270D	3,3-Dimethylbenzidine
GC-MS	EPA 8270C / 8270D	3,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3,5-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3-Methylchlolanthrene
GC-MS	EPA 8270C / 8270D	4-Aminobiphenyl
GC-MS	EPA 8270C / 8270D	4-Nitroquinoline-N-oxide
GC-MS	EPA 8270C / 8270D	5-Nitro-o-toluidine
GC-MS	EPA 8270C / 8270D	7,12-Dimethylbenz(a)anthracene
GC-MS	EPA 8270C / 8270D	a,a-dimethylphenethylamine
GC-MS	EPA 8270C / 8270D	Acetophenone
GC-MS	EPA 8270C / 8270D	Aramite
GC-MS	EPA 8270C / 8270D	Atrazine
GC-MS	EPA 8270C / 8270D	Biphenyl
GC-MS	EPA 8270C / 8270D	Chlorobenzilate
GC-MS	EPA 8270C / 8270D	Diallate
GC-MS	EPA 8270C / 8270D	Dibenzo(a,j)acridine
GC-MS	EPA 8270C / 8270D	Dimethoate
GC-MS	EPA 8270C / 8270D	Dinoseb
GC-MS	EPA 8270C / 8270D	Diphenyl ether
GC-MS	EPA 8270C / 8270D	Disulfoton
GC-MS	EPA 8270C / 8270D	Ethyl methacrylate
GC-MS	EPA 8270C / 8270D	Ethyl methanesulfonate
GC-MS	EPA 8270C / 8270D	Ethyl parathion
GC-MS	EPA 8270C / 8270D	Famphur
GC-MS	EPA 8270C / 8270D	Hexachlorophene
GC-MS	EPA 8270C / 8270D	Hexachloropropene
GC-MS	EPA 8270C / 8270D	Isodrin
GC-MS	EPA 8270C / 8270D	Isosafrole
GC-MS	EPA 8270C / 8270D	kepone
GC-MS	EPA 8270C / 8270D	Methapyrilene
GC-MS	EPA 8270C / 8270D	Methyl methanesulfonate
GC-MS	EPA 8270C / 8270D	Methyl parathion
GC-MS	EPA 8270C / 8270D	N-nitrosodiethylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosodi-n-butylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosomethylethylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosomorpholine

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	N-Nitrosopiperdine
GC-MS	EPA 8270C / 8270D	N-Nitrosopyrrolidine
GC-MS	EPA 8270C / 8270D	O,O,O-triethyl phosphorothi
GC-MS	EPA 8270C / 8270D	o-toluidine
GC-MS	EPA 8270C / 8270D	p-Dimethylaminoazobenze
GC-MS	EPA 8270C / 8270D	Pentachlorobenzene
GC-MS	EPA 8270C / 8270D	Pentachloroethane
GC-MS	EPA 8270C / 8270D	Pentachloronitrobenzene
GC-MS	EPA 8270C / 8270D	Phenacetin
GC-MS	EPA 8270C / 8270D	Phorate
GC-MS	EPA 8270C / 8270D	p-phenylenediamine
GC-MS	EPA 8270C / 8270D	Pronamide
GC-MS	EPA 8270C / 8270D	Safrole
GC-MS	EPA 8270C / 8270D	Sulfotepp
GC-MS	EPA 8270C / 8270D	Thionazin
GC-MS	EPA 8270C / 8270D SIM	Acenaphthene
GC-MS	EPA 8270C / 8270D SIM	Acenaphthylene
GC-MS	EPA 8270C / 8270D SIM	Anthracene
GC-MS	EPA 8270C / 8270D SIM	Azobenzene
GC-MS	EPA 8270C / 8270D SIM	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D SIM	benzo(a)pyrene
GC-MS	EPA 8270C / 8270D SIM	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Benzo(e)pyrene
GC-MS	EPA 8270C / 8270D SIM	Benzo(g,h,i)perylene
GC-MS	EPA 8270C / 8270D SIM	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Biphenyl
GC-MS	EPA 8270C / 8270D SIM	bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D SIM	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D SIM	Carbazole
GC-MS	EPA 8270C / 8270D SIM	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D SIM	2-Chlorophenol
GC-MS	EPA 8270C / 8270D SIM	Chrysene
GC-MS	EPA 8270C / 8270D SIM	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D SIM	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,6-Dimethylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D SIM	Fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Fluorene
GC-MS	EPA 8270C / 8270D SIM	Hexachlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D SIM	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D SIM	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	1-Methylphenanthrene
GC-MS	EPA 8270C / 8270D SIM	Naphthalene
GC-MS	EPA 8270C / 8270D SIM	n-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D SIM	n-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D SIM	Pentachlorophenol
GC-MS	EPA 8270C / 8270D SIM	Perylene
GC-MS	EPA 8270C / 8270D SIM	Phenanthrene
GC-MS	EPA 8270C / 8270D SIM	Phenol
GC-MS	EPA 8270C / 8270D SIM	Pyrene
GC-MS	EPA 8270C / 8270D SIM	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,3,5-Trimethylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	1,4-Dioxane
GC-MS	EPA 8270C / 8270D SIM	Butylbenzylphthalate
GC-MS	EPA 8270C / 8270D SIM	Diethylphthalate
GC-MS	EPA 8270C / 8270D SIM	Dimethylphthalate
GC-MS	EPA 8270C / 8270D SIM	Di-n-butylphthalate
GC-MS	EPA 8270C / 8270D SIM	Di-n-octylphthalate
HPLC	EPA 8310	Acenaphthene
HPLC	EPA 8310	Acenaphthylene
HPLC	EPA 8310	Anthracene
HPLC	EPA 8310	Benzo(a)anthracene
HPLC	EPA 8310	Benzo(a)pyrene
HPLC	EPA 8310	Benzo(b)fluoranthene
HPLC	EPA 8310	Benzo(g,h,i)perylene
HPLC	EPA 8310	Benzo(k)fluoranthene
HPLC	EPA 8310	Chrysene
HPLC	EPA 8310	Dibenzo(a,h)anthracene
HPLC	EPA 8310	Fluoranthene
HPLC	EPA 8310	Fluorene
HPLC	EPA 8310	Indeno(1,2,3-cd)pyrene
HPLC	EPA 8310	1-Methylnaphthalene
HPLC	EPA 8310	2-Methylnaphthalene
HPLC	EPA 8310	Naphthalene
HPLC	EPA 8310	Phenanthrene
HPLC	EPA 8310	Pyrene

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC	EPA 8330A / 8330 B	HMX
HPLC	EPA 8330A / 8330 B	RDX
HPLC	EPA 8330A / 8330 B	1,3,5-TNB
HPLC	EPA 8330A / 8330 B	1,3-DNB
HPLC	EPA 8330A / 8330 B	Tetryl
HPLC	EPA 8330A / 8330 B	Nitrobenzene
HPLC	EPA 8330A / 8330 B	2,4,6-TNT
HPLC	EPA 8330A / 8330 B	4-AM-2,6-DNT
HPLC	EPA 8330A / 8330 B	2-AM-4,6-DNT
HPLC	EPA 8330A / 8330 B	2,6-DNT
HPLC	EPA 8330A / 8330 B	2,4-DNT
HPLC	EPA 8330A / 8330 B	2-Nitrotoluene
HPLC	EPA 8330A / 8330 B	4-Nitrotoluene
HPLC	EPA 8330A / 8330 B	3-Nitrotoluene
HPLC	EPA 8330A	3,5-Dinitroaniline
HPLC	EPA 8330A	2,4-Diamino-6-nitrotoluene
HPLC	EPA 8330A	2,6-Diamino-4-nitrotoluene
HPLC	EPA 8330A	Picric Acid
HPLC	EPA 8332	Nitroglycerine
HPLC	EPA 8332	PETN
Spectrometric	EPA 9014	Cyanide
Electrode	EPA 9040B / 9040C	pH
IC	EPA 9056 / 9056A	Bromate
IC	EPA 9056 / 9056A	Bromide
IC	EPA 9056 / 9056A	Chloride
IC	EPA 9056 / 9056A	Fluoride
IC	EPA 9056 / 9056A	Nitrate
IC	EPA 9056 / 9056A	Nitrite
IC	EPA 9056 / 9056A	Phosphate
IC	EPA 9056 / 9056A	Sulfate
IC	EPA 9056 / 9056A	Chlorate
IC	EPA 9056 / 9056A	Nitrate - Nitrite
Combustion-IR	EPA 9060A	TOC
Spectrometric	EPA 9065	Phenols
Gravimetric	EPA 9070A	Oil & Grease
GC	RSK175	Methane
GC	RSK175	Acetylene
GC	RSK175	Ethylene
GC	RSK175	Ethane

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	RSK175	Propane
GC	RSK175	Carbon dioxide
GC	RSK175	Propene
Spectrometric	SM 4500-NH3F-2011 SM 4500-NH3F-1997	Ammonia
Spectrometric	SM 4500-NOrgC-2011NH3F-2011 SM 4500-NOrgC-1997NH3F-1997	TKN
Spectrometric	SM 4500-PE-2011 SM 4500-PE-1999	Phosphorus
Turbidimetric	SM 2130B-2011/ SM 2130B-2001	Turbidity
Titrimetric	SM 2310B-2011/ SM 2310B-1997	Acidity
Titrimetric	SM 2320B-2011/ SM 2320B-1997	Alkalinity
Titrimetric	SM 2340C-2011/ SM 2340C-1997	Hardness
Platinum Electrode	SM 2510B-2011/ SM 2510B-1997	Specific Conductance
Electrical Conductivity	SM 2520B-1993	Salinity
Gravimetric	SM 2540C-2011/ SM 2540C-1997	TDS
Gravimetric	SM 2540D-2011/ SM 2540D-1997	TSS
Gravimetric	SM 2540B-2011/ SM 2540B-1997	Total Residue
Gravimetric	SM 2540F-2011/ SM 2540F-1997	Settleable Residue
Spectrometric	SM 3500-FeB-2011 SM 3500-FeB-1997	Ferrous iron
IC	SM 4110B-2011/ SM 4110B-2000	Bromate
IC	SM 4110B-2011/ SM 4110B-2000	Bromide
IC	SM 4110B-2011/ SM 4110B-2000	Chloride
IC	SM 4110B-2011/ SM 4110B-2000	Fluoride
IC	SM 4110B-2011/ SM 4110B-2000	Nitrate
IC	SM 4110B-2011/ SM 4110B-2000	Nitrite
IC	SM 4110B-2011/ SM 4110B-2000	Phosphate
IC	SM 4110B-2011/ SM 4110B-2000	Sulfate
IC	SM 4110B-2011/ SM 4110B-2000	Chlorate
IC	SM 4110B-2011/ SM 4110B-2000	Nitrate – Nitrite
Titrimetric	SM 4500-Cl-B-2011 SM 4500-Cl-B-1997	Chloride
Spectrometric	SM 4500-CN E-2011 SM 4500-CN E-1999	Cyanide
Electrode	SM 4500-HB-2011/ SM 4500-HB-2000	pH
Spectrometric	SM 4500-NO2B-2011 SM 4500-NO2B-2000	Nitrite-N
Spectrometric	SM 4500-NO3E-2011 SM 4500-NO3E-2000	Nitrate-N

Non-Potable Water		
Technology	**Method**	**Analyte**
Spectrometric	SM 4500-P E-2011/ SM 4500-P E-1999	Ortho-phosphate
Spectrometric	SM 4500-P E(PB5)-2011 SM 4500-P E(PB5)-1999	Phosphorus
Spectrometric	SM 4500-S2D-2011 SM 4500-S2D-2000	Sulfide
Titrimetric	SM 4500-S2F-2011 SM 4500-S2F-2000	Sulfide
Spectrometric	SM 4500-SiO2C-2011 SM 4500-SiO2C-1997	Silica
Electrode	SM 5210B-2011/ SM 5210B-2001	BOD
Spectrometric	SM 5220D-2011/ SM 5220D-1997	COD
Combustion-IR	SM 5310B-2011/ SM 5310B-2000	TOC
Spectrometric	SM 5540C-2011/ SM 5540C-2000	Surfactants (MBAS)
Distillation	EPA 9010C	Cyanide
MicroDistillation	QuickChem 10-204-00-1-X	Cyanide
ICP/ICP-MS	SM 2340B-2011/ SM 2340B-1997	Hardness
GC	EPA 8011	DBCP
GC	EPA 8011	EDB
Platinum Electrode	EPA 9050A	Specific Conductance
Gravimetric	SM 5520B-2011/ SM 5520B-2001	Oil & Grease
Preparation	**Method**	**Type**
Purge & Trap	EPA 5030B / EPA 5030C	Volatiles Prep
Acid Digestion	EPA 3010A / EPA 200.8 / EPA 200.7	Metals Prep
Continuous Liquid-Liquid	EPA 3520C	Organic Extraction
Waste Dilution	EPA 3580A	Organic Extraction
TCLP	EPA 1311	Leaching
SPLP	EPA 1312	Leaching

Drinking Water		
Technology	**Method**	**Analyte**
Platinum Electrode	EPA 120.1	Specific Conductance
Electrode	EPA 150.1	pH
Turbidimetric	EPA 180.1	Turbidity
Turbidimetric	SM 2130B-2011/ SM 2130B-2001	Turbidity
ICP-MS	EPA 200.8	Aluminum
ICP-MS	EPA 200.8	Antimony
ICP-MS	EPA 200.8	Arsenic

Drinking Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 200.8	Barium
ICP-MS	EPA 200.8	Beryllium
ICP-MS	EPA 200.8	Boron
ICP-MS	EPA 200.8	Cadmium
ICP-MS	EPA 200.8	Calcium
ICP-MS	EPA 200.8	Chromium
ICP-MS	EPA 200.8	Cobalt
ICP-MS	EPA 200.8	Copper
ICP-MS	EPA 200.8	Iron
ICP-MS	EPA 200.8	Lithium
ICP-MS	EPA 200.8	Lead
ICP-MS	EPA 200.8	Magnesium
ICP-MS	EPA 200.8	Manganese
ICP-MS	EPA 200.8	Molybdenum
ICP-MS	EPA 200.8	Nickel
ICP-MS	EPA 200.8	Potassium
ICP-MS	EPA 200.8	Selenium
ICP-MS	EPA 200.8	Silver
ICP-MS	EPA 200.8	Sodium
ICP-MS	EPA 200.8	Strontium
ICP-MS	EPA 200.8	Thallium
ICP-MS	EPA 200.8	Tin
ICP-MS	EPA 200.8	Titanium
ICP-MS	EPA 200.8	Uranium
ICP-MS	EPA 200.8	Vanadium
ICP-MS	EPA 200.8	Zinc
IC	EPA 218.6	Hexavalent Chromium
Cold Vapor	EPA 245.1	Mercury
IC	EPA 300.0	Bromate
IC	EPA 300.0	Bromide
IC	EPA 300.0	Chloride
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Nitrite
IC	EPA 300.0	Phosphate
IC	EPA 300.0	Sulfate
IC	EPA 300.0	Chlorate

Drinking Water		
Technology	**Method**	**Analyte**
IC	EPA 300.0	Nitrate - Nitrite
IC	EPA 300M	Acetate
IC	EPA 300M	Butyrate
IC	EPA 300M	Lactate
IC	EPA 300M	Propionate
IC	EPA 300M	Pyruvate
IC	EPA 314.0	Perchlorate
Spectrometric	EPA 410.4	COD
Spectrometric	EPA 420.1	Phenols
GC	EPA 504.1	DBCP
GC	EPA 504.1	EDB
GC-MS	EPA 524.2	Acetone
GC-MS	EPA 524.2	Benzene
GC-MS	EPA 524.2	Bromobenzene
GC-MS	EPA 524.2	Bromochloromethane
GC-MS	EPA 524.2	Bromodichloromethane
GC-MS	EPA 524.2	Bromoform
GC-MS	EPA 524.2	Bromomethane
GC-MS	EPA 524.2	tert-Butyl alcohol
GC-MS	EPA 524.2	2-Butanone (MEK)
GC-MS	EPA 524.2	n-Butylbenzene
GC-MS	EPA 524.2	sec-Butylbenzene
GC-MS	EPA 524.2	tert-Butylbenzene
GC-MS	EPA 524.2	Carbon disulfide
GC-MS	EPA 524.2	Carbon tetrachloride
GC-MS	EPA 524.2	Chlorobenzene
GC-MS	EPA 524.2	Chloroethane
GC-MS	EPA 524.2	Chloroform
GC-MS	EPA 524.2	Chloromethane
GC-MS	EPA 524.2	2-Chlorotoluene
GC-MS	EPA 524.2	4-Chlorotoluene
GC-MS	EPA 524.2	Dibromochloromethane
GC-MS	EPA 524.2	1,2-Dibromo-3-chloropropane
GC-MS	EPA 524.2	1,2-Dibromoethane
GC-MS	EPA 524.2	Dibromomethane
GC-MS	EPA 524.2	1,1-Dichloroethane
GC-MS	EPA 524.2	1,2-Dichloroethane

Drinking Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 524.2	1,2-Dichlorobenzene
GC-MS	EPA 524.2	1,3-Dichlorobenzene
GC-MS	EPA 524.2	1,4-Dichlorobenzene
GC-MS	EPA 524.2	Dichlorodifluoromethane
GC-MS	EPA 524.2	1,1-Dichloroethene
GC-MS	EPA 524.2	cis-1,2-Dichloroethene
GC-MS	EPA 524.2	trans-1,2-Dichloroethene
GC-MS	EPA 524.2	1,1-Dichloropropene
GC-MS	EPA 524.2	1,2-Dichloropropane
GC-MS	EPA 524.2	1,3-Dichloropropane
GC-MS	EPA 524.2	2,2-Dichloropropane
GC-MS	EPA 524.2	cis-1,3-Dichloropropene
GC-MS	EPA 524.2	trans-1,3-Dichloropropene
GC-MS	EPA 524.2	tert-Butyl ethyl ether (ETBE)
GC-MS	EPA 524.2	Ethylbenzene
GC-MS	EPA 524.2	2-Hexanone (MBK)
GC-MS	EPA 524.2	Hexachlorobutadiene
GC-MS	EPA 524.2	Isopropyl ether (DIPE)
GC-MS	EPA 524.2	Isopropylbenzene
GC-MS	EPA 524.2	p-Isopropyltoluene
GC-MS	EPA 524.2	Methylene Chloride
GC-MS	EPA 524.2	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 524.2	tert-Butyl methyl ether
GC-MS	EPA 524.2	Naphthalene
GC-MS	EPA 524.2	n-Propylbenzene
GC-MS	EPA 524.2	Styrene
GC-MS	EPA 524.2	tert-Amyl methyl ether (TAME)
GC-MS	EPA 524.2	1,1,1,2-Tetrachloroethane
GC-MS	EPA 524.2	1,1,2,2-Tetrachloroethane
GC-MS	EPA 524.2	Tetrachloroethene
GC-MS	EPA 524.2	Toluene
GC-MS	EPA 524.2	1,1,1-Trichloroethane
GC-MS	EPA 524.2	1,1,2-Trichloroethane
GC-MS	EPA 524.2	1,2,3-Trichlorobenzene
GC-MS	EPA 524.2	1,2,4-Trichlorobenzene
GC-MS	EPA 524.2	Trichloroethene
GC-MS	EPA 524.2	Trichlorofluoromethane

Drinking Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 524.2	1,2,3-Trichloropropane
GC-MS	EPA 524.2	1,1,2-Trichloro1,2,2-trifluoroethane
GC-MS	EPA 524.2	1,2,4-Trimethylbenzene
GC-MS	EPA 524.2	1,3,5-Trimethylbenzene
GC-MS	EPA 524.2	Vinyl Chloride
GC-MS	EPA 524.2	m-Xylene & p-xylene
GC-MS	EPA 524.2	o-Xylene
Titrimetric	SM 2320B-2011/ SM 2320B-1997	Alkalinity
HPLC-MS	EPA 6850	Perchlorate
Colorimetric	SM 2120B-2011/ SM 2120B-2001	Color
Threshold Odor Test	SM 2150B-2011/ SM 2150B-1997	Odor
ICP/ICP-MS by Calculation	SM 2340B-2011/ SM 2340B-1997	Hardness
Titrimetric	SM 2340C-2011/ SM 2340C-1997	Hardness
Platinum Electrode	SM 2510B-2011/ SM 2510B-1997	Specific Conductance
Gravimetric	SM 2540B-2011/ SM 2540B-1997	Total Residue
Gravimetric	SM 2540C-2011/ SM 2540C-1997	TDS
Gravimetric	SM 2540D-2011/ SM 2540D-1997	TSS
Spectrometric	SM 3500-Fe B-2011/ SM 3500-Fe B-1997	Ferrous Iron
IC	SM 4110B-2011/ SM 4110B-2000	Bromate
IC	SM 4110B-2011/ SM 4110B-2000	Bromide
IC	SM 4110B-2011/ SM 4110B-2000	Chloride
IC	SM 4110B-2011/ SM 4110B-2000	Fluoride
IC	SM 4110B-2011/ SM 4110B-2000	Nitrate
IC	SM 4110B-2011/ SM 4110B-2000	Nitrite
IC	SM 4110B-2011/ SM 4110B-2000	Nitrate - Nitrite
IC	SM 4110B-2011/ SM 4110B-2000	Phosphate
IC	SM 4110B-2011/ SM 4110B-2000	Sulfate
IC	SM 4110B-2011/ SM 4110B-2000	Chlorate
Titrimetric	SM 4500-Cl B-2011/ SM 4500-Cl B-1997	Chloride
Spectrometric	SM 4500-CN E-2011 SM 4500-CN E-1999	Cyanide
Electrode	SM 4500-HB-2011/ SM 4500-HB-2000	pH
Spectrometric	SM 4500-NH3 F-2011 SM 4500-NH3 F-1997	Ammonia
Spectrometric	SM 4500-NO2 B-2011 SM 4500-NO2 B-2000	Nitrite-N
Spectrometric	SM 4500-NO3 E-2011	Nitrate-N

Drinking Water		
Technology	**Method**	**Analyte**
	SM 4500-NO3 E-2000	
Spectrometric	SM 4500-NOrgC-2011 NH3F-2011 SM 4500-NOrgC-1997 NH3F-1997	TKN
Spectrometric	SM 4500-P E-2011/ SM 4500-P E-1999	Ortho-phosphate
Spectrometric	SM 4500-P E(PB5)-2011 SM 4500-P E(PB5)-1999	Phosphorus
Spectrometric	SM 4500-S2D-2011 SM 4500-S2D-2000	Sulfide
Titrimetric	SM 4500-S2 F-2011 SM 4500-S2 F-2000	Sulfide
Spectrometric	SM 4500-SiO2 C-2011 SM 4500-SiO2 C-1997	Silica
Spectrometric	SM 5220D-2011/ SM 5220D-1997	COD
Combustion-IR	SM 5310B-2011/ SM 5310B-2000	TOC
Spectrometric	SM 5540C-2011/ SM 5540C-2000	Surfactants
MicroDistillation	QuickChem 10-204-00-1-X	Cyanide

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	AK101	GRO
GC	AK102	DRO
GC	AK103	RRO
GC	AZ8015	DRO (C10-C22)
GC	AZ8015	ORO (C22-C32)
Visual	s.7.3 SW-846	Reactive Cyanide
Visual	s.7.3 SW-846	Reactive Sulfide
Spectrometric	SM 4500-NH3 F-2011 SM 4500-NH3 F-1997	Ammonia
Spectrometric	SM 4500-NOrgC-2011 NH3F-2011 SM 4500-NOrgC-1997 NH3F-1997	TKN
Spectrometric	SM 4500-NO2B-2011 SM 4500-NO2B-2000	Nitrite-N
Spectrometric	SM 4500-NO3E-2011 SM 4500-NO3E-2000	Nitrate-N
Spectrometric	SM 4500-P E-2011/ SM 4500-P E-1999	Ortho-phosphate
Spectrometric	SM 4500-P E(PB5)-2011 SM 4500-P E(PB5)-1999	Phosphorus
Titrimetric	Walkley Black	TOC
Electrode	EPA 9045C / 9045D	pH

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Spectrometric	EPA 9065	Phenols
Pensky-Martens	EPA 1010 / 1010A	Ignitability
ICP	EPA 6010B / 6010C	Aluminum
ICP	EPA 6010B / 6010C	Antimony
ICP	EPA 6010B / 6010C	Arsenic
ICP	EPA 6010B / 6010C	Barium
ICP	EPA 6010B / 6010C	Beryllium
ICP	EPA 6010B / 6010C	Boron
ICP	EPA 6010B / 6010C	Cadmium
ICP	EPA 6010B / 6010C	Calcium
ICP	EPA 6010B / 6010C	Chromium
ICP	EPA 6010B / 6010C	Cobalt
ICP	EPA 6010B / 6010C	Copper
ICP	EPA 6010B / 6010C	Iron
ICP	EPA 6010B / 6010C	Lead
ICP	EPA 6010B / 6010C	Lithium
ICP	EPA 6010B / 6010C	Magnesium
ICP	EPA 6010B / 6010C	Manganese
ICP	EPA 6010B / 6010C	Molybdenum
ICP	EPA 6010B / 6010C	Nickel
ICP	EPA 6010B / 6010C	Potassium
ICP	EPA 6010B / 6010C	Selenium
ICP	EPA 6010B / 6010C	Silver
ICP	EPA 6010B / 6010C	Sodium
ICP	EPA 6010B / 6010C	Strontium
ICP	EPA 6010B / 6010C	Thallium
ICP	EPA 6010B / 6010C	Tin
ICP	EPA 6010B / 6010C	Titanium
ICP	EPA 6010B / 6010C	Vanadium
ICP	EPA 6010B / 6010C	Zinc
ICP-MS	EPA 6020A	Aluminum
ICP-MS	EPA 6020A	Antimony
ICP-MS	EPA 6020A	Arsenic
ICP-MS	EPA 6020A	Barium
ICP-MS	EPA 6020A	Beryllium
ICP-MS	EPA 6020A	Boron
ICP-MS	EPA 6020A	Cadmium
ICP-MS	EPA 6020A	Calcium
ICP-MS	EPA 6020A	Chromium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020A	Cobalt
ICP-MS	EPA 6020A	Copper
ICP-MS	EPA 6020A	Iron
ICP-MS	EPA 6020A	Lead
ICP-MS	EPA 6020A	Lithium
ICP-MS	EPA 6020A	Magnesium
ICP-MS	EPA 6020A	Manganese
ICP-MS	EPA 6020A	Molybdenum
ICP-MS	EPA 6020A	Nickel
ICP-MS	EPA 6020A	Potassium
ICP-MS	EPA 6020A	Selenium
ICP-MS	EPA 6020A	Silver
ICP-MS	EPA 6020A	Sodium
ICP-MS	EPA 6020A	Strontium
ICP-MS	EPA 6020A	Thallium
ICP-MS	EPA 6020A	Tin
ICP-MS	EPA 6020A	Titanium
ICP-MS	EPA 6020A	Tungsten
ICP-MS	EPA 6020A	Uranium
ICP-MS	EPA 6020A	Vanadium
ICP-MS	EPA 6020A	Zinc
HPLC-MS	EPA 6850	Perchlorate
Spectrometric	EPA 7196A	Hex. Chromium
IC	EPA 7199	Hex. Chromium
Cold-Vapor	EPA 7471A / 7471B	Mercury
GC	EPA 8011	DBCP
GC	EPA 8011	EDB
GC	EPA 8015B / 8015C / 8015D	GRO
GC	EPA 8015B / 8015C / 8015D	DRO
GC	EPA 8015B / 8015C / 8015D	ORO
GC	EPA 8015B / 8015C / 8015D	JP5
GC	EPA 8015B / 8015C	Ethanol
GC	EPA 8015B / 8015C	Isopropanol
GC	EPA 8015B / 8015C	Diethylene Glycol
GC	EPA 8015B / 8015C	Ethylene Glycol
GC	EPA 8015B / 8015C	Triethylene Glycol
GC	EPA 8015B / 8015C / 8015D	JP4
GC	EPA 8015B / 8015C	Methanol
GC	EPA 8015B / 8015C	Propylene Glycol

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	EPA 8081A / 8081B	Aldrin
GC	EPA 8081A / 8081B	alpha-BHC
GC	EPA 8081A / 8081B	beta-BHC
GC	EPA 8081A / 8081B	delta-BHC
GC	EPA 8081A / 8081B	gamma-BHC (Lindane)
GC	EPA 8081A / 8081B	DDD (4,4)
GC	EPA 8081A / 8081B	DDE (4,4)
GC	EPA 8081A / 8081B	DDT (4,4)
GC	EPA 8081A / 8081B	Dieldrin
GC	EPA 8081A / 8081B	Endosulfan I
GC	EPA 8081A / 8081B	Endosulfan II
GC	EPA 8081A / 8081B	Endosulfan sulfate
GC	EPA 8081A / 8081B	Endrin
GC	EPA 8081A / 8081B	Endrin Aldehyde
GC	EPA 8081A / 8081B	Heptachlor
GC	EPA 8081A / 8081B	Heptachlor epoxide
GC	EPA 8081A / 8081B	Methoxychlor
GC	EPA 8081A / 8081B	alpha-Chlordane
GC	EPA 8081A / 8081B	gamma-Chlordane
GC	EPA 8081A / 8081B	Endrin Ketone
GC	EPA 8081A / 8081B	Toxaphene
GC	EPA 8081A / 8081B	Technical Chlordane
GC	EPA 8081A / 8081B	cis-Nonachlor
GC	EPA 8081A / 8081B	DDD (2,4)
GC	EPA 8081A / 8081B	DDE (2,4)
GC	EPA 8081A / 8081B	DDT (2,4)
GC	EPA 8081A / 8081B	Mirex
GC	EPA 8081A / 8081B	Oxychlordane
GC	EPA 8081A / 8081B	trans-Nonachlor
GC	EPA 8082 / 8082A	PCB1016
GC	EPA 8082 / 8082A	PCB1221
GC	EPA 8082 / 8082A	PCB1232
GC	EPA 8082 / 8082A	PCB1242
GC	EPA 8082 / 8082A	PCB1248
GC	EPA 8082 / 8082A	PCB1254
GC	EPA 8082 / 8082A	PCB1260
GC	EPA 8082 / 8082A	PCB1262
GC	EPA 8082 / 8082A	PCB1268
GC	EPA 8082 / 8082A	PCB 8

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	EPA 8082 / 8082A	PCB 18
GC	EPA 8082 / 8082A	PCB 28
GC	EPA 8082 / 8082A	PCB 44
GC	EPA 8082 / 8082A	PCB 52
GC	EPA 8082 / 8082A	PCB 66
GC	EPA 8082 / 8082A	PCB 77
GC	EPA 8082 / 8082A	PCB 81
GC	EPA 8082 / 8082A	PCB 101
GC	EPA 8082 / 8082A	PCB 105
GC	EPA 8082 / 8082A	PCB 110
GC	EPA 8082 / 8082A	PCB 114
GC	EPA 8082 / 8082A	PCB 118
GC	EPA 8082 / 8082A	PCB 123
GC	EPA 8082 / 8082A	PCB 126
GC	EPA 8082 / 8082A	PCB 128
GC	EPA 8082 / 8082A	PCB 138
GC	EPA 8082 / 8082A	PCB 153
GC	EPA 8082 / 8082A	PCB 156
GC	EPA 8082 / 8082A	PCB 157
GC	EPA 8082 / 8082A	PCB 167
GC	EPA 8082 / 8082A	PCB 169
GC	EPA 8082 / 8082A	PCB 170
GC	EPA 8082 / 8082A	PCB 180
GC	EPA 8082 / 8082A	PCB 187
GC	EPA 8082 / 8082A	PCB 189
GC	EPA 8082 / 8082A	PCB 195
GC	EPA 8082 / 8082A	PCB 206
GC	EPA 8082 / 8082A	PCB 209
GC	EPA 8141A / 8141B	Azinphos-methyl
GC	EPA 8141A / 8141B	Bolstar
GC	EPA 8141A / 8141B	Chlorpyrifos
GC	EPA 8141A / 8141B	Coumaphos
GC	EPA 8141A / 8141B	Total Demeton
GC	EPA 8141A / 8141B	Diazinon
GC	EPA 8141A / 8141B	Dichlorvos
GC	EPA 8141A / 8141B	Disulfoton
GC	EPA 8141A / 8141B	Ethoprop
GC	EPA 8141A / 8141B	Fensulfothion
GC	EPA 8141A / 8141B	Fenthion

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	EPA 8141A / 8141B	Merphos
GC	EPA 8141A / 8141B	Mevinphos
GC	EPA 8141A / 8141B	Naled
GC	EPA 8141A / 8141B	Methyl Parathion
GC	EPA 8141A / 8141B	Phorate
GC	EPA 8141A / 8141B	Ronnel
GC	EPA 8141A / 8141B	Stirophos
GC	EPA 8141A / 8141B	Tokuthion
GC	EPA 8141A / 8141B	Trichloronate
GC	EPA 8141A / 8141B	Dimethoate
GC	EPA 8141A / 8141B	EPN
GC	EPA 8141A / 8141B	Famphur
GC	EPA 8141A / 8141B	Malathion
GC	EPA 8141A / 8141B	Ethyl Parathion
GC	EPA 8141A / 8141B	O,O,O-Triethylphosphorothioate
GC	EPA 8141A / 8141B	Sulfotepp
GC	EPA 8141A / 8141B	Thionazin
GC	EPA 8141A / 8141B	Tributyl Phosphate
GC-MS	EPA 8260B / 8260C	Acetone
GC-MS	EPA 8260B / 8260C	Acrolein
GC-MS	EPA 8260B / 8260C	Acrylonitrile
GC-MS	EPA 8260B / 8260C	Benzene
GC-MS	EPA 8260B / 8260C	Bromobenzene
GC-MS	EPA 8260B / 8260C	Bromochloromethane
GC-MS	EPA 8260B / 8260C	Bromodichloromethane
GC-MS	EPA 8260B / 8260C	Bromoform
GC-MS	EPA 8260B / 8260C	Bromomethane
GC-MS	EPA 8260B / 8260C	tert-Butyl alcohol
GC-MS	EPA 8260B / 8260C	2-Butanone (MEK)
GC-MS	EPA 8260B / 8260C	n-Butylbenzene
GC-MS	EPA 8260B / 8260C	sec-Butylbenzene
GC-MS	EPA 8260B / 8260C	tert-Butylbenzene
GC-MS	EPA 8260B / 8260C	Carbon disulfide
GC-MS	EPA 8260B / 8260C	Carbon tetrachloride
GC-MS	EPA 8260B / 8260C	Chlorobenzene
GC-MS	EPA 8260B / 8260C	2-Chloroethyl vinyl ether
GC-MS	EPA 8260B / 8260C	Chloroethane
GC-MS	EPA 8260B / 8260C	Chloroform
GC-MS	EPA 8260B / 8260C	1-Chlorohexane

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B / 8260C	Chloromethane
GC-MS	EPA 8260B / 8260C	2-Chlorotoluene
GC-MS	EPA 8260B / 8260C	4-Chlorotoluene
GC-MS	EPA 8260B / 8260C	Isopropyl ether (DIPE)
GC-MS	EPA 8260B / 8260C	Dibromochloromethane
GC-MS	EPA 8260B / 8260C	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B / 8260C	1,2-Dibromoethane
GC-MS	EPA 8260B / 8260C	Dibromomethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloroethane
GC-MS	EPA 8260B / 8260C	1,2-Dichloroethane
GC-MS	EPA 8260B / 8260C	1,2-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	1,3-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	trans-1,4-Dichloro-2-Butene
GC-MS	EPA 8260B / 8260C	1,4-Dichlorobenzene
GC-MS	EPA 8260B / 8260C	Dichlorodifluoromethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloroethene
GC-MS	EPA 8260B / 8260C	cis-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C	trans-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C	Dichlorofluoromethane
GC-MS	EPA 8260B / 8260C	1,1-Dichloropropene
GC-MS	EPA 8260B / 8260C	1,2-Dichloropropane
GC-MS	EPA 8260B / 8260C	1,3-Dichloropropane
GC-MS	EPA 8260B / 8260C	2,2-Dichloropropane
GC-MS	EPA 8260B / 8260C	cis-1,3-Dichloropropene
GC-MS	EPA 8260B / 8260C	trans-1,3-Dichloropropene
GC-MS	EPA 8260B / 8260C	tert-Butyl ethyl ether (ETBE)
GC-MS	EPA 8260B / 8260C	Ethyl Methacrylate
GC-MS	EPA 8260B / 8260C	Ethylbenzene
GC-MS	EPA 8260B / 8260C	2-Hexanone (MBK)
GC-MS	EPA 8260B / 8260C	Hexachlorobutadiene
GC-MS	EPA 8260B / 8260C	Iodomethane
GC-MS	EPA 8260B / 8260C	Isopropylbenzene
GC-MS	EPA 8260B / 8260C	p-Isopropyltoluene
GC-MS	EPA 8260B / 8260C	Methylene Chloride
GC-MS	EPA 8260B / 8260C	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B / 8260C	tert-Butyl methyl ether
GC-MS	EPA 8260B / 8260C	Naphthalene
GC-MS	EPA 8260B / 8260C	n-Propylbenzene
GC-MS	EPA 8260B / 8260C	Styrene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B / 8260C	tert-Amyl methyl ether (TAME)
GC-MS	EPA 8260B / 8260C	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C	Tetrachloroethene
GC-MS	EPA 8260B / 8260C	Toluene
GC-MS	EPA 8260B / 8260C	1,1,1-Trichloroethane
GC-MS	EPA 8260B / 8260C	1,1,2-Trichloroethane
GC-MS	EPA 8260B / 8260C	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B / 8260C	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B / 8260C	Trichloroethene
GC-MS	EPA 8260B / 8260C	Trichlorofluoromethane
GC-MS	EPA 8260B / 8260C	1,2,3-Trichloropropane
GC-MS	EPA 8260B / 8260C	1,1,2-Trichloro1,2,2-trifluoroethane
GC-MS	EPA 8260B / 8260C	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B / 8260C	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B / 8260C	Vinyl Acetate
GC-MS	EPA 8260B / 8260C	Vinyl Chloride
GC-MS	EPA 8260B / 8260C	m-Xylene & p-xylene
GC-MS	EPA 8260B / 8260C	o-Xylene
GC-MS	EPA 8260B / 8260C	2-Butanol
GC-MS	EPA 8260B / 8260C	Cyclohexane
GC-MS	EPA 8260B / 8260C	1,4-Dioxane
GC-MS	EPA 8260B / 8260C	2-Chloro-1,1,1-trifluoroethane
GC-MS	EPA 8260B / 8260C	Chlorotrifluoroethylene
GC-MS	EPA 8260B / 8260C	cis-1,4-Dichloro-2-butene
GC-MS	EPA 8260B / 8260C	Ethanol
GC-MS	EPA 8260B / 8260C	Ethyl Methacrylate
GC-MS	EPA 8260B / 8260C	Isobutyl Alcohol
GC-MS	EPA 8260B / 8260C	Methacrylonitrile
GC-MS	EPA 8260B / 8260C	Methyl Methacrylate
GC-MS	EPA 8260B / 8260C	Pentachloroethane
GC-MS	EPA 8260B / 8260C	Propionitrile
GC-MS	EPA 8260B / 8260C	Sec-Propyl alcohol
GC-MS	EPA 8260B / 8260C	Tetrahydrofuran
GC-MS	EPA 8260B / 8260C	Allyl Chloride
GC-MS	EPA 8260B / 8260C	Benzyl chloride
GC-MS	EPA 8260B / 8260C	Chloroprene
GC-MS	EPA 8260B / 8260C	Methyl Acetate

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8260B / 8260C	Methylcyclohexane
GC-MS	EPA 8260B / 8260C SIM	Benzene
GC-MS	EPA 8260B / 8260C SIM	Carbon tetrachloride
GC-MS	EPA 8260B / 8260C SIM	Chloroform
GC-MS	EPA 8260B / 8260C SIM	Chloromethane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dibromo-3-chloropropane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dibromoethane
GC-MS	EPA 8260B / 8260C SIM	1,2-Dichloroethane
GC-MS	EPA 8260B / 8260C SIM	1,1-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	cis-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	trans-1,2-Dichloroethene
GC-MS	EPA 8260B / 8260C SIM	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B / 8260C SIM	Tetrachloroethene
GC-MS	EPA 8260B / 8260C SIM	1,1,1-Trichloroethane
GC-MS	EPA 8260B / 8260C SIM	1,1,2-Trichloroethane
GC-MS	EPA 8260B / 8260C SIM	Trichloroethene
GC-MS	EPA 8260B / 8260C SIM	1,2,3-Trichloropropane
GC-MS	EPA 8260B / 8260C SIM	Vinyl Chloride
GC-MS	EPA 8260B / 8260C SIM	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	Acenaphthene
GC-MS	EPA 8270C / 8270D	Acenaphthylene
GC-MS	EPA 8270C / 8270D	Aniline
GC-MS	EPA 8270C / 8270D	Anthracene
GC-MS	EPA 8270C / 8270D	Azobenzene
GC-MS	EPA 8270C / 8270D	Benzidine
GC-MS	EPA 8270C / 8270D	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D	benzo(a)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzo(e)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(g,h,i)perylene
GC-MS	EPA 8270C / 8270D	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzoic Acid
GC-MS	EPA 8270C / 8270D	Benzyl Alcohol
GC-MS	EPA 8270C / 8270D	Biphenyl
GC-MS	EPA 8270C / 8270D	bis(2-chloroethoxy)methane
GC-MS	EPA 8270C / 8270D	bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D	2,2-oxybis(1-chloropropane)
GC-MS	EPA 8270C / 8270D	bis(2-Ethylhexyl)adipate
GC-MS	EPA 8270C / 8270D	bis(2-Ethylhexyl)phthalate

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	4-Bromophenyl-phenylether
GC-MS	EPA 8270C / 8270D	Butylbenzylphthalate
GC-MS	EPA 8270C / 8270D	Carbazole
GC-MS	EPA 8270C / 8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D	4-Chloroaniline
GC-MS	EPA 8270C / 8270D	2-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	2-Chlorophenol
GC-MS	EPA 8270C / 8270D	4-Chlorophenyl-phenylether
GC-MS	EPA 8270C / 8270D	Chrysene
GC-MS	EPA 8270C / 8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D	Dibenzofuran
GC-MS	EPA 8270C / 8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,3-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	3,3'-Dichlorobenzidine
GC-MS	EPA 8270C / 8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D	Diethylphthalate
GC-MS	EPA 8270C / 8270D	2,6-Dimethylnaphthalene
GC-MS	EPA 8270C / 8270D	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	Dimethylphthalate
GC-MS	EPA 8270C / 8270D	Di-n-butylphthalate
GC-MS	EPA 8270C / 8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	2,6-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	Di-n-octylphthalate
GC-MS	EPA 8270C / 8270D	Fluoranthene
GC-MS	EPA 8270C / 8270D	Fluorene
GC-MS	EPA 8270C / 8270D	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D	Hexachlorobutadiene
GC-MS	EPA 8270C / 8270D	Hexachlorocyclopentadiene
GC-MS	EPA 8270C / 8270D	Hexachloroethane
GC-MS	EPA 8270C / 8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D	Isophorone
GC-MS	EPA 8270C / 8270D	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	1-Methylphenanthrene
GC-MS	EPA 8270C / 8270D	2-Methylphenol
GC-MS	EPA 8270C / 8270D	3/4-Methylphenol

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	Naphthalene
GC-MS	EPA 8270C / 8270D	2-Nitroaniline
GC-MS	EPA 8270C / 8270D	3-Nitroaniline
GC-MS	EPA 8270C / 8270D	4-Nitroaniline
GC-MS	EPA 8270C / 8270D	Nitrobenzene
GC-MS	EPA 8270C / 8270D	2-Nitrophenol
GC-MS	EPA 8270C / 8270D	4-Nitrophenol
GC-MS	EPA 8270C / 8270D	n-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D	n-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D	n-Nitrosodiphenylamine
GC-MS	EPA 8270C / 8270D	Pentachlorophenol
GC-MS	EPA 8270C / 8270D	Perylene
GC-MS	EPA 8270C / 8270D	Phenanthrene
GC-MS	EPA 8270C / 8270D	Phenol
GC-MS	EPA 8270C / 8270D	Pyrene
GC-MS	EPA 8270C / 8270D	Pyridine
GC-MS	EPA 8270C / 8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C / 8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C / 8270D	2,3,4-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5-Trimethylnaphthalene
GC-MS	EPA 8270C / 8270D	1,2,4,5-Tetrachlorobenzene
GC-MS	EPA 8270C / 8270D	1,3,5-Trinitrobenzene
GC-MS	EPA 8270C / 8270D	1,3-Dinitrobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	1,4-Naphthoquinone
GC-MS	EPA 8270C / 8270D	1-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	1-Naphthylamine
GC-MS	EPA 8270C / 8270D	2,6-Dichlorophenol
GC-MS	EPA 8270C / 8270D	2-acetylaminofluorene
GC-MS	EPA 8270C / 8270D	2-Naphthylamine
GC-MS	EPA 8270C / 8270D	2-Picoline
GC-MS	EPA 8270C / 8270D	3,3-Dimethylbenzidine
GC-MS	EPA 8270C / 8270D	3,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3,5-Dimethylphenol
GC-MS	EPA 8270C / 8270D	3-Methylchlolanthrene
GC-MS	EPA 8270C / 8270D	4-Aminobiphenyl

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	4-Nitroquinoline-N-oxide
GC-MS	EPA 8270C / 8270D	5-Nitro-o-toluidine
GC-MS	EPA 8270C / 8270D	7,12-Dimethylbenz(a)anthracene
GC-MS	EPA 8270C / 8270D	Acetophenone
GC-MS	EPA 8270C / 8270D	Aramite
GC-MS	EPA 8270C / 8270D	Atrazine
GC-MS	EPA 8270C / 8270D	Chlorobenzilate
GC-MS	EPA 8270C / 8270D	Diallate
GC-MS	EPA 8270C / 8270D	Dibenzo(a,j)acridine
GC-MS	EPA 8270C / 8270D	Dimethoate
GC-MS	EPA 8270C / 8270D	Dinoseb
GC-MS	EPA 8270C / 8270D	Diphenyl ether
GC-MS	EPA 8270C / 8270D	Disulfoton
GC-MS	EPA 8270C / 8270D	Ethyl methacrylate
GC-MS	EPA 8270C / 8270D	Ethyl methanesulfonate
GC-MS	EPA 8270C / 8270D	Ethyl parathion
GC-MS	EPA 8270C / 8270D	Famphur
GC-MS	EPA 8270C / 8270D	Hexachlorophene
GC-MS	EPA 8270C / 8270D	Hexachloropropene
GC-MS	EPA 8270C / 8270D	Isodrin
GC-MS	EPA 8270C / 8270D	Isosafrole
GC-MS	EPA 8270C / 8270D	kepone
GC-MS	EPA 8270C / 8270D	Methapyrilene
GC-MS	EPA 8270C / 8270D	Methyl methanesulfonate
GC-MS	EPA 8270C / 8270D	Methyl parathion
GC-MS	EPA 8270C / 8270D	N-nitrosodiethylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosodi-n-butylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosomethylethylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosomorpholine
GC-MS	EPA 8270C / 8270D	N-Nitrosopiperdine
GC-MS	EPA 8270C / 8270D	N-Nitrosopyrrolidine
GC-MS	EPA 8270C / 8270D	O,O,O-triethyl phosphorothi
GC-MS	EPA 8270C / 8270D	o-toluidine
GC-MS	EPA 8270C / 8270D	p-Dimethylaminoazobenze
GC-MS	EPA 8270C / 8270D	Pentachlorobenzene
GC-MS	EPA 8270C / 8270D	Pentachloroethane
GC-MS	EPA 8270C / 8270D	Pentachloronitrobenzene
GC-MS	EPA 8270C / 8270D	Phenacetin
GC-MS	EPA 8270C / 8270D	Phorate

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	p-phenylenediamine
GC-MS	EPA 8270C / 8270D	Pronamide
GC-MS	EPA 8270C / 8270D	Safrole
GC-MS	EPA 8270C / 8270D	Sulfotepp
GC-MS	EPA 8270C / 8270D	Thionazin
GC-MS	EPA 8270C / 8270D SIM	Acenaphthene
GC-MS	EPA 8270C / 8270D SIM	Acenaphthylene
GC-MS	EPA 8270C / 8270D SIM	Anthracene
GC-MS	EPA 8270C / 8270D SIM	Azobenzene
GC-MS	EPA 8270C / 8270D SIM	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D SIM	benzo(a)pyrene
GC-MS	EPA 8270C / 8270D SIM	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Benzo(e)pyrene
GC-MS	EPA 8270C / 8270D SIM	Benzo(g,h,i)perylene
GC-MS	EPA 8270C / 8270D SIM	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Biphenyl
GC-MS	EPA 8270C / 8270D SIM	bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D SIM	bis(2-Ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D SIM	Carbazole
GC-MS	EPA 8270C / 8270D SIM	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D SIM	2-Chlorophenol
GC-MS	EPA 8270C / 8270D SIM	Chrysene
GC-MS	EPA 8270C / 8270D SIM	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D SIM	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,6-Dimethylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D SIM	Fluoranthene
GC-MS	EPA 8270C / 8270D SIM	Fluorene
GC-MS	EPA 8270C / 8270D SIM	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D SIM	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D SIM	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	1-Methylphenanthrene
GC-MS	EPA 8270C / 8270D SIM	Naphthalene
GC-MS	EPA 8270C / 8270D SIM	n-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D SIM	n-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D SIM	Pentachlorophenol
GC-MS	EPA 8270C / 8270D SIM	Perylene
GC-MS	EPA 8270C / 8270D SIM	Phenanthrene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D SIM	Phenol
GC-MS	EPA 8270C / 8270D SIM	Pyrene
GC-MS	EPA 8270C / 8270D SIM	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D SIM	2,3,5-Trimethylnaphthalene
GC-MS	EPA 8270C / 8270D SIM	1,4-Dioxane
GC-MS	EPA 8270C / 8270D SIM	Butylbenzylphthalate
GC-MS	EPA 8270C / 8270D SIM	Diethylphthalate
GC-MS	EPA 8270C / 8270D SIM	Dimethylphthalate
GC-MS	EPA 8270C / 8270D SIM	Di-n-butylphthalate
GC-MS	EPA 8270C / 8270D SIM	Di-n-octylphthalate
HPLC	EPA 8310	Acenaphthene
HPLC	EPA 8310	Acenaphthylene
HPLC	EPA 8310	Anthracene
HPLC	EPA 8310	Benzo(a)anthracene
HPLC	EPA 8310	Benzo(a)pyrene
HPLC	EPA 8310	Benzo(b)fluoranthene
HPLC	EPA 8310	Benzo(g,h,i)perylene
HPLC	EPA 8310	Benzo(k)fluoranthene
HPLC	EPA 8310	Chrysene
HPLC	EPA 8310	Dibenzo(a,h)anthracene
HPLC	EPA 8310	Fluoranthene
HPLC	EPA 8310	Fluorene
HPLC	EPA 8310	Indeno(1,2,3-cd)pyrene
HPLC	EPA 8310	1-Methylnaphthalene
HPLC	EPA 8310	2-Methylnaphthalene
HPLC	EPA 8310	Naphthalene
HPLC	EPA 8310	Phenanthrene
HPLC	EPA 8310	Pyrene
HPLC	EPA 8330A	HMX
HPLC	EPA 8330A	RDX
HPLC	EPA 8330A	1,3,5-TNB
HPLC	EPA 8330A	1,3-DNB
HPLC	EPA 8330A	Tetryl
HPLC	EPA 8330A	Nitrobenzene
HPLC	EPA 8330A	2,4,6-TNT
HPLC	EPA 8330A	4-AM-2,6-DNT

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
HPLC	EPA 8330A	2-AM-4,6-DNT
HPLC	EPA 8330A	2,6-DNT
HPLC	EPA 8330A	2,4-DNT
HPLC	EPA 8330A	2-Nitrotoluene
HPLC	EPA 8330A	4-Nitrotoluene
HPLC	EPA 8330A	3-Nitrotoluene
HPLC	EPA 8330A	3,5-Dinitroaniline
HPLC	EPA 8330A	2,4-Diamino-6-nitrotoluene
HPLC	EPA 8330A	2,6-Diamino-4-nitrotoluene
HPLC	EPA 8330A	Picric Acid
HPLC	EPA 8332	Nitroglycerine
HPLC	EPA 8332	PETN
IC	EPA 9056 / 9056A	Bromate
IC	EPA 9056 / 9056A	Bromide
IC	EPA 9056 / 9056A	Chloride
IC	EPA 9056 / 9056A	Fluoride
IC	EPA 9056 / 9056A	Nitrate
IC	EPA 9056 / 9056A	Nitrite
IC	EPA 9056 / 9056A	Phosphate
IC	EPA 9056 / 9056A	Sulfate
IC	EPA 9056 / 9056A	Chlorate
GC	EPA 8151A	Acifluorfen
GC	EPA 8151A	Bentazon
GC	EPA 8151A	Chloramben
GC	EPA 8151A	2,4-D
GC	EPA 8151A	2,4-DB
GC	EPA 8151A	Dacthal
GC	EPA 8151A	Dalapon
GC	EPA 8151A	Dicamba
GC	EPA 8151A	3,5-Dichlorobenzoic acid
GC	EPA 8151A	Dichlorprop
GC	EPA 8151A	Dinoseb
GC	EPA 8151A	MCPA
GC	EPA 8151A	MCPP
GC	EPA 8151A	Pentachlorophenol
GC	EPA 8151A	Picloram
GC	EPA 8151A	Silvex

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	EPA 8151A	2,4,5-T
GC	EPA 8151A	4-Nitrophenol
Spectrometric	EPA 9014	Cyanide
Spectrometric	EPA 9014	Amenable Cyanide
Gravimetric	EPA 9071B	Oil & Grease
GFAA	CA 939M	Organo Lead
Preparation	**Method**	**Type**
Purge &Trap	EPA 5030B / EPA 5035	Volatiles Prep
Acid Digestion	EPA 3050B	Metals Prep
Alkaline Digestion	EPA 3060A	Hexavalent Chrom
Soxhlet	EPA 3540C	Organic Extraction
Sonication	EPA 3550C	Organic Extraction
Waste Dilution	EPA 3580A	Organic Extraction
Microwave	EPA 3546	Organic Extraction
TCLP	EPA 1311	Leaching
SPLP	EPA 1312	Leaching
Floricil Clean-up	EPA 3620C	Extract Clean-Up
Sulfur Clean-up	EPA 3660B	Extract Clean-Up
Acid/Permanganate Clean-up	EPA 3665A	Extract Clean-Up

Air and Emissions		
Technology	**Method**	**Analyte**
GC-MS	TO-15	1,1,1-trichloroethane
GC-MS	TO-15	1,1,2,2-tetrachloroethane
GC-MS	TO-15	1,1,2-Trichloro1,2,2-trifluoroethane
GC-MS	TO-15	1,1,2-trichloroethane
GC-MS	TO-15	1,1-dichloroethane
GC-MS	TO-15	1,1-Dichloroethene
GC-MS	TO-15	1,2,4-trichlorobenzene
GC-MS	TO-15	1,2,4-trimethylbenzene
GC-MS	TO-15	1,2-dibromoethane
GC-MS	TO-15	1,2-dichloroethane
GC-MS	TO-15	1,2-dichloroethene
GC-MS	TO-15	1,2-dichloropropane

Air and Emissions		
Technology	**Method**	**Analyte**
GC-MS	TO-15	1,3,5-trimethylbenzene
GC-MS	TO-15	1,3-Butadiene
GC-MS	TO-15	1,3-Butadiene, 1,1,2,3,4,Hexachloro
GC-MS	TO-15	1,2-dichlorobenzene
GC-MS	TO-15	1,3-dichlorobenzene
GC-MS	TO-15	1,4-dichlorobenzene
GC-MS	TO-15	1,4-Dioxane
GC-MS	TO-15	2,2,4-Trimethylpentane
GC-MS	TO-15	4-Ethyltoluene
GC-MS	TO-15	Acetone
GC-MS	TO-15	Acrylonitrile
GC-MS	TO-15	Allyl Chloride
GC-MS	TO-15	Benzene
GC-MS	TO-15	Benzyl Chloride
GC-MS	TO-15	Bromodichloromethane
GC-MS	TO-15	Bromoform
GC-MS	TO-15	Bromomethane
GC-MS	TO-15	Carbon Disulfide
GC-MS	TO-15	Carbon Tetrachloride
GC-MS	TO-15	Chlorobenzene
GC-MS	TO-15	Chloroethane
GC-MS	TO-15	Chloroethene
GC-MS	TO-15	Chloroform
GC-MS	TO-15	Chloromethane
GC-MS	TO-15	cis-1,3-Dichloropropene
GC-MS	TO-15	Cyclohexane
GC-MS	TO-15	Dibromochloromethane
GC-MS	TO-15	Dichlorodifluoromethane
GC-MS	TO-15	Dichlorotetrafluoroethane
GC-MS	TO-15	Ethyl Acetate
GC-MS	TO-15	Ethylbenzene
GC-MS	TO-15	Isopropyl Alcohol
GC-MS	TO-15	m+p-Xylene
GC-MS	TO-15	Methyl butyl Ketone
GC-MS	TO-15	Methyl Ethyl Ketone
GC-MS	TO-15	Methyl Isobutyl Ketone

Air and Emissions		
Technology	**Method**	**Analyte**
GC-MS	TO-15	Methyl Tert-Butyl Ether
GC-MS	TO-15	Methylene Chloride
GC-MS	TO-15	n-Heptane
GC-MS	TO-15	n-Hexane
GC-MS	TO-15	o-Xylene
GC-MS	TO-15	Styrene
GC-MS	TO-15	Tetrachloroethylene
GC-MS	TO-15	Tetrahydrofuran
GC-MS	TO-15	Toluene
GC-MS	TO-15	Trans-1,2-Dichloroethene
GC-MS	TO-15	trans-1,3-Dichloropropene
GC-MS	TO-15	Trichloroethylene
GC-MS	TO-15	Trichloromonofluoromethan
GC-MS	TO-15	Vinyl Acetate
GC-MS	TO-15	Vinyl Bromide

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. L2278

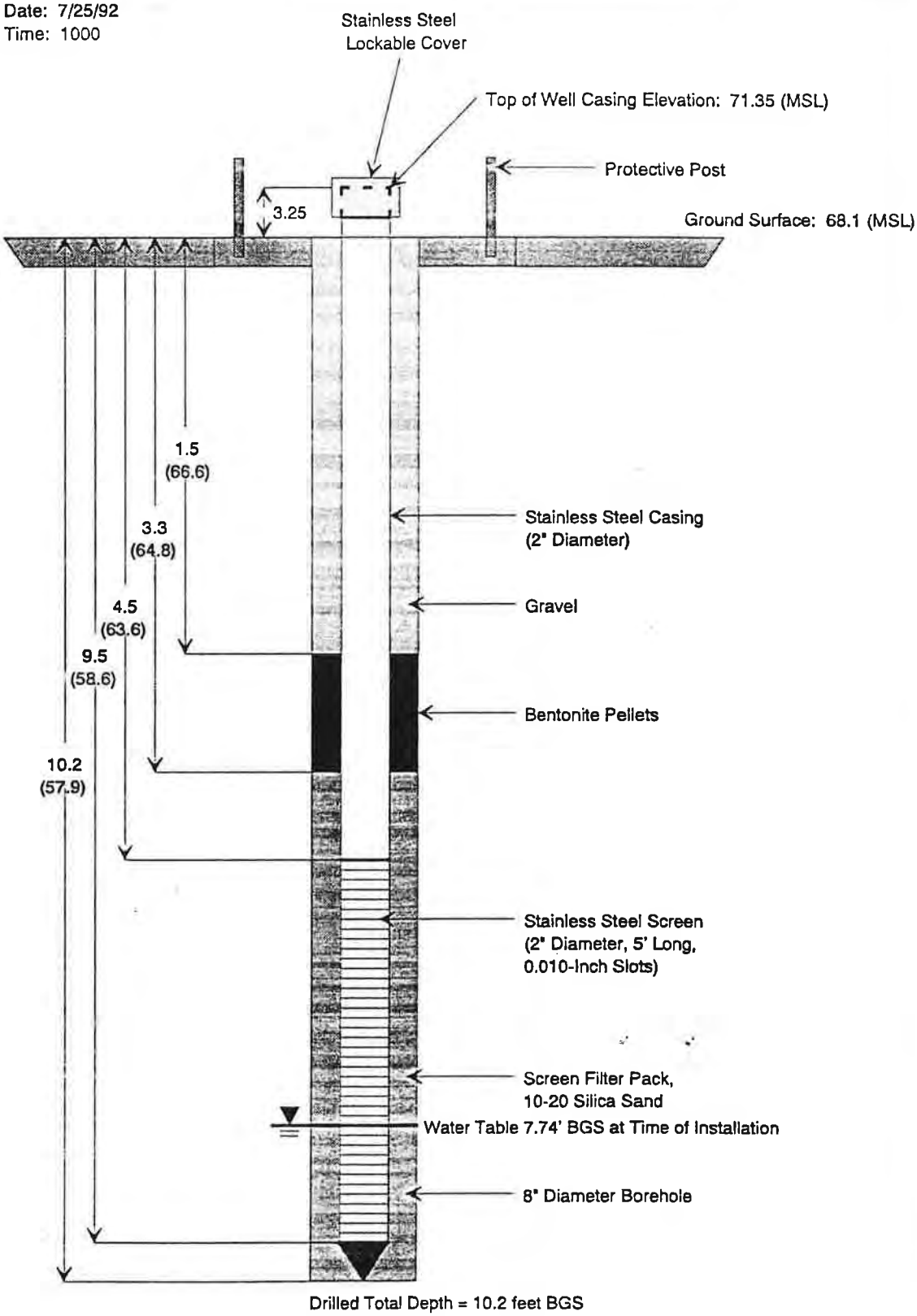
Vice President

APPENDIX C
WELL CONSTRUCTION LOGS

This page intentionally blank

SAIC	MONITORING WELL INSTALLATION DIAGRAM	Monitoring Well No. MW-01-007

Installation Date: 7/25/92
Installation Time: 1000



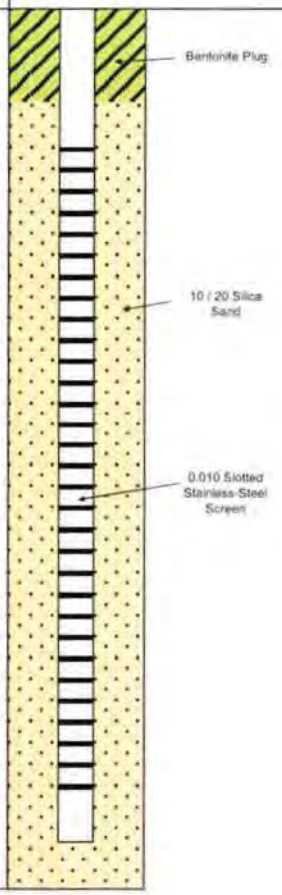
Not to Scale

Measurements in feet below ground surface (BGS); Parenthetical measurements in feet relative to mean sea level (MSL).

Boring Log and Well Construction Data for Monitoring Well MW-01-060B
Site 1 – Landfill
USCG ISC Kodiak, Alaska

Started:	April 17, 2008	**Borehole Diameter:**	8 inches
Completed:	April 17, 2008	**Total Depth Drilled:**	9.5 feet
Drilling Company:	Discovery Drilling	**Depth to Water:**	1.50 feet (at time of drilling)
Drilling Method:	Hollow Stem Auger	**Casing:**	2-inch diameter stainless steel
Well Construction:	Above Ground Monument	**Total Well Depth:**	11.30 feet (referenced to top of casing)
		Logged by:	William Watts

Depth in feet	Description	Sample Recovery	Sample Identification Number	Field Screening PID (ppmV)
1	Brown clayey SILT with organic material and some gravel. Frozen, no hydrocarbon odor	X	SB-01-060B-01	0.1
	Groundwater encountered at 1.50 feet below ground surface at time of drilling		SB-01-060B-02 (duplicate)	
2				
3				
4				<1
5	Gray sandy SILT. Wet, no hydrocarbon odor			
6				<1
7				
8				
9	Gray fractured BEDROCK. Moist, no hydrocarbon odor	X	SB-01-060B-03	4.3
9.5				
10				
11				



clarus

ENVIRONMENTAL BOREHOLE LOG

Date Started 5/24/00	Location	Depth Water First Encountered (ft) 13.0
Date Completed 5/24/00	Drilling Company Discovery Drilling	Drilling Method Truck-Mounted Auger
Total Depth (ft) 18.0	Sampling Method 2-inch Split-spoon	Hammer: Weight (lbs) 140 Drop (in) 30
Borehole Diam. (in) 3.75	Ground Elev. (ft) 76.7	Monument Elev. (ft) / SS Elev. (ft) 79.40

Depth (ft)	Sample Number	Interval	Blow Count Blows/Ft	Recovery(%)	PID (ppm)	Time	Depth (ft)	Lithologic Description	Soil Log	Well Log	Depth (ft)
								Ground Surface			
								Loose, gray, slightly gravelly SAND; SP-SM.			
								- increasing silt content			
							4.0	Soft, reddish-brown, slightly sandy, silty PEAT; moist to wet; PT.			
5	1		2 1 1 1	75		15:00		- from 4.5 to 4.8 feet was ASH			5
10	2		3/2'			15:10					10
							14.0	Medium dense, gray, silty, sandy GRAVEL; wet; (Till-like) GM.			
15	3		4 4 6 16			15:20		- drilling action indicates bedrock at about 17 feet			15
							18.0	BOTTOM OF BORING COMPLETED 05/24/2000			

Typ: EET Rev: DBW Log: RJM

ENV MASTER 21-14276.GPJ SHAN WIL.GDT 1/26/01

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
3. Groundwater level, if indicated above, is for the date specified and may vary.
4. Refer to KEY for explanation of "Symbols" and definitions.
5. USCS designation is based on visual-manual classification unless otherwise noted.

LEGEND

- 2-inch O.D. Split Spoon Sample
- 3-inch O.D. Split Spoon Sample
- Ground Water Level ATD
- Ground Water Level in Well

Site 1 - Coast Guard Landfill
USCG Integrated Support Command
Kodiak, Alaska

LOG OF BORING MW-01-061

January 2001 21-1-14276-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-3

DRAFT

ENVIRONMENTAL BOREHOLE LOG

Date Started 5/24/00	Location	Depth Water First Encountered (ft) 11.0
Date Completed 5/24/00	Drilling Company Discovery Drilling	Drilling Method Truck-Mounted Auger
Total Depth (ft) 18.0	Sampling Method 2-Inch Split-spoon	Hammer: Weight (lbs) 140 Drop (in) 30
Borehole Diam. (in) 8.75	Ground Elev. (ft) 54.7	Monument Elev. (ft) SS Elev. (ft) 56.40

Depth (ft)	Sample Number	Interval	Blow Count Blows/Ft	Recovery(%)	PID (ppm)	Time	Depth (ft)	Lithologic Description	Soil Log	Well Log	Depth (ft)
								Ground Surface			
								Soft, tan, silty SAND; moist to wet; SP-SM.			
5	1		2 12 11 19	90		11:40		- medium dense, tan, silty SAND from 4 to 4.5 feet; wet; ASH.			5
							5.5	- soft, tan to brown, sandy SILT from 4.5 to 5.5 feet; moist to wet			
								Medium dense to dense, tan to gray, slightly silty, gravelly SAND; moist to wet; trace of cobbles; SP-SM.			
10	2		11 11 10 9			11:50					10
							12.5	Medium dense, brown, slightly silty, sandy GRAVEL; wet; GW-GM.			
15	3		7 7 6 8			12:05					15
							18.0	BOTTOM OF BORING COMPLETED 05/24/2000			

Typ: EET Rev: DBW Log: RJM ENV MASTER 21-14276.GPJ SHAN WILGDT 1/26/01

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of the subsurface materials.
3. Groundwater level, if indicated above, is for the date specified and may vary.
4. Refer to KEY for explanation of "Symbols" and definitions.
5. USCS designation is based on visual-manual classification unless otherwise noted.

LEGEND

I	2-Inch O.D. Split Spoon Sample	▽	Ground Water Level ATD
III	3-Inch O.D. Split Spoon Sample	▼	Ground Water Level in Well

Site 1 - Coast Guard Landfill
USCG Integrated Support Command
Kodiak, Alaska

LOG OF BORING MW-01-062

January 2001 21-1-14276-002

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A-4

DRAFT

APPENDIX D
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION COMMENTS

This page intentionally blank

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Environmental Conservation

DIVISION OF ENVIRONMENTAL HEALTH
Solid Waste Program

555 Cordova Street
Anchorage, AK 99501
Phone: 907.269.7626
Fax: 907.269.7600
www.dec.alaska.gov

Certified Mail # 7016 2070 0000 6898 9951
Return Receipt Requested

June 27, 2017

Bob Gray
Base Kodiak Facilities Engineering
Environmental Division
P.O. Box 195025
Kodiak, AK 99619-5025

Subject: USCG Site 1 Surface Water Sampling Plan Review

Dear Mr. Gray:

The Alaska Department of Environmental Conservation (ADEC), Solid Waste Program reviewed the United States Coast Guards (USCG) Surface Water Sampling Plan for the Site 1 Kodiak Landfill, dated April 2017. The monitoring plan outlines sampling procedures and quality assurance/quality control plans for surface water sampling at the USCG Site 1 Landfill.

ADEC has the following comments:

- Provide the limit of detection (LOD) for all volatile Appendix I constituents in 40 CFR 258. The appendix I list includes more constituents than the standard EPA method 624 list. If a constituent cannot be analyzed for using the EPA 624 method then please use the SW8260 method for that constituent.
- Report all non-detects (NDs) down to the LOD.
- Report all results down to the LOD, this may cause some results to be estimated or J flagged.
- When performing statistics do not substitute 0.1 for all of the NDs instead please use the associated LOD.
- A separate chain of custody form should be generated for each sample cooler. This form should state which samples are contained within that single cooler.
- Provide a timeline for when reports will be submitted to ADEC.

ADEC appreciates the United States Coast Guard's commitment to landfill water monitoring. Please contact me at (907) 269-7626 or by email at kaylie.holland@alaska.gov if you have any questions or comments.

Sincerely,

Kaylie Holland
Municipal Waste Specialist

This page intentionally blank

THE STATE of ALASKA
GOVERNOR MICHAEL J. DUNLEAVY

Department of Environmental Conservation

DIVISION OF ENVIRONMENTAL HEALTH
Solid Waste Program

555 Cordova Street
Anchorage, AK 99501
Phone: 907.269.1099
Fax: 907.269.7510
www.dec.alaska.gov

Certified Mail # 7019 0140 0001 0059 0689
Return Receipt Requested

November 21, 2019

Jennifer Nutt
Base Kodiak Facilities Engineering
Environmental Division
P.O. Box 195025
Kodiak, Alaska 99619-5025

Subject: USCG Site 1 Post-Closure Monitoring Report Review

Dear Ms. Nutt:

The Alaska Department of Environmental Conservation (ADEC) Solid Waste Program reviewed the Spring 2019 Post-Closure Monitoring Report, dated July 2019, for the Site 1 United States Coast Guard (USCG) Kodiak Landfill. Post-closure groundwater monitoring under ADEC started in 2002. In September 2016, due to the shallow subsurface hydrology at the landfill, ADEC approved the transition from groundwater monitoring requirements to surface water monitoring requirements for all of the monitoring locations.

The monitoring program at Site 1 USCG Kodiak Landfill consists of semi-annual sampling of four monitoring wells (MW-01-007, MW-01-060B, MW-01-061, and MW-01-062) and three surface water locations (SW-01-050, SW-01-051, and SW-01-052) that are all considered downgradient of the site. The results are then compared to the applicable water quality standards (WQS). Sampling for this event was conducted on April 26 through April 28, 2019.

Monitoring Wells

- During this monitoring event sixteen metals (antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, vanadium, and zinc) were detected in the monitoring wells.
- Concentrations of arsenic (MW-01-061), iron (MW-01-061 and MW-01-062), and manganese (MW-01-061 and MW-01-062) were detected at levels that exceed the WQS.
- Five volatile organic compounds (VOCs) (acetone, chloroform, cis-1,2-dichloroethene, toluene, and xylenes) were detected in one or more monitoring wells at concentrations below the WQS.
- Trend analyses show that concentrations of copper (MW-01-060B) and iron (MW-01-060B) are increasing; other metals concentrations are stable or decreasing. However, in recent events the concentrations of iron and copper in MW-01-060B appear to be decreasing and do not exceed the applicable WQS. ADEC will continue to monitoring the metals concentrations in these wells.

Surface Water Locations

- During this monitoring event fifteen metals (antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, vanadium, and zinc) were detected at the surface water sampling locations.
- Concentrations of iron (SW-01-051 and SW-01-052) and manganese (SW-01-051 and SW-01-052) were detected at levels that exceed the WQS.
- Three VOCs (acetone, chloroform, and toluene) were detected in one or more surface water locations at concentrations below the WQS.
- Trend analyses show that concentrations of iron (SW-01-052) and manganese (SW-01-052) are increasing; other metals concentrations are stable or decreasing. ADEC will continue to closely monitor the metals concentrations for any continued changes over time. At this time it appears that the metals concentrations are much higher during the fall monitoring event than the spring monitoring event.

Please contact me at (907) 269-1099 or at kaylie.holland@alaska.gov with any questions or comments.

Sincerely,

Kaylie Holland
Technical Coordinator

Please note my new phone number. I have accepted a promotion to Technical Coordinator for the Solid Waste Program. Please continue to contact me for issues related to water monitoring; for general facility issues contact Lori Aldrich (lori.aldrich@alaska.gov / 907.269.7622) until my previous position can be filled.

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF ENVIRONMENTAL HEALTH
Solid Waste Program

555 Cordova Street
Anchorage, AK 99501
Phone: 907.269.1099
Fax: 907.269.7510
www.dec.alaska.gov

Certified Mail # Sent via email
Return Receipt Requested

October 16, 2020

Jennifer Nutt
Base Kodiak Facilities Engineering
Environmental Division
P.O. Box 195025
Kodiak, Alaska 99619-5025

Subject: USCG Site 1 Post-Closure Monitoring Report Review

Dear Ms. Nutt:

The Alaska Department of Environmental Conservation (ADEC) Solid Waste Program reviewed the February 2020 Post-Closure Monitoring Report, dated July 2020, for the Site 1 United States Coast Guard (USCG) Kodiak Landfill. Post-closure groundwater monitoring under ADEC started in 2002. In September 2016, due to the shallow subsurface hydrology at the landfill, ADEC approved the transition from groundwater monitoring requirements to surface water monitoring requirements for all the monitoring locations.

The monitoring program at Site 1 USCG Kodiak Landfill consists of semi-annual sampling of four monitoring wells (MW-01-070, MW-01-060B, MW-01-061, and MW-01-062) and three surface water locations (SW-01-050, SW-01-051, and SW-01-052) that are all considered downgradient of the site. The results are then compared to the Solid Waste Program Water Quality Standards (WQS) Table. Sampling for this event was conducted on February 16, 2020.

Monitoring Wells

- During this monitoring event seventeen metals were detected in groundwater monitoring wells across the site. Concentrations of arsenic, iron, and manganese in MW-01-061 were detected at levels that exceed the WQS.
- Two volatile organic compounds (VOCs) (chloroform and cis-1,2-dichloroethane) were detected in one or more monitoring wells at concentrations below the WQS.

Surface Water Locations

- During this monitoring event thirteen metals were detected in surface water monitoring locations across the site. Concentrations of iron and manganese in SW-01-051 and SW-01-052 were detected at levels that exceed the WQS.
- Two VOCs (chloroform and cis-1,2-dichloroethane) were detected at one or more surface water monitoring locations at concentrations below the WQS.
- Trend analyses show that concentrations of iron and manganese in SW-01-052 are increasing; other metals concentrations are stable or decreasing. ADEC will continue to closely monitor the metals concentrations for any continued changes over time. At this time, it appears that

the metals concentrations are much higher during the fall/winter events than the spring monitoring event, which could indicate a natural seasonal fluctuation.

ADEC noted the following concerns:

- The appropriate WQS were not used for this event thus copper and nickel concentrations were falsely labelled as exceedances. All future monitoring reports should use the standards listed in the ADEC Solid Water Program Surface Water Standards Table (attached).
- Page 4-1 of the narrative says that the mercury reporting limit is below the WQS. However, earlier in the report the narrative states that the mercury limit of detection exceeds the WQS. Please explain how the detection limit is above the standard while the reporting limit is not above the standard.
- The field notes indicated that there was bio-fouled sediment built up at the bottom of the wells. The wells must be redeveloped to remove the sediment build up no later than the Spring 2021 monitoring event.

Please contact me at (907) 269-1099 or at kaylie.holland@alaska.gov with any questions or comments.

Sincerely,

Kaylie Holland
Technical Specialist

Attachments: Solid Waste Program Surface Water Standards Table

Alaska Department of Environmental Conservation Division of Environmental Health - Solid Waste Program
ADEC Comments on *Final February 2020 Post-Closure Monitoring Report Former Landfill Site 1, U.S. Coast Guard Base Kodiak*
Reviewer: Kaylie Holland
Date Received: October 16, 2020

Cmnt #	Page No.	Section	ADEC Comment	Response
GENERAL COMMENTS				
1.	-	General	The appropriate WQS were not used for this event thus copper and nickel concentrations were falsely labelled as exceedances. All future monitoring reports should use the standards listed in the ADEC Solid Water Program Surface Water Standards Table.	Concur with clarification; the water quality criteria used to review data were specified in the approved *Final Surface Water Sampling Plan Site 1 – USCG Landfill* (Ahtna 2017). The work plan will be revised with the criteria established in the ADEC Solid Waste Program Surface Water Standards Table. The criteria identified in the aforementioned standards table will be used to review data for future semi-annual monitoring reports, including analytical data from the Site 1 semi-annual event conducted in October 2020.
2.	-	Field Forms	The field notes indicated that there was bio-fouled sediment built up at the bottom of the wells. The wells must be redeveloped to remove the sediment build up no later than the Spring 2021 monitoring event.	Concur; monitoring wells MW-01-061 and -062 were redeveloped prior sampling in October 2020. In February 2020, well MW-01-062 had multiple inches of rust-colored biofouling at the bottom of the casing; however, the turbidity was low. Water pumped from MW-01-061 was quite turbid (>400 NTU at the completion of purging).
SPECIFIC COMMENTS				
1.	4-1	1	Page 4-1 of the narrative says that the mercury reporting limit is below the WQS. However, earlier in the report the narrative states that the mercury limit of detection exceeds the WQS. Please explain how the detection limit is above the standard while the reporting limit is not above the standard.	Clarification; in Section 4.0 of the narrative discussing QA/QC of the February 2020 event, it is stated that "Although the absence of mercury and 1,2-dibromoethane cannot be confirmed, during the Spring 2019 event, the reporting limits were below the respective WQC for mercury and 1,2-dibromoethane, and they were also not detected (Ahtna 2019)." This statement about historical data was made to justify why mercury concentrations are probably below WQC even though it was non-detect at the LOD in February 2020.
			End of ADEC Comments	

This page intentionally blank

APPENDIX B
SITE 10/11 – CORRECTIVE MEASURES IMPLEMENTATION PLAN

This page intentionally blank

CORRECTIVE MEASURES IMPLEMENTATION WORK PLAN

SOLID WASTE MANAGEMENT UNIT / SITE 10/11 – AIR STATION/PAINT STORAGE AREA

RCRA PERMIT AK9690330742

BASE KODIAK

UNITED STATES COAST GUARD

UNITED STATES COAST GUARD
US DEPARTMENT OF HOMELAND SECURITY

Contract HSCG50-14-D-PSL008, Order 70Z08718FPXA70400

AECOM

This page intentionally blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS ..... **iii**
1 INTRODUCTION **1-1**
1.1 Objective 1-1
1.2 Regulatory Framework and Status 1-1
2 CONCEPTUAL SITE MODEL **2-1**
2.1 Site Description 2-1
2.1.1 Site 10 – Air Station 2-1
2.1.2 Site 11 – Paint Storage Area 2-1
2.2 Site Physical Characteristics 2-1
2.2.1 Geology 2-1
2.2.2 Hydrogeology 2-2
2.2.3 Climate 2-2
2.3 Site 10 Release and Investigation History 2-3
2.3.1 Documented Releases 2-3
2.3.2 Investigations in 1992, 1996, 1998, and 2000 2-3
2.3.3 2001 RCRA CMS 2-4
2.3.4 2002 Stormwater Investigation 2-4
2.3.5 1996-2008 Groundwater Sampling and Product Monitoring/Recovery 2-4
2.3.6 2004 Sampling of Stormwater, Seeps, Tarmac, and Groundwater 2-5
2.3.7 2005 Biological Reconnaissance 2-5
2.3.8 2016 Soil Investigation for Utility Upgrades 2-5
2.3.9 2018 Soil Sampling for Secondary Containment Improvement 2-6
2.3.10 2018 Soil Sampling for Fuel Systems Deficiencies Corrections 2-6
2.4 Site 11 Release and Investigation History 2-6
2.5 Media Cleanup Standards 2-6
2.5.1 Soil and Groundwater 2-6
2.5.2 Surface Water 2-7
2.6 Nature and Extent of Contamination 2-7
2.6.1 Soil 2-7
2.6.2 Groundwater 2-7
2.6.3 Surface Water 2-8
2.7 Contaminant Fate and Transport 2-8
2.8 Potential Receptors and Exposure Pathways 2-8
2.8.1 Potential Receptors 2-8
2.8.2 Contaminated Media/Exposure Pathways 2-9
2.9 Data Gaps 2-10
3 SELECTED REMEDY **3-1**
3.1 Remedy 3-1
4 CORRECTIVE MEASURE IMPLEMENTATION **4-3**
4.1 Land Use Controls 4-3
4.1.1 Land Use Control Assurance Plan 4-3
4.1.2 Site Inspection, Review, Certification 4-3
4.1.3 Annual LUC Reports and Five-Year Reviews 4-3
4.2 Stormwater Management 4-4
4.2.1 Stormwater Pollution Prevention Plan 4-4

TABLE OF CONTENTS (CONTINUED)

4.2.2 Annual Comprehensive Site Inspections 4-4
4.2.3 Annual SWPP Reporting 4-4
4.3 Groundwater and Seep Monitoring 4-4
4.3.1 2019 Baseline Monitoring Event 4-4
4.3.2 Long-Term Management Approach 4-8
4.4 Schedule 4-9
4.5 Public Involvement 4-9
5 REFERENCES 5-1

TABLES

Table 2-1 Kodiak Climate Summary 2-2
Table 4-1 Potential Baseline Groundwater Monitoring Locations 4-7

FIGURES

Figure 1 Site Location Map 1-3
Figure 2 Historical Petroleum-Related Contaminants of Concern in Groundwater at Site 10/11 2-11
Figure 3 Historical VOCs in Groundwater at Site 10/11 2-13
Figure 4 Contaminants of Concern in Soil and Groundwater at Site 11 2-15
Figure 5 Proposed New Well Locations and Existing Well Locations 4-11

APPENDICES

Appendix A Land Use Control Assurance Plan for Environmental Cleanup Activities
Appendix B Stormwater Pollution Prevention Plan
Appendix C Uniform Federal Policy for Quality Assurance Project Plan for Groundwater and Seep Monitoring
Appendix D Conceptual Site Model Scoping Form

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
µg/L	micrograms per liter
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, or xylenes
CFR	Code of Federal Regulations
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
CSL	cleanup standard level
CSM	conceptual site model
DRO	diesel-range organics
EPA	United States Environmental Protection Agency
in.	inches
ISC	Integrated Support Command (Kodiak)
L	liter
LUC	Land Use Control
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
MEK	methyl ethyl ketone
mg/kg	milligrams per kilogram
mL	milliliter
MSGP	Multi-Sector General Permit
MW	monitoring well
NAPL	non-aqueous phase liquid
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PAL	project action limit
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene
POL	petroleum, oil, and lubricants
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RRO	residual-range organics
S&W	Shannon and Wilson, Inc.
SAIC	Science Applications International Corporation
SOP	Standard Operating Procedure

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SQS	sediment quality standards
SWMU	Solid Waste Management Unit
SWPPP	Stormwater Pollution Prevention Plan
TAH	total aromatic hydrocarbons
TAqH	total aqueous hydrocarbons
TCE	trichloroethene
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USCG	United States Coast Guard
UST	Underground storage tank
UVOST	ultraviolet optical screening tool
VOC	volatile organic compound
WP	Work Plan
WRCC	Western Regional Climate Center

1 INTRODUCTION

The United States Coast Guard (USCG) Base Kodiak (formerly known as Integrated Support Command (ISC) Kodiak) has a Resource Conservation and Recovery Act (RCRA) Permit for Post Closure and Corrective Action (Permit AK9690330742) that includes correct action provisions at solid waste management units (SWMUs). This permit was reissued to USCG in 2011 in accordance with the RCRA of 1976, Hazardous and Solid Waste Amendments of 1984, and United States Environmental Protection Agency (EPA) regulations implemented in Title 40 of the *Code of Federal Regulations* (CFR). The permit was amended in 2014 (USCG 2014a); additional revisions are under draft review currently.

Sites 10 and 11 are SWMUs located on Nyman Peninsula, on Kodiak Island, Alaska (Figure 1). Site 10 (Air Station) includes three hangars, several fueling pits, an oil/water separator, the Air Station fuel farm, and a large tarmac area where helicopters and C-130 aircraft are serviced and fueled. Site 11 (Paint Storage Building) includes a small building (Building 24) used for storing and dispensing paint and paint-related solvents. Both sites are considered SWMUs under RCRA. Because the sites are adjacent to each other, they are addressed together as Site 10/11. Historical releases of jet fuel (JP-5) at Site 10 and presumed releases of solvents at Site 11 have resulted in soil and groundwater contamination that has been investigated/remediated under the past and current RCRA permits.

Condition IX.L of RCRA Permit AK9690330742 requires submittal of a Corrective Measures Implementation (CMI) Work Plan (WP) for SWMUs at Base Kodiak, including Site 10/11. As such, this CMI WP outlines the plan to implement the remedies selected by EPA (Attachment 11 of the RCRA Permit) for Site 10/11, which include Land Use Controls (LUCs), stormwater monitoring and management, groundwater monitoring in sentry wells, seep sampling in the intertidal zone, and determination of presence or absence of free product. The following documents, included as appendices to this CMI Plan, outline the specific implementation plans for the selected remedy:

- Appendix A – Land Use Control Assurance Plan for Environmental Cleanup Activities (USCG 2014)
- Appendix B – Stormwater Pollution Prevention Plan (SWPPP) (USCG 2015)
- Appendix C – Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) for Groundwater and Seep Monitoring

1.1 OBJECTIVE

The purpose of this CMI WP is to determine the current concentrations of contaminants in soil, groundwater, and surface water; evaluate the effectiveness and status of the current selected remedy (Section 3.0); and determine the appropriate path forward for the site, including considering potential revisions to the remedy and defining the data quality objectives associated with those remedy components and long-term management of the site.

1.2 REGULATORY FRAMEWORK AND STATUS

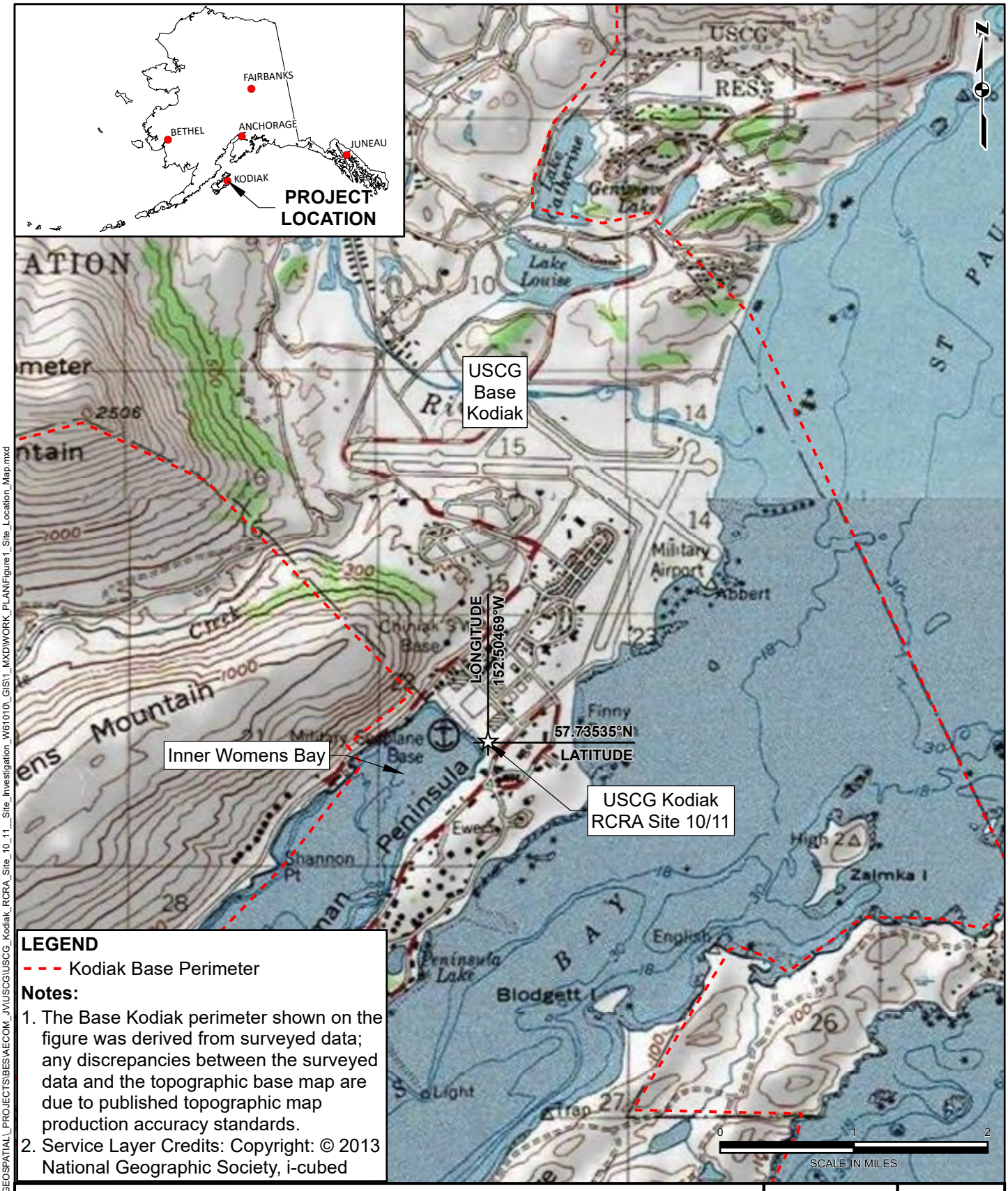
Site 10/11 is regulated as a SWMU by EPA under the Corrective Action process in the Base Kodiak RCRA Hazardous Waste Management Facility Permit AK9690330742. Site 10/11 is also regulated as a contaminated site by the Alaska Department of Environmental Conservation (ADEC) under 18 *Alaska*

Administrative Code (AAC) 75 (ADEC File Numbers 2601.38.020 and 2601.38.021). According to the ADEC contaminated site database, Site 10/11 is an active site requiring additional action to be closed.

The RCRA Corrective Action Process generally follows these steps:

- RCRA Facility Assessment (RFA) – Identify potential and actual releases
- RCRA Facility Investigation (RFI) – Investigate releases identified in the RFA; perform risk assessment
- Interim Corrective Measures – Implement corrective action to control threats to human health and the environment or prevent or minimize spread of contamination
- Corrective Measures Study (CMS) – Identify and evaluate cleanup alternatives
- Statement of Basis – Selection of remedy
- Corrective Measures Implementation (CMI) – Implementation of selected remedy
- Corrective Action Complete With or Without Controls – Final decisions by EPA.

Selection of remedy occurred in 2001 and Site 10/11 is currently in the CMI step.



LEGEND

- - - Kodiak Base Perimeter

Notes:

1. The Base Kodiak perimeter shown on the figure was derived from surveyed data; any discrepancies between the surveyed data and the topographic base map are due to published topographic map production accuracy standards.
2. Service Layer Credits: Copyright: © 2013 National Geographic Society, i-cubed

USCG KODIAK RCRA – SITE 10/11 INVESTIGATION

KODIAK, ALASKA

SITE LOCATION MAP

DATE: 3/4/2019

PROJECT No.: 610101

DRAWN: R.D.

FIGURE: **1**

Document Path: Q:\BES Anchorage\GEOSPATIAL_PROJECTS\BES\AECOM_JV\USCG\USCG_Kodiak_RCRA_Site_10_11__Site_Investigation_W61010_GIS\1_MXD\WORK_PLAN\Figure1_Site_Location_Map.mxd

This page intentionally blank

2 CONCEPTUAL SITE MODEL

2.1 SITE DESCRIPTION

Sites 10 and 11 are located on the northwest end of the Nyman Peninsula at the northern end of Inner Womens Bay of Kodiak Island, Alaska (Figure 1). Due to the proximity of both sites, these have historically been addressed together as one site, Site 10/11. The approximate geographic coordinates of Site 10/11 are 57.73535°N, 152.50469°W. Site 10/11 is located in the "Industrial Area" of Base Kodiak; base plans restrict the area to industrial use.

2.1.1 Site 10 – Air Station

The Site 10 Air Station was constructed in the early 1940s and has been active ever since. The facility is in continuous operation, supporting fixed-wing aircraft and helicopters. The overall Air Station consists of three hangars, fueling operations, and aircraft parking areas. The Air Station (Site 10) consists of the Operational Fuel Storage Area, which includes two 75,000-gallon JP-5 aboveground storage tanks, one unused 10,000-gallon underground storage tank (UST), and one truck fill-stand and pump station; Tarmac I, which includes Hangar 1, the fueling/defueling pits, and the oil-water separator tank; and Tarmac II, which includes the western portion of the tarmac. An earthen dike and trench runs in a northwesterly to southeasterly direction between the bank of the bay and the tarmac along the entire length of the Air Station. This dike and trench were installed in 1989 to provide both an early warning of potential surface water impacts to the bay from fuel in the site groundwater and to provide a barrier against both runoff and groundwater flow. A stormwater outfall (IA-1), shown on Figure 2, is located on the southcentral end of the site, discharging into Inner Womens Bay depending upon trench levels.

2.1.2 Site 11 – Paint Storage Area

The Paint Storage Building (Site 11), consists of Building 24, which is used for storing and dispensing paint and paint-related solvents. The building is constructed of concrete and is located approximately 250 feet northeast of Hangar 1 (Figure 2). No paint manufacturing or mixing is known to have occurred on this site (Shannon and Wilson [S&W] 1999). Since taking over the facility in 1972, the Coast Guard has used Building 24 for storing paint and painting equipment. Approximately 90 percent of the paints are water-based and 10 percent are oil-based. In 1991 several hundred drums were stored outside the building waiting pick-up by a contractor for disposal. These wastes included antifreeze and methyl ethyl ketone (MEK) (S&W 1999). No documented releases are associated with this building or drums stored at the site.

2.2 SITE PHYSICAL CHARACTERISTICS

2.2.1 Geology

The industrial area of Base Kodiak is constructed on filled tidelands (Alaska Division of Geological and Geophysical Surveys, 1989), consisting of compacted gravel fill, glacial till, and sand (USGS 1996a). Site 10/11, in particular, exists on lands created from hydraulic fill excavated from Inner Womens Bay in the 1940s by the United States Navy. The fill material consists of loose to medium dense, gray to black, slightly silty to gravelly sand (S&W 1999). Bedrock has been encountered at the eastern portion of the site, near Seafarer Drive, at 11 feet belowground surface (USGS 1996b).

2.2.2 Hydrogeology

Depth to groundwater at Sites 10/11 averages from approximately 4 feet below ground surface (bgs) to approximately 11 feet bgs (Clarus 2007). Groundwater south of Seafarer Drive flows toward the northwest, then bends and flows toward the bay. The subsurface has a relatively high hydraulic conductivity (Hart Crowser 2005a), ranging between 0.8 to > 180 feet per day with the highest conductivities on the east side of the Air Station ramp (S&W 1999). While steeper hydraulic gradients occur along Seafarer Drive, gradients are typically flat in the area of the tarmac (Hart Crowser 2005a).

A sheet pile wall is located within a dike between the edge of the tarmac and Inner Womens Bay and was originally installed as a seawall. Data suggest that the sheet pile wall acts as a barrier between site groundwater and the bay (Hart Crowser 2005a), and is likely causing a steepened hydraulic gradient near the bay (S&W 1999).

Groundwater is subject to saltwater intrusion because of the proximity of Inner Womens Bay; the degree of saltwater intrusion is lessened by the sheet pile wall (Hart Crowser 2005a). A study performed to assess the influence of tides on shallow groundwater levels determined that most wells onsite are influenced more by precipitation recharge events than by tide fluctuations. In one well (MW-10-022), however, relatively large tidal influences may be related to a breach in the sheet pile wall (S&W 1999); it is possible that the sheet pile was damaged during the 1964 earthquake and may now allow groundwater contamination to move through discontinuities in the sheet pile wall.

2.2.3 Climate

Base Kodiak and Kodiak Island lie within the maritime climatic zone of Alaska and are generally characterized by moderate temperatures and moderate to large amounts of rainfall; daily temperatures are relatively uniform, with occasional high winds and frequent cloud cover and fog. From 1981 to 2010, average winter (October through March) temperatures ranged from 25.9 to 46.4 degrees Fahrenheit (°F), and average summer temperatures ranged from 32.3 to 61.3 °F. Temperature extremes recorded from 1931 to 2016 ranged from -16 °F to 86 °F. Annual precipitation from 1981 to 2010 averaged 78.63 inches, although precipitation may vary considerably according to local topography. The driest months are July and August and receive an average of 4 to 5 inches of rain, whereas the wettest months of October, December, and January receive more than 8 inches of rain (Western Regional Climate Center [WRCC] 2018). Table 2-1 provides a summary of annual climate data collected by WRCC (WRCC 2018).

TABLE 2-1 KODIAK CLIMATE SUMMARY

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL TOTAL
KODIAK AP, ALASKA (STATION 504988) FROM 1981 TO 2010													
Avg. Max. Temp. [°F]	35.0	35.5	37.9	42.9	49.9	54.8	59.8	61.3	55.6	46.4	39.1	36.1	46.3
Avg. Min. Temp. [°F]	25.9	26.1	27.7	32.3	38.7	44.5	49.2	49	43.2	34.5	28.7	26.3	35.5
Avg. Total. Precip. [in.]	8.29	6.14	5.53	5.81	5.62	5.91	4.93	4.56	7.35	8.26	6.84	8.73	78.63

Notes:
For definitions, see the Acronyms section.

2.3 SITE 10 RELEASE AND INVESTIGATION HISTORY

2.3.1 Documented Releases

The history of Site 10 includes two known and sizeable below-ground releases of fuel:

- A leak of approximately 220,000 gallons of JP-5 was discovered in 1987. This leak originated from a truck fill stand pipeline on Seafarer Drive. Following the determination of the plume extent/boundary, 4-inch and 18-inch monitoring and recovery wells were installed to retain and recover the non-aqueous phase liquid (NAPL)/free product. Floating barriers and absorbent pads in Inner Womens Bay were also used. Additionally, in 1989 two recovery trenches with impermeable barriers were installed along the dike to recover product and prevent further migration to the bay.
- In 1992, approximately 41,500 gallons of JP-5 was found to have leaked from a faulty butterfly valve on a fuel line associated with the tank farm. In response to the release, two additional recovery wells with pneumatic pumps connected to oil water separators were installed at the site. Free product recovered by the trenches and wells declined over several years, and active recovery ceased in 1993; however, it is estimated that the pneumatic recovery wells recovered approximately 5,000 gallons attributable to the 1992 release.

In total, approximately 145,000 gallons of the approximate 261,500 gallons released from the two events was recovered through the various active efforts performed at the site, with approximately 118,000 gallons recovered from the 1989 release and approximately 27,000 gallons recovered from the 1992 release (Science Applications International Corporation [SAIC] 1995).

In 1997, an additional leak, caused by a flanged pumpout fitting missing an appropriate plug, was discovered in the hydrant fuel system. Near the missing plug “oily water” was noted in a “shallow pit”. It is unknown how much product was released through this leak.

2.3.2 Investigations in 1992, 1996, 1998, and 2000

Investigations of Site 10/11 in 1992, 1996, 1998, and 2000 were performed to characterize the nature and extent of petroleum, petroleum constituents, and solvents in soil and groundwater and to determine whether petroleum and petroleum constituents were entering Inner Womens Bay. Twenty permanent monitoring wells, 49 hydropunch wells, 13 test pits, and 23 soil borings, along with numerous sediment samples, outfall samples, and seep samples have been used to gain an understanding of the transport and fate of petroleum and associated constituents at the Air Station (EPA 2009). Interceptor trenches and recovery wells were used to remove fuel from the groundwater during this period.

Information on the aerial extent and thickness of free-phase product floating on the groundwater table has been gathered in a series of investigations and well monitoring events beginning in 1992. Product thicknesses have ranged from a sheen to up to 1 foot (EPA 2009) and have decreased between the start of product monitoring/recovery efforts in 1992 (S&W 1995) and the last product monitoring event in 2011 (Windward 2012). During the last quarter of 2011 (October through December), measurable product was observed in five monitoring wells at the site ranging in thickness from 0.01 to 0.33 feet.

In 1996, the UST at Site 10 was removed and a remedial investigation (RI) was performed. Additional free product was discovered in two hydropunches performed for this RI: one located roughly 30 feet west of the runway, and one located near the midpoint of the taxiway. Two monitoring wells were

installed (MW-10-028 and MW-10-029; Figure 2) and one hydropunch was pushed near the oil-water separator at the northeast corner of Hangar 1. Product was noted in MW-10-028, and the hydropunch also had free product, however, its characteristics were noted to be markedly different visually and olfactorily than the upstream product (SAIC 1996, S&W 1997).

A free product survey of the existing wells at the site was performed in 1998 and no free product was observed. Results from the free product survey and the previous investigations indicate that the extent of JP-5 impacts from the two releases is roughly bounded by Cape Spencer Street, Seafarer Drive, the dike at the head (north end) of Inner Womens Bay, and the northwest side of Hangar 1 (S&W 1999). Both groundwater and surface soil results indicate that JP-5 is the primary contaminant of concern, with groundwater impacts centered beneath Hanger 1 and Seafarer Drive. When the Site 10 wells were sampled in 2000, it was observed that two wells (MW-10-026 and MW-10-028) contained free product.

2.3.3 2001 RCRA CMS

This study assessed a variety of sites on Base Kodiak, including Site 10/11, and evaluated potential alternatives for remediation. Studies on the groundwater gradient and flow, hydraulic conductivity, and tidal influence concluded that:

- The site had high hydraulic conductivity but low groundwater gradient.
- Tidal fluctuations in groundwater were dampened by the sheet pile wall.
- The sheet pile wall acts as a barrier between site groundwater and the bay (Hart Crowser 2005a).

A human health risk assessment was conducted that determined that the site posed unacceptable risks to recreational fisherman in Inner Womens Bay (Hart Crowser 2005a).

Corrective actions were recommended and included product recovery and continued groundwater monitoring. Institutional controls were also recommended.

2.3.4 2002 Stormwater Investigation

An investigation of the stormwater management system at the Air Station was performed to better understand the flow paths that stormwater takes between the downgradient edge of the tarmac and Inner Womens Bay and to determine logistics for flow measurements and water-sampling activities. This investigation showed that the dike at the edge of the tarmac prevents runoff from draining directly to the bay as overland flow. Surface seeps at the toe of the dike were sampled for diesel-range organics (DRO) and polycyclic aromatic hydrocarbons (PAHs) to determine whether petroleum was reaching the bay through any discontinuities of the sheet pile behind the dike. Outfalls related to the stormwater system were also sampled in this investigation for benzene, toluene, ethylbenzene, or xylenes (BTEX) and PAHs. Catch basin sediments were sampled once for PAHs (EPA 2009).

2.3.5 1996-2008 Groundwater Sampling and Product Monitoring/Recovery

At Site 10/11, a network of 20 groundwater monitoring wells were sampled and monitored for the presence of free product for several years (Figures 2 through 4). Wells that have had measurable thickness of free product have been used as product recovery wells, using a passive skimmer of absorbent sock device. Free product recovery efforts undertaken from May 2003 through June 2007 and April 2009 through September 2011 resulted in the recovery of 17.8 liters (L) of free product from Site 10/11 wells (Windward and Clarus 2012). Groundwater monitoring has not occurred since 2007.

All 20 wells at the site have been monitored for free product; in 2007, the number of wells monitored was reduced to 10 (EPA, 2009). Passive free product removal was terminated in January 2012 due to the

low recovery of product during monitoring events; from 2009 to January 2012 the maximum volume of free product recovered per well per monthly service period remained less than 375 milliliters (mL) per well. No monitoring activities have been performed at the site since January 2012. Over the course of the last year of product monitoring (i.e., January 2011 to January 2012), free product was present in small volumes in 10 wells over the course of the year (Figure 2) (Windward 2012).

2.3.6 2004 Sampling of Stormwater, Seeps, Tarmac, and Groundwater

This investigation (Hart Crowser 2005a) concluded the following:

- Contaminant concentrations in stormwater from the outfall and in groundwater from seeps along the beach comply with State of Alaska surface water criteria. Contaminant concentrations in groundwater from seeps are also below state groundwater criteria.
- Analytical results for surface water, outfall, seep, and tarmac runoff samples were below ecotoxicological criteria.
- Contaminant concentrations in groundwater in the vicinity of the historical spills continue to exceed Alaska surface water criteria.
- Potential sediment impacts from PAHs were predicted using a conservative equilibrium partitioning approach. All but one predicted PAH concentrations were below sediment quality standards (SQS) and cleanup standard levels (CSL) for the detected compounds.

The 2001 human health risk assessment (Section 2.3.3) was also revised using the new outfall and seep data. The assessment concluded that Site 10/11 does not pose an unacceptable risk to recreational receptors/fishermen.

2.3.7 2005 Biological Reconnaissance

In 2005, a biological reconnaissance was performed at low tide along the beach southwest of the dike at the Air Station (Hart Crowser 2005b). The purpose of this investigation was to:

- Describe intertidal habitats and biota present
- Assess the health of the identified biota
- Identify any apparent hydrocarbon seepage to the beach face

2.3.8 2016 Soil Investigation for Utility Upgrades

Soil samples were collected as part of the USCG planning process for repair and replacement of water, sanitary sewer and storm sewer utilities near Building 24 (Site 11) and along section of the existing petroleum, oil, and lubricants (POL) pipeline that connects the Base Fuel Farm located on the south end of Nyman Peninsula to the Aviation Fuel Farm located near Building N21 (Site 10). Soil sampling was conducted as a best management practice to determine if contaminated soil is likely to be encountered during proposed utility repairs/upgrades; neither the WP for the 2016 investigation nor the data have been reviewed or approved by ADEC or EPA. As such, the uses of these data are considered “screening data” for the purposes of this WP. Results from three soil borings near Site 11 included low level detections of trichloroethene (TCE) and tetrachloroethene (PCE) in one boring. TCE result of 0.223 milligrams per kilogram (mg/kg) is above the ADEC Table B1 migration to groundwater cleanup level of 0.011 mg/kg (ADEC 2018a). Results from four borings along the POL pipeline at the edge of Site 10 indicated the soil remains impacted by fuel contamination below the ADEC Table B2 Human Health cleanup levels but above the migration to groundwater cleanup levels (1,390 mg/kg DRO and 984 mg/kg DRO).

2.3.9 2018 Soil Sampling for Secondary Containment Improvement

An Environmental Analytical Data Report completed in 2018 (North Wind Site Services 2018), documented the environmental characterization sampling that took place in conjunction with secondary containment improvement activities at multiple tank sites on Base Kodiak; one of these sites was at Tanks N19 and N20, directly across Seafarer Drive from Site 10. While the secondary containment liner was being replaced and new leak detection systems were installed, soil samples were collected within the containment area at N19 and N20. DRO, naphthalene, and arsenic were detected above ADEC cleanup levels. Additionally, soil samples were collected less than 50 feet to the northwest of the tanks, closer to Seafarer Drive, at two areas outside of the containment area. However, no chemcials were detected greater than their respective ADEC cleanup levels at the two sampling locations outside of the containment area. Based on results, it was recommended that existing monitoring wells be sampled regularly.

2.3.10 2018 Soil Sampling for Fuel Systems Deficiencies Corrections

Also, in 2018, four soil borings were drilled and soil samples were collected to support design and construction of the Fuel Systems Deficiencies Corrections project at the USCG Base Kodiak (S&W 2019). The soil sampling activities were conducted along Storis Drive, beginning northeast of the PAC N27 Building and terminating west of Pump House N21. Petroleum hydrocarbons, specifically DRO, naphthalene, and 1-methylnaphthalene, were detected above ADEC Table B1 and B2 cleanup levels in soil samples from three of the four borings.

2.4 SITE 11 RELEASE AND INVESTIGATION HISTORY

A RCRA Facility Assessment conducted in 1991 noted drums containing wastes such as antifreeze, MEK, paint thinners, and solvents near the Paint Storage Building (Site 11). While the drums were noted to be in good condition, the contents caused the Paint Storage Building to be identified as a SWMU with suspected releases to groundwater (S&W 1992).

In 1992, three investigations were conducted at the Paint Storage Building, finding paint thinners stored in 55-gallon drums, and solvents stored in a safety cabinet outside of the building (S&W 1992). Concentrations of BTEX, DRO, chlorinated volatile organic compounds (VOCs) (i.e., TCE and PCE), and MEK have been detected historically in surface soil at Site 11, indicating association with paint handling activities, and chlorinated organics in groundwater are localized around the northeast side of Building 24. The observed lack of petroleum hydrocarbons indicates a distinct, separate source associated with chlorinated organics originating within or near Site 11. The extent of contamination from chlorinated organics, which are represented by concentrations greater than applicable cleanup levels in soil, is limited, suggesting no continuing surface source of solvents within Sites 10 and 11 (S&W 1999).

2.5 MEDIA CLEANUP STANDARDS

2.5.1 Soil and Groundwater

Groundwater beneath Site 10/11 is not presently being used for drinking water and is not expected to be of suitable quality for use as drinking water because of the potential for salt water intrusion and the existing industrial land use. In June 2002, ADEC issued approval for development of alternative cleanup levels at the Air Station area (including Site 10/11) under 18 AAC 75.350. At that time, alternative cleanup values were set for groundwater and soil migration to groundwater cleanup levels at 10 times

the Table C groundwater and Tables B1/B2 cleanup levels, respectively (ADEC 2002). These alternative cleanup levels are the basis for the selected remedy at Site 10/11 (Section 3.0).

Through this determination, the Site 10/11 site-specific project action limits (PALs) for groundwater and soil (Appendix C, Worksheet 15) are as follows:

- **Soil** – PALs are the most conservative of the Human Health cleanup level or 10 times the migration to groundwater soil cleanup levels from Tables B1 and B2 over 40-inch zone of 18 AAC 75.341 (ADEC 2018a).
- **Groundwater** – PALs are 10 times the groundwater cleanup levels from 18 AAC 75.345 Table C and 18 AAC 75.350 (ADEC 2018a).

The applicability of the 350 determination at Site 10/11 and the resulting PALs described above will be reviewed following the 2019 Baseline Monitoring Event (Section 4.3.1).

2.5.2 Surface Water

Alaska water quality criteria (18 AAC 70; ADEC 2018b) apply to this site, including the numeric criteria specified in the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances* (ADEC 2008). Based on the known contaminants at the site (Section 2.6), total aqueous hydrocarbons (TAqH), as represented by the sum of BTEX and PAHs, and total aromatic hydrocarbons (TAH), as represented by the sum of BTEX compounds, are the primary constituents of interest in surface water. TAqH must be less than 15 micrograms per liter (µg/L), and TAH must be less than 10 µg/L. All analytes reported in surface water samples will be compared to applicable numeric criteria (ADEC 2008).

2.6 NATURE AND EXTENT OF CONTAMINATION

Figures 2 through 4 present historical groundwater and soil data associated with Site 10/11.

2.6.1 Soil

As summarized in Section 2.3, subsurface soil impacts are the result of the two major spills/leaks of JP-5 that occurred in 1987 and 1992. Analysis of samples from borings drilled within the southeast end of the Air Station tarmac confirm that the contaminated soil zone is limited to an area roughly bounded by Cape Spencer Street, Seafarer Drive, the dike at the head of Inner Womens Bay, and the northwest side of Hangar 1.

Results from previous investigations at Site 11 indicate that the soils in the vicinity of the Paint Storage Area have been contaminated, presumably due to activities related to paint handling or waste management. Analyses of soil samples in the vicinity of Building 24 (Figure 4) confirmed the presence of TCE, PCE, and MEK (Figure 4). Petroleum-related hydrocarbon contamination (e.g., DRO and BTEX) was also detected near Building 24, but it appears to be localized in lateral extent and to affect only surficial soil. The chlorinated volatile organics (PCE and TCE) and MEK were present only in deeper soil samples (Figure 4), suggesting that there is no continuing source to soils.

2.6.2 Groundwater

Investigations at Site 10/11 have shown that groundwater contains free product, which has historically been present in 14 of 24 wells across the site (EPA 2009). The area over which free product has been detected on the groundwater table has been estimated at approximately 9 acres. In 2011, when the last

round of product monitoring was conducted, measurable free product was observed in 10 wells over the course of the year (Windward 2012); Figure 2 shows the locations of those 10 wells.

The last round of groundwater monitoring at the site in 2007 (Clarus 2008) sampled ten of the twenty wells for DRO, BTEX, and PAHs. Of the ten wells sampled in November 2007, six wells exceeded the ADEC groundwater cleanup level for DRO of 1500 µg/L; four wells exceeded the ADEC groundwater cleanup level for benzene of 5 µg/L; six wells exceeded the ADEC surface water criterion of 10 µg/L for TAH; and six wells exceeded the ADEC surface water criterion of 15 µg/L for TAqH. Elevated concentrations of PAHs have historically been measured in monitoring wells at the downgradient edge of the hangar apron tarmac (Hart Crowser 2002); these contaminants are believed to be associated with stormwater runoff from the tarmac.

The last groundwater sampling round where samples were analyzed for chlorinated VOCs occurred in 2000. TCE was detected in Site 11 source area well MW-11-010 at 6.4 µg/L, and vinyl chloride was detected in downgradient well MW-10-023 at a concentration of 4.9 µg/L (Figures 3 and 4).

2.6.3 Surface Water

Samples of intertidal seeps adjacent to the tarmac (Figure 2) that were collected in 2002 and 2003 (Hart Crowser 2003 and 2005a) and analyzed for BTEX and PAHs had detections of PAHs but no detections of BTEX. All results were below applicable surface water criteria.

2.7 Contaminant Fate and Transport

Free product thicknesses at Site 10/11 have ranged from a sheen to 1 foot or more (EPA 2009) and have decreased over time (Windward 2012).

Mann-Kendall trend analyses of dissolved-phase contamination were performed in downgradient wells MW-10-018, MW-10-021, and MW- 10-022 for TAH and TAqH with the available historical data through the last round of sampling in 2007 (Ahtna 2017). Using that dataset, trend analyses of MW-10-018 and MW-10-021 show a decreasing trend in TAH, and MW-10-022 shows insufficient evidence of a trend. MW-10-018 and MW-10-022 show insufficient evidence of a trend, and MW-10-021 shows a decreasing trend in TAqH. This suggests that the concentrations of petroleum in the groundwater may be stable and shrinking.

Mann-Kendall trend analyses of dissolved-phase contaminants were also performed for two source area wells: MW-10-028 and MW-10- 033 (Ahtna 2017). In MW-10-028, TAH is decreasing and there is insufficient evidence of a trend in TAqH. In MW-10- 033, there is insufficient evidence for a trend in TAH, and TAqH is increasing. All analyses show a stable concentration except TAH in MW-10-021.

Mann-Kendall analysis of TCE in MW-11-010 shows a decreasing stable trend from sampling conducted between 1992 and 2000.

2.8 Potential Receptors and Exposure Pathways

A preliminary ADEC Human Health Conceptual Site Model (CSM) Scoping Form for Site 10/11 is included in Appendix D of this WP.

2.8.1 Potential Receptors

Potential receptors include current and future commercial/industrial workers, current and future construction workers, current and future site visitors/trespassers, and future residents. Recreational

users in Inner Womens Bay are also potential receptors, but they will be considered as part of Site 32, not Site 10/11.

2.8.2 Contaminated Media/Exposure Pathways

2.8.2.1 Soil

Petroleum hydrocarbon and VOC contamination has been detected from the surface to the groundwater table. As such, direct contact with soil, and inhalation of outdoor air and fugitive dust during construction activities are potential complete exposure pathways. LUCs are currently in place at Site 10/11 to prevent exposure to contaminated subsurface soil, and the presence of pavement (e.g., the tarmac) and buildings over the site impedes exposure to impacted surface soils.

2.8.2.2 Groundwater

The groundwater at Site 10/11 is not suitable as a current or future drinking water source according to ADEC in accordance with 18 AAC 75.350 (ADEC 2002) (note that Base Kodiak is provided drinking water supply via pipeline from Buskin Lake, located approximately 3 miles north of the site). This ADEC determination is an acknowledgement that the groundwater is not a viable source of water for drinking and/or other human uses, and subsequently alleviates the requirement to achieve the drinking water criteria for groundwater at the subject site. However, dermal contact with contaminated groundwater is potentially complete during construction activities. LUCS are in place to prevent dermal exposure to groundwater during construction activities.

2.8.2.3 Surface Water

The surface water body present at Site 10/11 is Inner Womens Bay, which has brackish water that will never be used as a drinking water source. While Site 10/11 may present a potential source of contamination to Inner Womens Bay, risk related to surface water in Inner Womens Bay will be addressed as part of Site 32. However, dermal exposure to surface water at Site 10/11 could occur through contact with contaminated water in the intertidal seeps.

2.8.2.4 Indoor Air/Vapor Intrusion

The vapor intrusion pathway is potentially complete for current/future commercial/industrial workers. Two occupied/occupiable industrial buildings (Hangar 1 and Building 24) are located within 30 feet of petroleum contamination in soil and groundwater and/or 100 feet of non-petroleum VOC soil/groundwater contamination.

2.8.2.5 Ecological Receptors and Wild Food Ingestion

Site 10/11 is in an active industrial area; a paved tarmac and buildings cover the site; therefore, significant terrestrial ecological receptors are not present at the site.

Womens Bay contains several potential receptors, including but not limited to fish (herring and salmon), shellfish (crab and shrimp), seabirds (pintails and sea ducks), and harbor seals that periodically visit both Inner and Outer Womens Bays. Some of these species, such as fish and crab are recreationally caught in both bays. While it is possible that Site 10/11 may be a potential source of contamination to Inner Womens Bay, ecological risk in the bay will be addressed as part of Site 32, not Site 10/11.

2.9 DATA GAPS

Current data gaps at Site 10/11 include:

- The current presence of free product
- The current concentrations of contaminants in the groundwater and surface water
- Numerous monitoring wells at the site have been destroyed or damaged during construction/repaving activities that have occurred onsite since the last sampling event; site reconnaissance will be performed to determine which wells exist and are viable for sampling
- The extents of contamination in soil, groundwater, and surface water

The groundwater and seep sampling proposed for the 2019 Baseline Monitoring Event (see Section 4.3 and Appendix C) will be a first step to fill these data gaps.

1 INCH

MW-10-003									
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04	Nov-07	Jun-08
TAH	2.7	2	ND	0.51	ND	ND	0.35 J	0.17	ND
TAqH	-	-	ND	9.89	0.011	0.36	-	-	-
TPH	ND	190	-	-	-	-	-	-	-
DRO	-	-	-	-	-	-	-	ND	ND

MW-10-018									
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04	Nov-07	Jun-08
TAH	**19.8**	**14.9**	**11.6**	8.7	3.4	1.47	10.3	1.52	ND
TAqH	-	-	**20.6**	**50.1**	6.7	10.8	-	-	-
TPH	**120000**	**10000**	-	-	-	-	-	-	-
DRO	-	-	-	-	-	-	-	640 J	340 J

MW-10-019									
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04	Nov-07	Jun-08
TAH	2	2	ND	ND	ND	ND	0.27	ND	ND
TAqH	-	-	**24**	0.13	0.61	0.32	-	-	-
TPH	ND	ND	-	-	-	-	-	-	-
DRO	-	-	-	-	-	-	-	ND	-

MW-10-020							
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04
TAH	2	2	ND	ND	ND	ND	ND
TAqH	-	-	2.09	0.38	ND	0.3	-
TPH	**2300**	**1100**	-	-	-	-	-
DRO	-	-	-	-	-	-	-

MW-10-021								
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04	Jun-08
TAH	**22.1**	**16.9**	**19.3**	10.2	2.06	1.46	**11.1**	0.48 J
TAqH	-	-	**19.9**	**11.6**	2.13	1.87	-	-
TPH	**4000**	**28000**	-	-	-	-	-	-
DRO	-	-	-	-	-	-	-	340 J

MW-10-022							
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04
TAH	**50**	**29.3**	**15.1**	**13.1**	3.9	**14.3**	**10.7**
TAqH	-	-	**26.4**	**66.1**	4.4	**35**	-
TPH	**1200000**	**120000**	-	-	-	-	-
DRO	-	-	-	-	-	-	-

MW-10-023			
	Oct-96	Jul-97	Sep-03
TAH	6.7	2	3.1
TAqH	-	-	**15.9**
TPH	**27000**	**22000**	-
DRO	-	-	-

MW-10-024							
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04
TAH	2	2	ND	ND	ND	ND	ND
TAqH	-	-	ND	ND	ND	0.04	-
TPH	ND	ND	-	-	-	-	-
DRO	-	-	-	-	-	-	-

MW-10-025									
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04	Nov-07	Jun-08
TAH	2	2	ND	0.9	ND	ND	9.9	8.1	5.5
TAqH	-	-	ND	0.9	0.3	0.06	-	**39**	-
TPH	ND	ND	-	-	-	-	-	-	-
DRO	-	-	-	-	-	-	-	**3900**	**3100**

MW-10-026								
	Oct-96	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Sep-04	Nov-07
TAH	**70**	**46**	**85**	**68.5**	**78**	**90**	**93**	**96**
TAqH	-	-	**157**	**748**	**698**	**562**	-	**874**
TPH	**4400**	**35000**	-	-	-	-	-	-
DRO	-	-	-	-	-	-	-	**8400**

MW-10-028							
	Jul-97	Sep-00	Sep-02	May-03	Nov-03	Nov-07	Jun-08
TAH	**245**	**145**	**93.8**	**66.5**	**74.4**	**90**	**27.2**
TAqH	-	**171**	**380**	**160**	**158**	**304**	**79**
TPH	**700000**	-	-	-	-	-	-
DRO	-	-	-	-	-	**16000**	**5900**

MW-10-030			
	May-03	Nov-03	Sep-04
TAH	**15.5**	9.9	**14.8**
TAqH	**19**	11.5	-
TPH	-	-	-
DRO	-	-	-

MW-10-031					
	May-03	Nov-03	Sep-04	Nov-07	Jun-08
TAH	**60.1**	**54.6**	**67**	-	**32**
TAqH	**270**	**245**	-	-	**114**
TPH	-	-	-	-	-
DRO	-	-	-	-	**51000**

MW-10-032			
	May-03	Nov-03	Sep-04
TAH	4.3	5.2	9.9
TAqH	5	5.5	-
TPH	-	-	-
DRO	-	-	-

MW-10-033				
	May-03	Nov-03	Nov-07	Jun-08
TAH	**118**	**129**	**121**	**164**
TAqH	**218**	**234**	290	**355**
TPH	-	-	-	-
DRO	-	-	**4600**	**6500**

MW-10-034			
	May-03	Nov-03	Sep-04
TAH	ND	ND	0.26
TAqH	ND	ND	-
TPH	-	-	-
DRO	-	-	-

MW-10-035			
	May-03	Nov-03	Sep-04
TAH	4	4.1	3.8
TAqH	**65.7**	**126**	-
TPH	-	-	-
DRO	-	-	-

MW-10-036				
	May-03	Nov-03	Nov-07	Jun-08
TAH	**34.8**	**46.1**	**40**	**43**
TAqH	**225**	**286**	**472**	**307**
TPH	-	-	-	-
DRO	-	-	**7300**	**7600**

MW-10-037				
	May-03	Nov-03	Nov-07	Jun-08
TAH	**62.7**	**41**	**33**	**28**
TAqH	**603**	**375**	-	-
TPH	-	-	-	-
DRO	-	-	**4300**	-

MW-10-038					
	May-03	Nov-03	Sep-04	Nov-07	Jun-08
TAH	**81.8**	**59.3**	**55**	**40**	**36**
TAqH	**815**	**613**	-	**623**	**245**
TPH	-	-	-	-	-
DRO	-	-	-	**7300**	**9000**

MW-10-039			
	May-03	Nov-03	Sep-04
TAH	**35.3**	**28.7**	**25**
TAqH	**67.4**	**191**	-
TPH	-	-	-
DRO	-	-	-

Water Quality Standards[1] (µg/L)	
TAH	10
TAqH	15
Cleanup Level[2] (µg/L)	
DRO	1500

MW-11-010	
	Sep-00
TAH	2.5
TAqH	0.42
TPH	-
DRO	0.11

MW-10-OR1	
	Jul-97
TAH	**875**
TAqH	-
TPH	**1300000**
DRO	-

MW-10-OR2		
	Oct-96	Jul-97
TAH	**283**	3.9
TAqH	-	-
TPH	**27000**	**22000**
DRO	-	-

SW-10-SH1		
	Sep-02	Nov-02
TAH	ND	ND
TAqH	0.11	0.063

SW-10-SH2		
	Sep-02	Nov-02
TAH	ND	ND
TAqH	0.092	ND

SW-10-SH3		
	Sep-02	Nov-02
TAH	ND	ND
TAqH	ND	ND

SW-10-SH4		
	Sep-02	Nov-02
TAH	ND	ND
TAqH	0.039	2.06

USCG KODIAK RCRA – SITE 10/11 INVESTIGATION

USCG BASE KODIAK
KODIAK, ALASKA

HISTORICAL PETROLEUM-RELATED CONTAMINANTS OF CONCERN IN GROUNDWATER AT SITE 10/11

Legend

- Well present; petroleum-related COCs were above cleanup levels in most-recent sampling
- Well present; petroleum-related COCs were below cleanup levels in most-recent sampling
- Well demolished or damaged; petroleum-related COCs were above cleanup levels in most-recent sampling
- Well demolished or damaged; petroleum-related COCs were below cleanup levels in most-recent sampling
- Product present in well during 2011 monitoring
- 2004 Seep Sample (2019 locations may differ, see UFP-QAPP Section 17.2.4)
- Fuel pipeline
- Outfall location
- Land use control site boundary
- Approximate outline of new nose shelter building
- Spill location

Chemistry Notes:

1. Established in 18 AAC 70 Water Quality Standards (2018).
2. Cleanup levels established in Table C of 18 AAC 75 (2018).
3. All results are in microgram/liter (µg/L).
4. Red bold indicates the result exceeds the cleanup level (Table C) or water quality standard. TPH concentration is compared to the DRO cleanup level.

Acronym/Symbol Definitions

– ..... Not sampled/no data available
COC ..... Contaminant of concern
DRO ..... Diesel range organics
J ..... Result is approximated
ND ..... Non detect
TAH ..... Total aromatic hydrocarbons
TAqH ..... Total aqueous hydrocarbons
TPH ..... Total petroleum hydrocarbons

Notes:

1. Imagery from ESRI (Digital Globe WV-2, 0.5m resolution, 9/13/2016).

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5

U.S. SURVEY FEET
HORIZONTAL DATUM: NAD83 (2011)
VERTICAL DATUM: NAVD88

240 120 0 240 480

SCALE IN FEET

PROJECT No.: 610101	DATE: 5/15/2019	FIGURE: 2
P.M.: J.O.	DRAWN: R.D.	

Document Path: G:_PROJECTS\BES\AECOM_JV\USCG\USCG_Kodiak_RCRA_Site_10_11__Site_Investigation_W6T0101_GIS\1_MXD\WORK_PLAN\Figure2-1_Historical_Petroleum_Related_Contaminants_of_Concern_in_GW_at_Site_10-11_v2.mxd

This page intentionally blank

1 INCH

MW-10-OR1	Jan-97	Apr-97
PCE	-	-
TCE	ND(5)	ND(5)
cis-DCE	-	-
trans-DCE	-	-
VC	-	-

MW-10-OR2	Jan-97	Apr-97
PCE	-	-
TCE	ND(250)	ND(5)
cis-DCE	-	-
trans-DCE	-	-
VC	-	-

Cleanup Level[1] (µg/L)	
PCE	41
TCE	2.8
cis-DCE	36
trans-DCE	360
VC	0.19

MW-10-003	Oct-96	Apr-97	Jul-97	Sep-00
PCE	ND(1)	ND(5)	ND(1)	ND(1)
TCE	ND(1)	ND(5)	ND(1)	ND(1)
cis-DCE	ND(1)	ND(5)	ND(1)	ND(1)
trans-DCE	ND(1)	ND(5)	ND(1)	ND(1)
VC	ND(1)	ND(5)	ND(1)	ND(1)

MW-10-018	Oct-96	Jan-97	Apr-97	Jul-97	Sep-00
PCE	ND(1)	ND(50)	ND(25)	ND(2.5)	ND(1)
TCE	ND(1)	ND(50)	ND(25)	ND(2.5)	ND(1)
cis-DCE	ND(1)	ND(50)	ND(25)	ND(2.5)	ND(1)
trans-DCE	ND(1)	ND(50)	ND(25)	ND(2.5)	ND(1)
VC	ND(1)	ND(100)	ND(25)	ND(2.5)	ND(1)

MW-10-019	Oct-96	Jan-97	Apr-97	Jul-97	Sep-00
PCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
TCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
cis-DCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
trans-DCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
VC	ND(1)	ND(10)	ND(5)	ND(1)	ND(1)

MW-10-020	Oct-96	Sep-00
PCE	ND(1)	ND(1)
TCE	ND(1)	ND(1)
cis-DCE	ND(1)	ND(1)
trans-DCE	ND(1)	ND(1)
VC	ND(1)	ND(1)

MW-10-021	Oct-96	Jan-97	Apr-97	Jul-97	Sep-00
PCE	ND(1)	ND(10)	ND(5)	ND(1)	ND(1)
TCE	ND(1)	ND(10)	ND(5)	ND(1)	ND(1)
cis-DCE	ND(1)	ND(10)	ND(5)	ND(1)	ND(1)
trans-DCE	ND(1)	ND(10)	ND(5)	ND(1)	ND(1)
VC	ND(1)	ND(20)	ND(5)	ND(1)	ND(1)

MW-10-022	Oct-96	Apr-97	Jul-97	Jul-97
PCE	ND(25)	ND(250)	ND(5)	ND(2.5)
TCE	ND(25)	ND(250)	ND(5)	ND(2.5)
cis-DCE	ND(25)	ND(250)	ND(5)	ND(2.5)
trans-DCE	ND(25)	ND(250)	ND(5)	ND(2.5)
VC	ND(25)	ND(500)	ND(5)	ND(2.5)

MW-10-023	Oct-96	Jan-97	Apr-97	Jul-97	Sep-00
PCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
TCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
cis-DCE	6.8	ND(5)	6.3	4	1.2
trans-DCE	1.2	ND(5)	ND(5)	ND(1)	ND(1)
VC	ND(1)	ND(10)	ND(5)	ND(1)	**4.9**

MW-10-024	Oct-96	Jan-97	Apr-97	Jul-97	Sep-00
PCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
TCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
cis-DCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
trans-DCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
VC	ND(1)	ND(10)	ND(5)	ND(1)	ND(1)

MW-10-025	Oct-96	Jan-97	Apr-97	Jul-97	Sep-00
PCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
TCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
cis-DCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
trans-DCE	ND(1)	ND(5)	ND(5)	ND(1)	ND(1)
VC	ND(1)	ND(10)	ND(5)	ND(1)	ND(1)

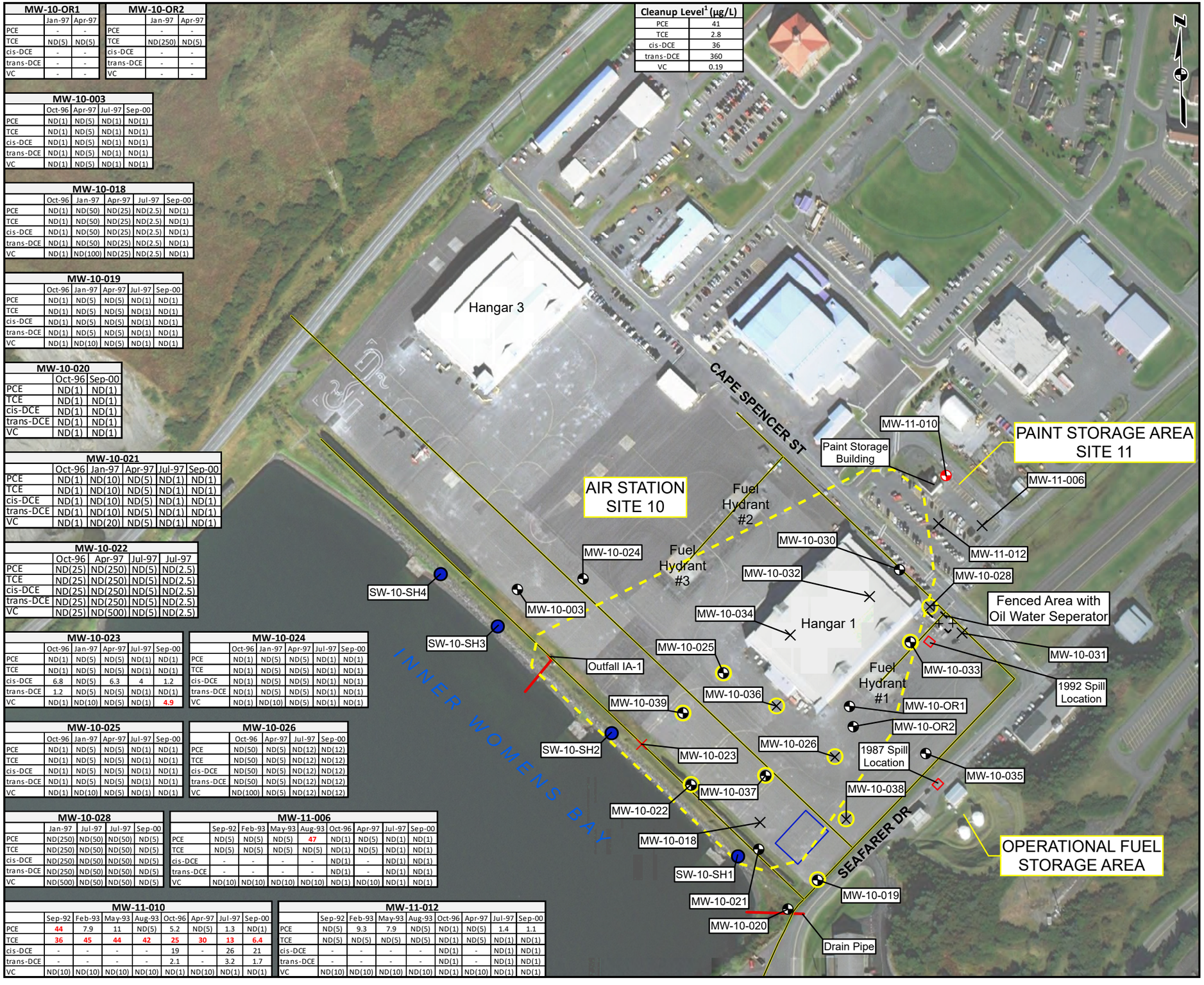
MW-10-026	Oct-96	Apr-97	Jul-97	Sep-00
PCE	ND(50)	ND(5)	ND(12)	ND(12)
TCE	ND(50)	ND(5)	ND(12)	ND(12)
cis-DCE	ND(50)	ND(5)	ND(12)	ND(12)
trans-DCE	ND(50)	ND(5)	ND(12)	ND(12)
VC	ND(100)	ND(5)	ND(12)	ND(12)

MW-10-028	Jan-97	Jul-97	Jul-97	Sep-00
PCE	ND(250)	ND(50)	ND(50)	ND(5)
TCE	ND(250)	ND(50)	ND(50)	ND(5)
cis-DCE	ND(250)	ND(50)	ND(50)	ND(5)
trans-DCE	ND(250)	ND(50)	ND(50)	ND(5)
VC	ND(500)	ND(50)	ND(50)	ND(5)

MW-11-006	Sep-92	Feb-93	May-93	Aug-93	Oct-96	Apr-97	Jul-97	Sep-00
PCE	ND(5)	ND(5)	ND(5)	**47**	ND(1)	ND(5)	ND(1)	ND(1)
TCE	ND(5)	ND(5)	ND(5)	ND(5)	ND(1)	ND(5)	ND(1)	ND(1)
cis-DCE	-	-	-	-	ND(1)	-	ND(1)	ND(1)
trans-DCE	-	-	-	-	ND(1)	-	ND(1)	ND(1)
VC	ND(10)	ND(10)	ND(10)	ND(10)	ND(1)	ND(10)	ND(1)	ND(1)

MW-11-010	Sep-92	Feb-93	May-93	Aug-93	Oct-96	Apr-97	Jul-97	Sep-00
PCE	**44**	7.9	11	ND(5)	5.2	ND(5)	1.3	ND(1)
TCE	**36**	**45**	**44**	**42**	**25**	**30**	**13**	**6.4**
cis-DCE	-	-	-	-	19	-	26	21
trans-DCE	-	-	-	-	2.1	-	3.2	1.7
VC	ND(10)	ND(10)	ND(10)	ND(10)	ND(1)	ND(10)	ND(1)	ND(1)

MW-11-012	Sep-92	Feb-93	May-93	Aug-93	Oct-96	Apr-97	Jul-97	Sep-00
PCE	ND(5)	9.3	7.9	ND(5)	ND(1)	ND(5)	1.4	1.1
TCE	ND(5)	ND(5)	ND(5)	ND(5)	ND(1)	ND(5)	ND(1)	ND(1)
cis-DCE	-	-	-	-	ND(1)	-	ND(1)	ND(1)
trans-DCE	-	-	-	-	ND(1)	-	ND(1)	ND(1)
VC	ND(10)	ND(10)	ND(10)	ND(10)	ND(1)	ND(10)	ND(1)	ND(1)



USCG KODIAK RCRA – SITE 10/11 INVESTIGATION

USCG BASE KODIAK
KODIAK, ALASKA

HISTORICAL VOCs IN GROUNDWATER AT SITE 10/11

Legend

- Well present; VOC COCs were above cleanup levels in most-recent sampling
- Well present; petroleum-related COCs were above cleanup levels in most-recent sampling
- Well demolished or damaged; VOC COCs were above cleanup levels in most-recent sampling
- Well demolished or damaged; petroleum-related COCs were above cleanup levels in most-recent sampling
- Product present in well during 2011 monitoring
- 2004 Seep Sample (2019 locations may differ, see UFP-QAPP Section 17.2.4)
- Fuel pipeline
- Outfall location
- Land use control site boundary
- Approximate outline of new nose shelter building
- Spill location

Chemistry Notes:

1. Cleanup levels established in Table C of 18 AAC 75 (2018).
2. All results are in microgram/liter (µg/L).
3. Red bold indicates the result exceeds the cleanup level (Table C).

Acronym/Symbol Definitions:

–	..... Not sampled/data unavailable
cis-DCE	..... 1,2-cis-dichloroethylene
COC	..... Contaminant of concern
J	..... Result is approximated
ND	..... Non detect
PCE	..... Tetrachloroethylene
TCE	..... Trichloroethylene
trans-DCE	..... 1,2-trans-dichloroethylene
VC	..... Vinyl chloride
VOC	..... Volatile organic compound

Notes:

1. Imagery from ESRI (Digital Globe WV-2, 0.5m resolution, 9/13/2016).

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5
U.S. SURVEY FEET
HORIZONTAL DATUM: NAD83 (2011)
VERTICAL DATUM: NAVD88

250 125 0 250 500
SCALE IN FEET

PROJECT No.:	DATE:	FIGURE:
610101	5/15/2019	3
P.M.: J.O.	DRAWN: R.D.	

Document Path: G:_PROJECTS\BES\AECOM_JV\USCG\USCG_Kodiak_RCRA_Site_10_11__Site_Investigation_W61010_GIS\1_MXD\WORK_PLAN\Figure2-2_Historical_VOCs_in_Groundwater_at_Site_10-11_v2.mxd

This page intentionally blank

1 INCH

Groundwater Cleanup Levels[1] (µg/L)	
PCE	41
TCE	2.8
cis-DCE	36
trans-DCE	360
VC	0.19
Soil Cleanup Levels[2] (µg/kg)	
PCE	190
TCE	11
VC	0.8
DRO	230,000
GRO	260,000
RRO	9,700,000

MW-11-006 (Groundwater)								
	Sep-92	Feb-93	May-93	Aug-93	Oct-96	Apr-97	Jul-97	Sep-00
PCE	ND(5)	ND(5)	ND(5)	**47**	ND(1)	ND(5)	ND(1)	ND(1)
TCE	ND(5)	ND(5)	ND(5)	ND(5)	ND(1)	ND(5)	ND(1)	ND(1)
cis-DCE	-	-	-	-	ND(1)	-	ND(1)	ND(1)
trans-DCE	-	-	-	-	ND(1)	-	ND(1)	ND(1)
VC	ND(10)	ND(10)	ND(10)	ND(10)	ND(1)	ND(10)	ND(1)	ND(1)

MW-11-010 (Groundwater)								
	Sep-92	Feb-93	May-93	Aug-93	Oct-96	Apr-97	Jul-97	Sep-00
PCE	**44**	7.9	11	ND(5)	5.2	ND(5)	1.3	ND(1)
TCE	**36**	**45**	**44**	**42**	**25**	**30**	**13**	**6.4**
cis-DCE	-	-	-	-	19	-	26	21
trans-DCE	-	-	-	-	2.1	-	3.2	1.7
VC	ND(10)	ND(10)	ND(10)	ND(10)	ND(1)	ND(10)	ND(1)	ND(1)

MW-11-012 (Groundwater)								
	Sep-92	Feb-93	May-93	Aug-93	Oct-96	Apr-97	Jul-97	Sep-00
PCE	ND(5)	9.3	7.9	ND(5)	ND(1)	ND(5)	1.4	1.1
TCE	ND(5)	ND(5)	ND(5)	ND(5)	ND(1)	ND(5)	ND(1)	ND(1)
cis-DCE	-	-	-	-	ND(1)	-	ND(1)	ND(1)
trans-DCE	-	-	-	-	ND(1)	-	ND(1)	ND(1)
VC	ND(10)	ND(10)	ND(10)	ND(10)	ND(1)	ND(10)	ND(1)	ND(1)

SOIL BORING RESULTS

Boring	Depth (ft bgs)	Date	PCE	TCE	VC	DRO	GRO	RRO
SB-11-001	3-4.5	Sep-92	ND	ND	ND	-	-	-
	15-16		ND	ND	ND	-	-	-
SB-11-002	2-3.5	Aug-92	ND	ND	ND	-	-	-
	14-16		9.1	ND	ND	-	-	-
SB-11-003	8-9.5	Aug-92	ND	6.8	ND	-	-	-
	13-15		ND	ND	ND	-	-	-
SB-11-006	3-4.5	Aug-92	ND	ND	ND	-	-	-
	18-20		ND	ND	ND	-	-	-
SB-11-010	13-14	Sep-92	ND	ND	ND	-	-	-
SB-11-012	4-5.5	Aug-92	ND	ND	ND	-	-	-
	15-16		8.9	ND	ND	-	-	-
SB-10-027	7.5-10	Sep-96	ND	ND	ND	-	-	-
	13-15		ND	7.2	ND	-	-	-
SB-BK-301	4.5	Apr-16	ND	ND	-	**927,000**	6,900	5,100,000
SB-BK-302	5	Apr-16	ND	ND	-	ND	ND	ND
	10		ND	ND	-	ND	ND	ND
SB-BK-303	5	Apr-16	ND	ND	-	25,700	ND	50,500
	10		36.9 J	**223**	-	ND	1,900 J	3,300 J

USCG KODIAK RCRA – SITE 10/11 INVESTIGATION

USCG BASE KODIAK
KODIAK, ALASKA

HISTORICAL CONTAMINANTS OF CONCERN IN SOIL AND GROUNDWATER AT SITE 11

Legend

- Well present; VOC COCs were above cleanup levels in most-recent sampling
- Soil boring with VOC COCs above cleanup levels
- Soil boring with VOC COCs below cleanup levels
- Well demolished or damaged; VOC COCs were below cleanup levels in most-recent sampling
- Fuel pipeline
- Land use control site boundary

Chemistry Notes:

1. Groundwater cleanup levels established in Table C of 18 AAC 75 (2018).
2. Soil cleanup levels established from the most-stringent of the ADEC 18 AAC 75 (2018) human health and migration to groundwater levels.
3. Groundwater results are reported in micrograms/liter (µg/L); soil sample results are reported in micrograms/kilogram (µg/kg).
4. Red bold indicates the result exceeds the cleanup level (Table B1/B2 [soil] or Table C [groundwater]).

Acronym/Symbol Definition:

–	..... Not sampled/data unavailable
cis-DCE	..... 1,2-cis-dichloroethylene
COC	..... Contaminant of concern
DRO	..... Diesel range organics
ft bgs	..... Feet below ground surface
GRO	..... Gasoline range organics
J	..... Result is approximated
ND	..... Non detect
PCE	..... Tetrachloroethylene
RRO	..... Residual range organics
TCE	..... Trichloroethylene
trans-DCE	..... 1,2-trans-dichloroethylene
VC	..... Vinyl chloride
VOC	..... Volatile Organic Compound

Notes:

1. Imagery from ESRI (Digital Globe WV-2, 0.5m resolution, 9/13/2016).

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5
U.S. SURVEY FEET
HORIZONTAL DATUM: NAD83 (2011)
VERTICAL DATUM: NAVD88

50 25 0 50 100
SCALE IN FEET

PROJECT No.: 610101	DATE: 5/15/2019	FIGURE: 4
P.M.: J.O.	DRAWN: R.D.	

Document Path: G:_PROJECTS\BES\AECOM_JV\USCG\USCG_Kodiak_RCRA_Site_10_11__Site_Investigation_W61010_GIS\1_MXD\WORK_PLAN\Figure2-3_Historical_Contaminants_of_Concern_in_Soil_and_Groundwater_at_Site_11_v2.mxd

This page intentionally blank

3 SELECTED REMEDY

The selected remedy for Site 10/11 includes LUCs, stormwater monitoring and management, groundwater monitoring in sentry wells, seep sampling in the intertidal zone, and the determination of presence or absence of free product.

Specifically, the remedy is listed in the Attachment 11 of the RCRA Permit as follows:

- Intrusive activities must be reviewed and approved by the Base Kodiak Facilities Engineer, and notification will be made to any contractors working at the site that petroleum-contaminated soil may be present, and appropriate health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for petroleum hydrocarbons prior to off-site disposal.
- Stormwater monitoring and management in accordance with EPA's Multi-Sector General Permit (MSGP).
- Groundwater monitoring in sentry wells and seep sampling in the intertidal zone to ensure that there is no release of contaminants above Alaska ambient water quality standards to Inner Womens Bay.
- Product monitoring in all wells. The presence or absence of product will be documented.

This page intentionally blank

4 CORRECTIVE MEASURE IMPLEMENTATION

The following subsections detail the implementation of the selected correctives measures for Site 10/11.

4.1 LAND USE CONTROLS

4.1.1 Land Use Control Assurance Plan

The Base Kodiak LUC Assurance Plan for Environmental Cleanup Activities (LUCAP) (Attachment 10 of the RCRA Permit {USCG 2014]) is included in this this CMI WP as Appendix A. The LUCAP includes a site-specific LUC Implementation Plan (LUCIP) for Site 10/11, which defines the specific LUCs in place for Site 10/11. To remain protective of human health and the environment, the property at the site is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils and groundwater. Specifically:

- Any intrusive activity at this site will require review and approval by the Base Kodiak Facilities Engineer and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification to the contractor that petroleum-contaminated soil may be present and that appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method Two cleanup levels prior to offsite disposal.

4.1.2 Site Inspection, Review, Certification

In accordance with the LUCAP, Base Kodiak will conduct annual visual inspections of Site 10/11 (Appendix A, Attachment A of the Site 10/11 LUCIP) and annual reviews of the Environmental Management System. These inspections and reviews will be for the purposes of verifying that all necessary land use controls are properly documented and maintained. The Base Kodiak Supervisory Environmental Protection Specialist will be responsible for ensuring that all required inspections and reviews are performed, that EPA and ADEC are notified of any deficiencies noted, and that all appropriate measures are taken in a timely manner to correct any deficiencies with timely notification to EPA and ADEC detailing such measures.

Base Kodiak will notify EPA and ADEC within 30 days upon discovery of any activity inconsistent with the LUCAP objectives. Base Kodiak will work together with EPA and ADEC to rectify the situation. Base Kodiak will also identify what went wrong with the land use control process, evaluate how to correct the process in an effort to prevent future problems, and implement these changes after consultation with EPA and ADEC.

4.1.3 Annual LUC Reports and Five-Year Reviews

The annual LUC report for this site will be prepared in accordance with the LUCAP, Section 9.0 (Appendix A), using the results of the inspection items identified in Attachment A of the Site 10/11 LUCIP. A five-year review of the appropriateness of continuing LUCs will be performed using the criteria set forth in Attachment B of the Site 10/11 LUCAP (Appendix A). Five-year review reports will be submitted on the five-year anniversary of the first annual report.

4.2 STORMWATER MANAGEMENT

4.2.1 Stormwater Pollution Prevention Plan

Base Kodiak has obtained a National Pollutant Discharge Elimination System (NPDES) permit through the 2015 EPA MSGP for Stormwater Discharges Associated with Industrial Activities, in compliance with 40 CFR 122.26. ADEC has been responsible for administering the permit since 2009. According to permit requirements, the base has also developed and implemented a SWPPP (USCG 2015), which is included in this CMI WP as Appendix B. The SWPPP identifies and evaluates potential pollutant sources, includes actions to minimize their impacts, includes and implements Best Management Practices, and provides monitoring and inspection practices to evaluate the effectiveness of the activities.

4.2.2 Annual Comprehensive Site Inspections

Base Kodiak will conduct annual site compliance inspections. The comprehensive site inspection must be conducted annually and be completed by December 31 of each year. The inspection must cover all areas of the facility affected by the MSGP (sector-specific facilities/areas). Specifically, the inspection will encompass all facilities/areas in Table 3-1 of the SWPPP.

4.2.3 Annual SWPP Reporting

Base Kodiak will prepare an annual report using the Annual Reporting Form included as Attachment A of the SWPPP (Appendix B).

4.3 GROUNDWATER AND SEEP MONITORING

The selected remedy requires product monitoring in all wells. The presence or absence of product in each well will be documented.

The selected remedy also requires groundwater monitoring in sentry wells and seep sampling in the intertidal zone to ensure that there is no release of contaminants above ADEC ambient water quality standards into Inner Womens Bay.

The plan for groundwater and seep monitoring going forward at Site 10/11 is detailed in the UFP-QAPP included in Appendix C, and summarized below. This monitoring will assess the remaining impacts and progress towards complying with applicable cleanup standards.

4.3.1 2019 Baseline Monitoring Event

A baseline monitoring event will be performed in 2019. The objectives of the baseline monitoring event are as follows:

1. **Monitoring Well Installation** – Rehabilitate the monitoring well network by installing eight new wells to replace destroyed/damaged wells and fill previous data gaps
2. **NAPL Survey** – Determine if measurable/recoverable free product exists in any of the Site 10/11 monitoring wells and document the results
3. **Groundwater Sampling** – Characterize the current nature and extent of groundwater contamination at the site above the groundwater cleanup standards at the site
4. **Seep Sampling** – Determine if seep samples exceed surface water cleanup standards

Following the baseline monitoring event, a CMI Report will be prepared to document the baseline conditions at Site 10/11 and, if necessary, modify the long-term monitoring and management recommendations provided in this CMI WP (see Section 4.3.2, below)

4.3.1.1 Monitoring Well Installation

Numerous monitoring wells at the site have been destroyed or damaged during recent construction/repaving activities that have occurred onsite. Table 17-1 in the UFP-QAPP [Appendix C] provides a summary of the wells that have been destroyed/damaged. Table 4-1 (below) lists the wells in the existing network that have been confirmed as still existing, based on a 2017 well inventory (Ahtna 2018) and an informal site visit completed in 2018. Importantly, as listed in inventory/reconnaissance observations in many of the existing wells listed in Table 4-1, while not missing or destroyed, were observed to be damaged (Table 17-1 [Appendix C]). As a first step during the baseline sampling event, a new site reconnaissance/well inventory will be performed to determine the actual number of existing and viable wells onsite.

Eight new wells will be installed in key locations to both replace destroyed sentry wells or otherwise fill a data gap at Site 10/11. Figure 5 shows the locations of the proposed monitoring wells, and Table 17-2 in the UFP-QAPP (Appendix C) provides the rationale for the location of each new well.

Prior to installing wells, ultraviolet optical screening tool (UVOST) will be performed at select proposed well locations (Figure 5) to provide greater confidence that the proposed well is installed outside of the NAPL plume. UVOST will be performed at all of the well locations where it will be possible to step-out away from the NAPL plume – Figure 5 shows those locations and the potential step-out directions. If UVOST results and field observations indicate that the select locations are within the NAPL plume, a step-out process will be performed, as possible, to select a new location outside of the NAPL plume. If the step-out distance to select a new location is greater than 50 feet, the decision to step out, field notes and boring log, UVOST log, and new step-out locations will be reported to ADEC and EPA prior to installing the well. The maximum step-out distance is 200 feet. If, after stepping-out 200 feet, UVOST indicates that location is still within contamination, the well will be installed.

During groundwater well installation, one soil sample will be collected from the unsaturated zone in each location and submitted to the laboratory for the analysis of DRO, residual-range organics (RRO), VOCs, and PAHs. The soil sample will be collected from the interval with most visible staining/odor or the interval with the highest photoionization detector response. If no staining/odor is observed or if there is no elevated photoionization detector response, the sample will be collected from the interval 6 inches above the water table. These samples will assist in the further delineation of soil impacts, the migration of these impacts, and the connection (if any) between soil and groundwater impacts. Soil samples will also further assist in the understanding and monitoring of natural attenuation occurring at Site 10/11.

Monitoring wells will be developed no sooner than 24 hours after well installation. The wells will be developed using a surge block and a peristaltic or submersible pump to cyclically remove sediment from the bottom of the well and well screen. Once the turbidity decreases and the water is visually clear, water quality parameters will be monitored for stabilization. Development procedures are detailed in Standard Operating Procedure (SOP) BE-SOP-22 *Monitoring Well Installation and Development* (Appendix C, Attachment C-2).

The locations of UVOST borings, monitoring wells, and other pertinent site features will be surveyed using global navigation satellite system (GNSS) real-time kinematic (RTK) techniques, as described in Appendix C, UFP-QAPP Worksheet #17, Section 17.5.2.

4.3.1.2 NAPL Survey

After new wells are installed, the entire viable well network (i.e., the wells listed in Table 4-1, as possible) will be monitored for the presence of floating product/ sheen, and static water levels will be measured. The monitoring well inventory (Table 17-1, Appendix C) will be updated, and damaged wells will be assessed and repaired, if possible. An electronic oil-water interface probe capable of distinguishing between water and petroleum product, and sensitive to ± 0.01 foot, will be used for the measurements and decontaminated prior to use in each well.

If more than 1 inch of product is observed in a well, a baildown test will be performed to assess NAPL mobility. This test will consist of removing the product using a bailer and monitoring how quickly the product returns. This information will be used to determine if the recommended remedy that will be provided in the CMI Report should include product recovery.

4.3.1.3 Groundwater Sampling

After new wells are installed and the NAPL survey is completed, up to 30 monitoring wells, as listed in Table 4-1, will be sampled. Monitoring wells will not be sampled if:

1. Measurable free product is observed during the NAPL survey
2. Since the previous inventory/site reconnaissance activities (Appendix C, Table 17-1), the well has been destroyed or damaged to the extent that it is not sampleable.

We anticipate that some of the existing wells listed in Table 4-1 will meet one of the criteria above and will not be sampled. As such, the proposed new wells have been positioned to provide a standalone sentry well network for the site (Figure 5).

Monitoring wells will be sampled using low flow techniques, as described in Worksheet 17 of the UFP-QAPP (Appendix C) and in accordance with *Field Sampling Procedures* (ADEC 2017), EPA Guidance (EPA 2017 and 2002), and SOP BE-SOP-09 *Groundwater Sample Collection* (Appendix C).

TABLE 4-1 POTENTIAL BASELINE GROUNDWATER MONITORING LOCATIONS

EXISTING WELLS	
MW-10-003	MW-10-032*
MW-10-018*	MW-10-033
MW-10-019	MW-10-034*
MW-10-020	MW-10-035
MW-10-021	MW-10-036*
MW-10-022	MW-10-037
MW-10-024	MW-10-038*
MW-10-025	MW-10-039
MW-10-026*	MW-10-OR1
MW-10-030	MW-10-OR2
MW-10-031*	MW-11-010
PROPOSED NEW WELLS	
MW-10-040	MW-10-044
MW-10-041	MW-10-045
MW-10-042	MW-10-046
MW-10-043	MW-10-047

*Well is likely damaged/destroyed, but will be sampled if present/viable

4.3.1.4 Seep Sampling

Four seeps will be sampled for DRO, RRO, VOCs, and PAHs. BTEX and PAH analytical results for seep water samples will be totaled and compared to ADEC TAH and TAqH water quality standards (Section 2.5).

The locations of the seeps are not precisely defined. Figure 2 shows the locations where seeps were present and sampled in 2004 (Hart Crowser 2005a). To select the four seep locations for this baseline monitoring event, a reconnaissance survey will first be conducted to identify locations where seeps are present along the shoreline in the vicinity of Site 10/11. All seep locations will be documented, and their locations will be surveyed. After reconnaissance, the following criteria will be used to select the four sampling locations (listed in descending order of importance):

- Select seep locations immediately downgradient from existing monitoring wells with known historical contamination (e.g., MW-10-039, MW-10-022, MW-10-038)
- Select seep locations where a sheen or odor is present
- Select seep locations that are separated by at least 200 feet and are at least 100 feet from Outfall IA-1
- Select at least one seep location northwest of Outfall IA-1
- Select seep locations that have the highest apparent flow rates.

Collection of the seep samples will be coordinated with the beginning of an incoming tide to ensure that samples collected from the intertidal zone are most representative of site groundwater, as opposed to outflowing salt water that may have intruded the subsurface during the previous high tide event. If

springs are not observed along the intertidal zone, additional attempts will be made to collect these samples during subsequent site visits.

4.3.1.5 CMI Report

Upon completion of the baseline NAPL survey, seep sampling, and groundwater sampling event, a CMI Report will be prepared. The CMI Report will summarize the fieldwork and lab results, identify necessary revisions to the current selected remedy, and develop the specific scope for long-term monitoring and management of the site.

4.3.2 Long-Term Management Approach

Following the 2019 Baseline Monitoring Event, at least two additional annual monitoring events will be performed in 2020 and 2021. While the specifics of the additional monitoring events will be defined in the CMI Report, we anticipate the additional monitoring events will include a NAPL survey (and potential product removal), sentry well groundwater sampling, and seep sampling.

The following outlines the decision points for the Site 10/11 long-term management approach beyond the proposed baseline (2019) and two annual monitoring events (2020 and 2021):

1. If, during the baseline monitoring and the two subsequent annual monitoring events, sitewide surface water and groundwater concentrations are below their respective cleanup standards (Section 2.5) and no measurable/recoverable free product is detected, then a "Corrective Action Complete" determination will be requested and the RCRA permit will be modified in accordance with 40 CFR 270.42

2. If, during the baseline monitoring event and the two subsequent annual monitoring events, contaminants are detected in groundwater above their respective cleanup levels (Section 2.5), measurable/recoverable free product is detected, and:

    a. If (1) dissolved-phase concentration trend analyses indicate that the plume is stable or decreasing, (2) contaminant concentrations in points-of-compliance (i.e., surface water or designated sentry wells) are <u>below</u> media cleanup standards (Section 2.5), and (3) no significant free product is measured in the site monitoring wells, then a "Corrective Action Complete with Controls" determination will be requested and the RCRA permit will be modified in accordance with 40 CFR 270.42.

    b. If (1) trend analyses indicate that the plume is not stable, (2) contaminant concentrations in points-of-compliance are <u>above</u> media cleanup standards (Section2.5), or (3) significant free product is measured in the site monitoring wells, then additional annual monitoring events will be proposed and/or a revised remedy will be considered.

4.3.2.1 Annual Monitoring Reports

As described in Section 4.3.1.5, the CMI Report will be prepared following the 2019 Baseline Monitoring Event. Following the subsequent annual monitoring events (which, at a minimum, will occur in 2020 and 2021), results will be reported along with the RCRA quarterly monitoring results from the same period. The content of these reports will include the following:

- A narrative describing activities conducted, including a description of any deviations from the approved CMI WP/UFP-QAPP

- A summary of the findings, analytical results, analytical data tables, an interpretation of the analytical data, trend analyses, and a summary of the data quality and usability
- A discussion of data, plus, if possible, using the recently acquired groundwater/seep results to assess the effectiveness of the corrective measures
- Tables and figures supporting the narrative report
- Conclusions and recommendations
- Appendices containing copies of all chemical data generated and field documentation (field notes, forms, copies of the chain of custody, a sample summary, cooler receipt forms, and any variance requests, site photographs, Chemical Quality Data Review, ADEC checklists, etc.)

4.4 SCHEDULE

The schedule for implementation of the components of the selected remedy is outlined below:

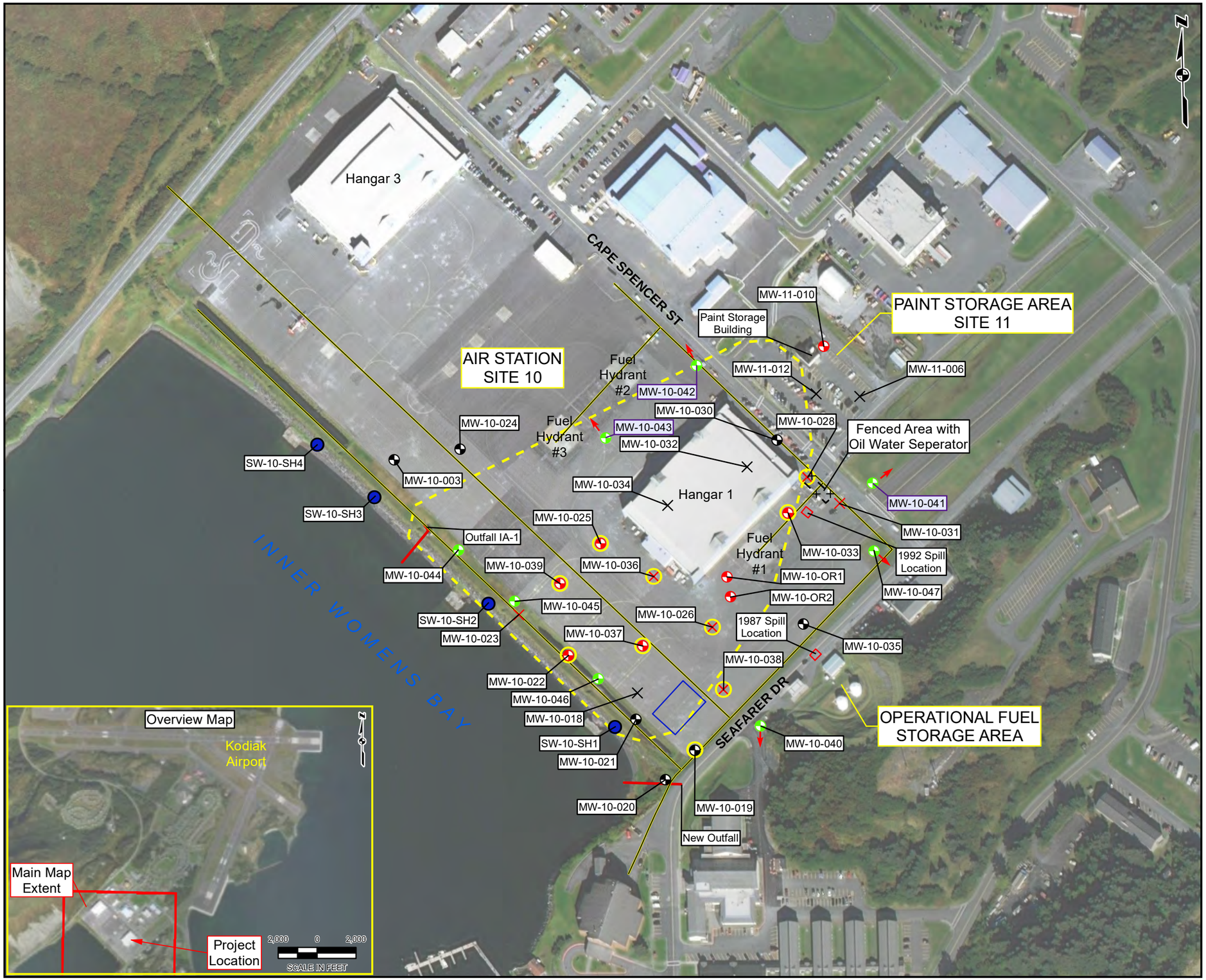
- **Land Use Controls**
  - Implementation Schedule: *IN PLACE*
  - Notes: *USCG Base Kodiak Land Use Control Assurance Plan for Environmental Cleanup Activities, Revision 2* finalized in August 2014 (USCG 2014) (Appendix A)
- **Stormwater Management**
  - Implementation Schedule: *IN PLACE*
  - Notes: *USCG Base Kodiak Stormwater Pollution Prevention Plan* finalized in October 2015 (USCG 2015) (Appendix B)
- **Groundwater and Seep Monitoring**
  - Implementation Schedule:
    - Baseline Sampling Event: *Summer 2019*
    - CMI Report: *Winter 2019*
    - 2020 Annual Sampling Event: *Summer 2020*
    - 2020 Annual Report: *Winter 2020*
    - 2021 Annual Sampling Event: *Summer 2021*
    - 2021 Annual Report: *Winter 2021*
  - Notes:
    - *UFP-QAPP)for Groundwater and Seep Monitoring* (Appendix C) is attached to this CMI WP for review
    - Baseline Monitoring Event and CMI Report scheduled for 2019
    - Annual Long-Term Monitoring Events and reports scheduled for 2020 and 2021

4.5 PUBLIC INVOLVEMENT

RCRA permitting and corrective action processes involve public participation. Cooperation amongst community members, regulators, and local industry representatives improves environmental outcomes. Amendments to the Base Kodiak RCRA Permit are made available for public comment. As such, any further changes to that plan or the permit that will require subsequent permit modification will include appropriate public comment period(s). The EPA's *Resource Conservation and Recovery Act Public Participation Manual* (EPA 2017) provides details on activities and requirements for public participation in the RCRA permit process.

This page intentionally blank

1 INCH



USCG KODIAK RCRA – SITE 10/11 INVESTIGATION

USCG BASE KODIAK
KODIAK, ALASKA

PROPOSED NEW WELL LOCATIONS AND EXISTING WELL CONDITIONS

Legend

- Proposed new well location
- Well present; COCs were above cleanup levels in most-recent sampling
- Well present; COCs were below cleanup levels in most-recent sampling
- Well demolished or damaged; COCs were above cleanup levels in most-recent sampling
- Well demolished or damaged; COCs were below cleanup levels in most-recent sampling
- Product present in well during 2011 monitoring
- 2004 Seep Sample (2019 locations may differ, see UFP-QAPP Section 17.2.4)
- Fuel pipeline
- Outfall location
- Land use control site boundary
- UVOST step-out direction
- Approximate outline of new nose shelter building
- Spill location

Acronym/Symbol Definitions:

COC ..... Contaminant of concern
UVOST ..... Ultra-violet optical screening tool

Notes:

1. Imagery from ESRI (Digital Globe WV-2, 0.5m resolution, 9/13/2016).
2. Proposed preliminary UVOST locations are represented with a purple callout box.

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 5
U.S. SURVEY FEET
HORIZONTAL DATUM: NAD83 (2011)
VERTICAL DATUM: NAVD88

240 120 0 240 480
SCALE IN FEET

PROJECT No.: 610101	DATE: 5/15/2019	FIGURE: 5
P.M.: J.O.	DRAWN: R.D.	

Document Path: G:_PROJECTS\BES\AECOM_JV\USCG\USCG_Kodiak_RCRA_Ste_10_11__Site_Investigation_W61010_GIS\1_MXD\WORK_PLAN\Figure17-1_Proposed_New_Well_Locations_and_Existing_Well_Conditions_v2.mxd

This page intentionally blank

5 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2018a (July). 18 *Alaska Administrative Code* (AAC) 75, Oil and Other Hazardous Pollution Control Regulations.

ADEC. 2018b. 18 AAC 70, *Water Quality Standards*.

ADEC. 2017 (August). *Field Sampling Procedures.*

ADEC. 2008 (December). *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances.*

ADEC. 2002 (June). *ADEC Division of Spill Prevention and Response Contaminated Sites Remediation Program Air Station and Paint Storage Area, Kodiak, Alaska.* Determination Document. Prepared for USCG.

Alaska Division of Geological and Geophysical Surveys. 1989 (April). *Surficial Geology of the U.S. Coast Guard Reservation, Kodiak, Alaska*.

Ahtna Environmental, Inc (Ahtna). 2018 (March). *Final Monitoring Well Inventory Technical Memorandum, United States Coast Guard Base, Kodiak, Alaska.*

Ahtna. 2017 (April). *Site Compliance Report; Site 10/11 Air Station/Paint Storage, Kodiak, Alaska.* Prepared for USCG Civil Engineering Unit – Juneau.

Clarus Technologies, LLC (Clarus). 2008 (December). *USCG ISC Kodiak, Site 10/11, June 2008 Site Groundwater Sampling and Analysis Report.* Prepared for USCG FD & CC (Pacific).

Clarus. 2007 (September). *USCG ISC Kodiak, Site 10/11, January 2007 through June 2007 Site Data for Groundwater Monitoring and Product Recovery.* Prepared for USCG FD & CC (Pacific).

Hart Crowser. 2005a (February 17). *2004 Summary Report for Environmental Sampling and Analysis and Product Recovery Results USCG ISC Kodiak, Site 10/11 Kodiak, Alaska.* Prepared for USCG.

Hart Crowser. 2005b (October). *Biological Reconnaissance of the Shoreline Adjacent to Site 10/11 United States Coast Guard Base Kodiak, Alaska.*

Hart Crowser. 2003 (September). *Quarterly Report for Flow Monitoring, Environmental Sampling, and Product Recovery Results; USCG ISC Kodiak, Site 10/11. Kodiak, Alaska.*

Hart Crowser. 2002 (October). *Draft Work Plan for Flow Monitoring and Environmental Sampling to Support Stormwater Management USCG ISC Kodiak, Site 10/11, Kodiak, Alaska.*

North Wind Site Services. 2018 (October). *Environmental Analytical Data Report, Secondary Containment Improvements for Tanks N-10/N-12, N-19/N-20 and N-60, United States Coast Guard Base Support Unit Kodiak, Kodiak, Alaska.* Prepared for USCG.

Shannon and Wilson (S&W). 2019 (January). *Draft Appendix C; Soil Sampling, USCG Base Kodiak, Fuel Systems Deficiencies Corrections, Kodiak, Alaska.*

S*&W. 1999 (May). Corrective Measures Study: Sites 10/11, Air Station/Paint Storage Area, ISC Kodiak, Kodiak, Alaska.* Prepared for USCG.

S&W. 1997 (May). *Corrective Measures Study: Site 10/11, Air Station/Paint Storage Area, ISC Kodiak*, *Kodiak, Alaska.* Prepared for USCG.

S&W. 1995 (February). *Final RFI/CMS Report, Volume 5, Site 10 - Air Station, Kodiak, Alaska.* Prepared for USCG.

S&W. 1992 (May). *Hazardous Materials Survey and Environmental Site Assessment Cutter Storage Building, Building No. 22 and Parking Lots A and B at Hangar No. 22 US Coast Guard Support Center, Kodiak, Alaska.* Prepared for USCG.

Science Applications International Corporation (SAIC). 1996 (April). *Draft RFI/CMS Work Plan for Site 10 (Air Station) and Site 11 (Paint Storage Area) U.S. Coast Guard Support Center Kodiak, Kodiak, Alaska.* Prepared for USCG.

SAIC. 1995 (February). *RFI/CMS Report: Volume 5 Site 10 – Air Station, USCG Support Center Kodiak*, *Kodiak, Alaska.* Prepared for USCG.

United States Coast Guard (USCG). 2015 (October). *Stormwater Pollution Prevention Plan, USCG Base Kodiak, Alaska.*

USCG. 2014 (August) (amended). *Resource Conservation and Recovery Act (RCRA) Permit number AK9690330742*. Issued by the U.S. Environmental Protection Agency, Region 10 (EPA) under the authority of the RCRA in 2011 (February). USCG Base Kodiak, Alaska.

U.S. Environmental Protection Agency (EPA). 2017 (January). *Resource Conservation and Recovery Act Public Participation Manual.*

EPA. 2017 (September). *Low Stress (low flow) Purging and Sampling Procedures for the Collection of Ground Water Samples from Monitoring Wells*, EQASOP-GW4.

EPA. 2009. *Statements of Basis for Remedy Selections and Determinations of Corrective Action Complete without Controls, U.S. Coast Guard Kodiak Proposed in Draft Permit*. July 17.

EPA. 2002 (May). *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers*, *EPA 542-S-02-001*.

EPA. 1990 (February). *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells, EPA600/4-89/034.*

United States Geological Survey (USGS). 1996a. *Hydrologic and Water-Quality Data for U.S. Coast Guard Support Center Kodiak, Alaska, 1987–89*. Open file report 96-498.

USGS. 1996b. *Description of Wells Drilled at the U.S. Coast Guard Support Center Kodiak, Alaska,* 1988-89. Open-File Report 96-134.

Western Regional Climate Center (WRCC). 2018. https://wrcc.dri.edu/. Accessed November 5, 2018.

Windward Environmental LLC (Windward). 2012 (February). *Free Product Monitoring and Recovery Quarterly Report – Sites 6B and 10/11 Oct 2011- Dec 2011.*

Windward and Clarus. 2012 (January). *Free Product Monitoring and Recovery Quarterly Report – Sites 6B and 10/11 July 2011 - Sept 2011.*

This page intentionally blank

APPENDIX A:
LAND USE CONTROL ASSURANCE PLAN FOR ENVIRONMENTAL CLEANUP ACTIVITIES

This page intentionally blank

U.S. Coast Guard
Base Kodiak

Land Use Control Assurance Plan for Environmental Cleanup Activities

Revision 2

Prepared for:

US Coast Guard
U.S. Coast Guard Civil Engineering Unit
Juneau, Alaska

Prepared by:

HDR, Inc.
606 Columbia Street NW, STE 200
Olympia, Washington

Table of Contents

1.0 Introduction....1
2.0 Authorities....1
3.0 Definitions....2
4.0 Objectives of the Land Use Control Assurance Plan....3
5.0 Activities Covered Under the Plan....4
6.0 LUCAP Location and Responsibly for Update and Distribution....4
7.0 Implementation....5
8.0 Site Inspection, Review, Certification....6
9.0 Annual Reports and Five Year Reviews....6
10.0 Changes in Land Use, Agency Coordination....6
11.0 Funding Commitment....7
12.0 Future Property Conveyance....8
13.0 Change in Applicable Standards....8

Appendices

A. List of Sites Requiring Land Use Control Measures
B. General Services Administration Memo, October 16, 1998
C. Agency Contacts
D. Five Year Review Criteria
E. Land Use Control Implementation Plans

Land Use Control Assurance Plan for Environmental Cleanup Activities U.S. Coast Guard

1.0 Introduction

Environmental investigative activities being undertaken at Base Kodiak have revealed and may in the future reveal areas of environmental contamination ("sites"). These sites include those where hazardous substances and/or Resource Conservation and Recovery Act (RCRA) hazardous wastes or hazardous constituents were or may have been released into the environment as a result of activities conducted over the history of the facility. Sites may be regulated under RCRA, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Alaska State Cleanup or Underground Storage Tank regulations.

Such sites may generally be categorized as follows:

- Industrial sites, such as landfills, where waste remains in place when the site is closed
- Sites where soil and/or groundwater contamination remains in place because remediation activities take place over a long period (years)
- Sites where soil and/or groundwater contamination remain in place because removal is not practical (buildings or utilities prevent excavation, contamination is diffuse, no known successful remedial measures exist for the contaminants)

The sites for which land use controls are planned or have been implemented may be found in Appendix A. Additional sites may be added as final remedial decisions are made.

Because Base Kodiak is currently and will likely remain a multi-use facility with industrial, commercial, recreational and residential land uses, site remedy determinations must take land use into account to facilitate the use of risk-based cleanup criteria and/or to prevent unacceptable exposure to contaminants.

2.0 Authorities

Base Kodiak operates a hazardous waste storage facility and manages three RCRA landfills in post-closure status under RCRA permit No. AK9690330742. Section IX of the permit directs the Coast Guard to undertake corrective action for Solid Waste Management Units (SWMUs), as required under Section 3004(u) of the RCRA statute and promulgated in regulation under 40 Code of Federal Regulations (CFR) 264.101.

RCRA requires that cleanup of releases of hazardous wastes and hazardous constituents to the environment be protective of human health and the environment. Part of the decision process for selecting a remedy involves assumptions concerning the current and future use of the land or water associated with a SWMU. In many cases, it is not possible or cost effective to clean up a

site to contaminant levels that would allow residential development to occur. In such cases, future land uses and activities must be controlled in some way to ensure that the remedy selected is protective. These land use controls become part of the remedy, and are reviewed and enforced by the regulatory agencies. The Environmental Protection Agency (EPA) documents the remedy and associated land use control requirements in a Corrective Action Statement of Basis, and modifies the RCRA permit to include the provisions of the remedy. EPA Region 10 has developed guidance to ensure the consistent application of institutional controls or land use controls at Federal facilities (EPA, 5/3/99). National EPA guidance is also available (EPA, 12/02).

In addition to RCRA, and associated EPA Region 10 guidance, the Alaska Department of Environmental Conservation (ADEC) cleanup regulations (18 Alaska Administrative Code [AAC] 75 allow for the development of institutional controls as part of a site remedy when required to be protective of human health and the environment (18 AAC 75.375). ADEC requires institutional controls at sites where contamination will remain on-site at levels higher than residential cleanup standards, or where constituents left in place do not allow groundwater to be used as a drinking water source. ADEC documents the decision in a "No Further Remedial Action Planned" Decision Document, which recognizes that wastes or contamination have, by necessity or mutual agreement with EPA or ADEC, been left in place, and requires the imposition of land use restrictions to protect human health and the environment. ADEC also has developed guidance for the development of institutional controls (ADEC, 2/9/01).

All real property interests controlled by the Coast Guard are owned or held by the United States government. The Coast Guard is the federal agency charged with administrative accountability, control, and custody over the real property at Base Kodiak. In the course of continuing operations, USCG has been required to perform certain environmental remedial actions. At some sites, the imposition of land use controls is part of the remedial action.

The U.S. Coast Guard, as the landholding agency, has no authority to place deed restrictions on any land within its purview. This authority is held by the General Services Administration (GSA) as part of its authority to manage the utilization and disposal of real property. GSA has delineated this authority in an October 1998 memo (see Appendix B). This Land Use Control Assurance Plan and the attached site-specific Land Use Control Implementation Plans provide a mechanism for instituting land use controls with continuing operations at Base Kodiak as required in the relevant remediation decision documents.

Should sites identified in this Land Use Control Assurance Plan be identified for excess, then, as required under CERCLA Section 120, environmental due diligence would identify whether additional remediation or changes to land use controls or control mechanisms were warranted as part of the disposal process. At that time, this Land Use Control Assurance Plan will be reviewed for its appropriateness.

3.0 Definitions

"Land use control" means any restriction or control arising from the need to protect human health and the environment, that limits the use of and/or exposure to, environmentally contaminated media (e.g., soils, surface water, groundwater) at any site at Base Kodiak. The term

includes controls on access (e.g., engineered and non-engineered mechanisms such as fences, caps, security guards). Additionally, the term encompasses both affirmative measures to achieve the desired control (e.g., night lighting of an area) and prohibitive directives (e.g., no drilling of drinking water wells). The term also includes **"institutional controls,"** which are non-engineered mechanisms for ensuring compliance with necessary land use limitations (e.g., public advisories, legal restrictions on land or water usage, restrictions imposed and information recorded pursuant to Land Use Control Implementation Plans).

"Land Use Control Implementation Plan" or **"LUCIP"** means the plan through which land use controls are implemented. The LUCIPs include both land use control objectives for the site being addressed as well as those land use controls which will be relied upon to achieve that objective. Each LUCIP will also specify what must be done in order to implement and maintain the specific land use controls required for the site. LUCIPs for each site will be appended to and be part of the Corrective Action Statement of Basis (CASOB) or other decision document for that site.

"Decision document" includes, but is not limited to, RCRA Statements of Basis/ Notices of Decision, RCRA Permit Modifications, and Alaska Department of Environmental Conservation Decision Documents as identified in 18 AAC 75.

"**Residential land use"** (18 AAC 75) means the use of property for dwellings such as single family homes, multi-family apartments, children's homes, and nursing homes; because of the similarity of exposure potential and the sensitive nature of the potentially exposed population, "residential land use" includes uses of property for day care facilities, educational facilities, hospitals, playgrounds, and similar facilities; "residential land use" includes property restricted to residential use by legally enforceable zoning ordinance or specific deed restriction; vacant land that is not zoned or deed-restricted for commercial or industrial land use will be considered residential unless demonstrated otherwise.

4.0 Objectives of the Land Use Control Assurance Plan

The Base Kodiak Land Use Control Assurance Plan has the following objectives:

- To establish and institutionalize a process to ensure appropriate long-term maintenance of those land use controls implemented as part of remedy selection for any contaminated site on the facility. This process is designed to accomplish the following:
  - Prevent unacceptable human or environmental exposures, where appropriate, through consideration of assumed future land use scenarios at those sites where land use controls will be necessary to make such assumptions reliable.
  - Integrate all site remedies that include land use controls into the facility's planning process.
  - Elevate the general level of awareness among Base Kodiak personnel as to the need to maintain land use controls in order to ensure long-term protection of human health and the environment.

- ♦ Implement a process to add sites as it is determined that they require land use controls, or to delete sites as it is determined that they no longer require land use controls.

- To implement a process for Base Kodiak to periodically advise EPA and ADEC (as appropriate) of the continued maintenance of any land use controls implemented at Base Kodiak and of any planned changes in land use which might impact the site remedy.
- To provide reasonable assurances to EPA and ADEC (as appropriate) that those specific pathway and exposure assumptions relied upon in applying a risk-based cleanup standard to a given site will remain valid until such time as the Parties agree that either different site controls or unrestricted site usage would be appropriate.

5.0 Activities Covered Under the Plan

The following activities are examples of work that would be covered under this Land Use Control Assurance Plan:

- Soil disturbance
- Routine and non-routine above-ground and below-ground utility work
- Well placement and drilling
- Drilling for other purposes
- Paving activities
- Construction and renovation of above-ground and below-ground structures
- Outdoor recreational activities
- Groundwater withdrawals
- Training activities

6.0 LUCAP Location and Responsibility for Update and Distribution

When land use controls are necessary to assure the reliability of land use assumptions, it is essential that appropriate procedures be put in place to ensure that such controls will be maintained for as long as necessary to keep the chosen remedy fully protective of human health and the environment.

Updated copies of the LUCAP (with all appendices) will be maintained by the following entities within the Coast Guard and its contractors.

Unit Copies	Copy Number
ENV BR File Room	
Master, Reproducible: Original Issue	Doc #
Master, Maintained Copy	Doc #
Record of Changes	Doc #
ENV BR Library	01
CEU Juneau	02
FD&CCPAC – Special Projects Office	03
MLCPAC (s) – Master Planning	04
Base Kodiak BOSS Contractor	05
EPA Region 10 (2 copies)	06/07
ADEC (2 copies)	08/09

Personal Copies	Copy Number
Base Kodiak, Chief Technical and Design Branch	10
Base Kodiak, Chief Maintenance Branch	11
Base Kodiak, Chief, Facilities Engineering Division	12
Base Kodiak, Chief, Environmental & Fire Protection Branch	13
Base Kodiak, Supervisory Environmental Protection Specialist	14

The Base Kodiak Supervisory Environmental Protection Specialist has the responsibility for ensuring that updates are performed in a timely manner and that distribution of copies is made to all Plan holders.

A control document will be added to the Base Kodiak Environmental Management System documenting how updates to the Land Use Control Implementation Plan for each site will be handled by Base Kodiak.

7.0 Implementation

This Land Use Control Assurance Plan contains five appendices:

- **Appendix A:** Land Use Control Site Listing for all sites covered under the Land Use Control Assurance Plan. The list includes, for each site, the site name, site description and site location as specified in the decision document, and the name and date of the decision document itself.
- **Appendix B:** A General Services Administration policy memo regarding property disposals.
- **Appendix C:** Agency Points of Contact
- **Appendix D:** Land Use Controls Five Year Review Criteria
- **Appendix E:** Land Use Control Implementation Plans for all sites for which they have been developed.

Within six (6) months after publication and final approval of a decision document containing land use controls, Base Kodiak will incorporate the land use controls into Base Kodiak's Environmental Management System and will provide written notification to EPA and ADEC when the land use controls have been so incorporated. As future decisions involving land use controls are made at sites on Base Kodiak, these sites will become covered under this Land Use Control Assurance Plan and listed in Appendix A, and a new LUCIP appropriate to each such newly-covered site will be added to Appendix C upon final approval of the decision document for that site. Every five years a review of each site will occur using the criteria listed in Appendix E.

This Land Use Control Assurance Plan and its appendices will be legally binding on the Coast Guard, regulatory agencies, and contractors working at Base Kodiak.

8.0 Site Inspection, Review, Certification

Unless otherwise agreed to in a LUCIP, Base Kodiak will conduct annual visual inspections of all sites identified in Appendix A to this Plan and annual reviews of the Environmental Management System. These inspections and reviews will be for the purposes of verifying that all necessary land use controls are properly documented and maintained. The Base Kodiak Supervisory Environmental Protection Specialist will be responsible for ensuring that all required inspections and reviews are performed, that EPA and ADEC are notified of any deficiencies noted, and that all appropriate measures are taken in a timely manner to correct any deficiencies with timely notification to EPA and ADEC detailing such measures.

Base Kodiak will notify EPA and ADEC within 30 days upon discovery of any activity inconsistent with the LUCAP objectives. Base Kodiak will work together with EPA and ADEC to rectify the situation. Base Kodiak will also identify what went wrong with the land use control process, evaluate how to correct the process in an effort to prevent future problems, and implement these changes after consultation with EPA and ADEC.

9.0 Annual Reports and Five Year Reviews

An annual monitoring report will be provided to EPA and ADEC. The annual report for all sites with Land Use Controls at Base Kodiak will consist of a cover letter that will state that all sites are being monitored and maintained in accordance with the LUCAP and the specific LUCIPs that apply for the individual sites. An attachment to the letter will list the sites inspected with the dates of inspection and any discrepancies and corrective actions implemented.

Five year review of the appropriateness of continuing land use controls will be performed using the criteria set forth in Appendix E. Five year review reports will be submitted on the five-year anniversary of the first annual report.

10.0 Changes in Land Use, Agency Coordination

At least sixty days (except in emergency situations) prior to implementation of any proposed major change in land usage (defined below) at any site subject to land use controls, Base Kodiak

will submit a request for agency concurrence of any such proposed change to EPA and ADEC. This notification will be provided to EPA and/or ADEC to obtain concurrence regarding the potential impact of the land use change on the site.

Each request for concurrence will include:

- An evaluation of whether the anticipated land use change will pose unacceptable risks to human health and the environment or negatively impact the effectiveness of the selected site remedy;
- An evaluation of the need for any additional remedial action or land use controls resulting from implementation of the anticipated major land use change; and,
- A proposal for any necessary changes in the selected site remedy.

No major land use change will be implemented until EPA and ADEC concurrence is obtained, so long as EPA and ADEC respond in a timely fashion (normally 30 days).

The following will constitute a major change in land use:

- Any change in land use (e.g., from industrial or recreational to residential) that would be inconsistent with those specific exposure assumptions in the human health and/or ecological risk assessments that served as the basis for the land use controls that were implemented at the site;
- Any activity intended to alter or negate the need for the specific land use controls implemented at the site.

Base Kodiak will immediately notify EPA and ADEC if, despite its best efforts to ensure compliance, a major change in land use at any site with an implemented land use control is discovered that has not been previously agreed to by EPA and ADEC. Such notifications will describe the nature and extent of the change and describe any measures implemented or proposed (including a timetable for completion), to reduce or prevent human health or ecological impacts.

11.0 Funding Commitment

Base Kodiak agrees to use its best efforts to obtain all necessary funding through the appropriate authorities or source(s) to ensure the continued maintenance of all land use controls covered under this Plan and, where necessary, the timely re-implementation of any land use controls and/or completion of site restoration activities necessitated by any violation of or unauthorized change to an implemented land use control. All requirements of this document requiring the expenditure of Coast Guard funds are expressly subject to the availability of appropriations and the requirements of the Anti-Deficiency Act (31 U.S.C. Section 1341). No obligation undertaken by the Coast Guard under the terms of this document will require or be interpreted to require a commitment to expend funds not obligated for a particular purpose. If the Coast Guard cannot perform its obligations set forth in this document due to the unavailability of funds, the Coast Guard will apply its best efforts to renegotiate the provisions of the Land Use Controls.

12.0 Future Property Conveyance

Should areas identified in this Land Use Control Assurance Plan be identified for excess, then Base Kodiak will ensure that:

- EPA and ADEC are provided with written notice at least six (6) months prior to any such intended conveyance. If it is not possible to provide six months notice, then at least 60 days' notice will be provided. Such notice will provide the regulatory agencies with the opportunity to discuss the appropriateness of the existing land use controls in light of the planned excess, and
- Consideration of each land use control is incorporated into those property disposal procedures (e.g., preparation of the Environmental Baseline Survey for Transfer (EBST), Finding of Suitability for Lease (FOSL), and Finding of Suitability for Transfer (FOST) to be utilized to meet CERCLA Section 120 and 40 CFR 373 notice requirements so that the transferee(s) is given adequate notice of site condition(s). It is understood that the planned excess of property of any site with land use controls may prompt the Coast Guard, EPA, or ADEC to re-evaluate the appropriateness of the selected remedy, including any existing land use controls.

13.0 Change in Applicable Standards

Nothing herein should be construed to preclude Base Kodiak from proposing at any time or the Parties from agreeing to the deletion of any site from coverage under this document based on either: (i) a change to applicable Federal or State risk-based cleanup standards, or (ii) a change in contaminant concentration levels allowing for unrestricted use as a result of the effects of man-induced or naturally-occurring bioremediation / attenuation. Deletion of a site from coverage under the Land Use Control Assurance Plan will be accomplished by one of the following methods:

- For sites under the RCRA permit, a request for a Class 3 permit modification will be submitted requesting approval of No Further Action for the site
- For sites under other state or Federal authorities, a written request will be submitted documenting the request for deletion, reasons for such request, and a timeline for agency review and approval.

References

Alaska Department of Environmental Conservation. February 9, 2001. Guidance on Using Institutional Controls in Oil and Other Hazardous Substance Cleanups. Draft Final.

EPA Region 10. May 3, 1999. Region 10 Final Policy on the Use of Institutional Controls at Federal Facilities.

EPA Office of Solid Waste and Response. December 2002. Institutional Controls: A Guide to Implementing, Monitoring, and Enforcing Institutional Controls at Superfund, Brown Fields, Federal Facility, UST, and RCRA Corrective Action Cleanups.

Martin, J.Q., Director, Redeployment Services Division, GSA. October 15, 1998. Memorandum for Regional Directors, GSA. Subject: Restrictive Covenants on Non-Excess Property.

Appendix A
List of Sites Requiring Land Use Control Measures

List of Sites Requiring Land Use Control Measures					
Site No., Name	**Location and Description**	**Name and Date of Decision Document**	**Objectives of Restriction and Control**	**Tools to Implement and Evaluate**	**Time frame in which Land Use Controls Apply**
Site 1, Coast Guard Landfill, RCRA Solid Waste Management Unit	Located north of Tom Stiles Road. Ten acre landfill	Post-closure Plan, 1999 EPA RCRA Permit Modification for remedy, not signed in 2006	To prevent waste exposure; to protect human health and environment	Post-closure Plan, 1999; EMS; annual inspections; five year review	In perpetuity
Site 2, Navy Landfill, RCRA Solid Waste Management Unit	Located north of Tom Stiles Road and west of Coast Guard Landfill. 7.5 acre landfill	ADEC Decision Document, not yet signed EPA RCRA Permit Modification for Remedy, not yet signed	To prevent waste exposure; to protect human health and environment	EMS; annual inspections; five year review	In perpetuity
Site 3, Laundry, RCRA Hazardous Waste Management Unit	Located at north end of Nyman Peninsula. Soil and groundwater contaminated with VOCs from former dry cleaning facility	RCRA Post-closure Permit, January 1998	To prevent waste exposure; to protect human health and environment	RCRA permit Attachment 5 post-closure plan; EMS; annual inspections; five year review	Until soil and groundwater contamination is below applicable standards
Site 6A, MOGAS, RCRA Hazardous Waste Management Unit	Located at south end of Nyman Peninsula. Soil contaminated with petroleum hydrocarbons and VOCs from former USTs.	RCRA Post-closure Permit, January 1998	To prevent waste exposure; to protect human health and environment	RCRA permit Attachment 5 post-closure plan; EMS; annual inspections; five year review	Until soil and groundwater contamination are below applicable standards
Site 6B, Nyman Peninsula Fuel Farm	Located on the southeast side of the base, spanning the central elevated portion of the Nyman Peninsula. Soil contaminated with petroleum hydrocarbons from former fuel storage tanks and conveyance facilities.	ADEC Decision Document, not yet signed EPA RCRA Permit Modification for Remedy, not yet signed	To prevent waste exposure; to protect human health and environment	EMS; annual inspections; five year review	In perpetuity
Site 7A, Barrel Storage Area No. 2, RCRA Hazardous Waste Management Unit	Located on Nyman Peninsula, within the fuel farm. Soil and groundwater contaminated with VOCs and petroleum hydrocarbons from former barrel storage area	RCRA Post-closure Permit, January 1998	To prevent waste exposure; to protect human health and environment	RCRA permit Attachment 5 post-closure plan; EMS; annual inspections; five year review	Until soil and groundwater contamination are below applicable standards

List of Sites Requiring Land Use Control Measures					
Site No., Name	**Location and Description**	**Name and Date of Decision Document**	**Objectives of Restriction and Control**	**Tools to Implement and Evaluate**	**Time frame in which Land Use Controls Apply**
Site 10/11, Air Station	Located within the industrial southern portion of Base Kodiak. Groundwater contamination with petroleum products.	ADEC Decision Document, July 2003 EPA RCRA Permit Modification for Remedy, not yet signed	To prevent waste exposure; to protect human health and environment	EMS; annual inspections; five year review	In perpetuity
Site 12, Buskin Lake Drum Disposal Area	Located approximately seven miles southwest of the city of Kodiak. Soil and ground water contamination with POL and DRO petroleum products.	ADEC Decision Document, July 2003 EPA RCRA Permit Modification for Remedy, not yet signed	To prevent waste exposure; to protect human health and environment	EMS; annual inspections; five year review	In perpetuity
Site 18, Drury Gulch, RCRA Solid Waste Management Unit	Located north of Rezanof Highway, across from the base main gate. Former metal debris landfill; soil contaminated with PCBs	ADEC Decision Document, July 2003 EPA RCRA Permit Modification for Remedy, not yet signed	To prevent debris and contaminated soil exposure; to protect human health and the environment	Inspection and Corrective Action Plan; EMS; five year review	In perpetuity
Site 23, Old Power Plant, RCRA Solid Waste Management Unit	Located on north end of Nyman Peninsula, south of Site 3, Laundry. Soil and groundwater contamination by FS-6 fuel oil, soil, contaminated with PCBs.	EPA RCRA Permit Modification for Remedy, not signed February 2006	To protect human health and the environment	Annual inspections; EMS; five year review	Until soil and groundwater contamination are below applicable standards
Site 28, Former Building 17 Public Works Garage, RCRA Solid Waste Management Unit	Located south of the main gate, along the west fence-line. PCB contamination in soils from former transformer leakage	EPA RCRA permit Modification for Remedy, not signed ADEC Site Closure Approval Letter, 7/2/01	To protect human health and the environment	Annual inspections; EMS; five year review	Until soil and groundwater contamination are below applicable standards
Site 33, Empty Container Storage Area, Subarea 33A	Located on the north side of Nyman Peninsula within the fuel farm. Petroleum contamination in soils.	EPA RCRA Permit Modification for Remedy, not yet signed June 2009	To protect human health and the environment	Annual inspections; EMS; five year review	Until soil contamination is below applicable standards
Site 34, Building A711, RCRA Solid Waste Management Unit	Located at corner of Tom Stiles Road and Anton Larsen Bay Road. Soil contaminated with FS-6 fuel oil; groundwater contaminated with low levels of petroleum hydrocarbons.	ADEC Decision Document, not yet signed EPA RCRA Permit Modification for Remedy, not yet signed	To protect human health and the environment from contaminated soils and groundwater	Annual inspections; EMS; five year review	Until soil and groundwater contamination are below applicable standards

List of Sites Requiring Land Use Control Measures					
Site No., Name	**Location and Description**	**Name and Date of Decision Document**	**Objectives of Restriction and Control**	**Tools to Implement and Evaluate**	**Time frame in which Land Use Controls Apply**
Site 35, Fire Training Area, RCRA solid waste management unit	Located on north side of airport. Soil and groundwater contaminated with fuel oils from fire training activity.	EPA RCRA permit modification for remedy not yet signed	To protect human health and the environment from contaminated soils and groundwater	EMS, annual inspections, five year review	Until soil and groundwater contamination are below applicable standards.
Asbestos Monofill, Tank 167	Located on Nyman Peninsula within the fuel farm. Closed asbestos monofill disposal site	ADEC Decision Document not yet signed	To prevent waste exposure	EMS; five year review	In perpetuity

Appendix B
General Services Administration Memo
October 16, 1998

OCT 1 5 1998

MEMORANDUM FOR REGIONAL DIRECTOS – 1PR, 4PR, 7PR, 9PR

FROM: JOHN Q. MARTIN s/JOHN Q. MARTIN
DIRECTOR
REDEPLOYMENT SERVICES DIVISION

SUBJECT: Restrictive Covenants on Non-excess Property

This memorandum clarifies the General Services Administration's (GSA) policy regarding restrictive covenants on real property by landholding agencies.

This issue has caused confusion and has created obstacles to the efficient and effective disposal of excess and surplus real property. Therefore it is essential that this issue be clarified and a consistent approach taken to these actions. This letter applies to GSA regional officials involved in the disposal of Federal real property and to all landholding executive agencies. This memorandum is effective immediately.

Recently, GSA has been approached by several military services requesting assistance with State environmental regulators. In the course of continuing military operations at specific installations, the Department of Defense (DOD) has been required to perform certain environmental remediation. These remediation actions require the final approval of the State regulators. In some states, the State regulators have demanded that DOD place use restrictions or other covenants on the property. These restrictions are intended to run with the land and restrict future owners of the property to specific uses. At this time, the installations in question are in continual use and are not being evaluated as potentially excess property.

At the same time, GSA is aware that other agencies have agreed to restrictive covenants on property in their inventory. These include historic preservation restrictions which have been agreed to by the landholding agency during negotiation of the National Environmental Policy Act (NEPA) or National Historic Preservation Act (NHPA) as these acts apply to the decision to excess the property.

GSA does not believe landholding agencies have the authority to place such restrictions on property in their inventory. GSA views such restrictive covenants as disposals of real property. Under the Federal Property and Administrative Services Act of 1949, as amended (Property Act) GSA was given the exclusive authority to manage the utilization and disposal of real property (40 U.S.C. §§ 471, et seq). The Property Act defines "property" to include "any interest in

property" (40 U.S.C. § 472(d)). GSA's regulations (41 C.F.R. §101-47.103-12(a)) define "real property" to include "any interest in land". Therefore, unless the landholding agency has specific authority to dispose of such property rights, the landholding agency must request GSA to dispose of these real property rights or request a delegation of disposal authority from GSA.

Generally, covenants restricting the future use of property are evaluated during the disposal process carried out by GSA. Therefore, where property is expected to be reported excess, GSA will usually deny the request from the landholding agency and evaluate any necessary restrictions during the disposal process. If there are special circumstances that demand agreement on use restrictions prior to being evaluated in the disposal process, GSA will review the request on a case-by-case basis. GSA's evaluation will consider the impact any restrictions may have on the future disposition of the property, the ability to use the property for its highest and best use (as determined by GSA), the economic impact of the requested restrictions, the legal requirement to place such a restriction on the property, and/or the enforceability of the requested restriction.

GSA is particularly concerned about requests to restrict the future use of property when the landholding agency does not contemplate declaring the property excess in the near future. GSA is doubtful as to the necessity, desirability or legal enforceability of placing restrictions on property that will remain in the Government's inventory. Questions as to how such restrictions will be enforced, and by whom, while the property is still an active Government facility are raised by these requests. Further, it would be difficult, if not impossible, for GSA to accurately determine the impact such restrictions may have on the future disposal of the property when immediate disposal of the property is not being contemplated. Therefore, GSA will deny all requests for land use restrictions on fully utilized property unless the requesting landholding agency can demonstrate the unique and extreme circumstances which would overcome GSA's objections to the placing of such restrictions on the property.

Official File – PRD
Readers – PR, PRD, PRP, PRA, Brooks, Chase, Flowers, Kelly, Mandell, Martin, Shouts, Butterworth LR

H:\RestCove.doc

PRD:JohnQ.Martin:10/16/1998:AW

Appendix C
Agency Contacts

Facility Contacts for Land Use Control Assurance Plan

US Coast Guard, Base Kodiak

Supervisory Environmental Protection Specialist
US Coast Guard Base Kodiak
Building N-38
Kodiak, Alaska 99619
907-487-5320

Chief, Environmental and Fire Protection Branch
US Coast Guard Base Kodiak
Building N-38
Kodiak, Alaska 99619
907-487-5320

Chief, Facilities Maintenance Branch
US Coast Guard Base Kodiak
Building N-38
Kodiak, Alaska 99619
907-487-5320

Planning Technician
US Coast Guard Base Kodiak
Building N-38
Kodiak, Alaska 99619
907-487-5320

US Coast Guard, Facilities Design and Construction Center Pacific

U.S. Coast Guard Civil Engineering Unit Juneau
P.O. Box 21747
Juneau, Alaska 99802-174
907-463-2407

US Environmental Protection Agency

RCRA Permits
US Environmental Protection Agency
1200 Sixth Avenue
Seattle, WA 98101
206-553-6702

Alaska Department of Environmental Conservation

Chief, Division of Spill Prevention and Response
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, AK 99501
907-269-7545

Appendix D
Five Year Review Criteria

Land Use Controls
Five Year Review Criteria

Date: _____ Date of Previous 5 year review: _____

Name: _____ Date of Next 5-Year Review: _____

Every 5 years the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for 5 Year Review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next 5 years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors change to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should land use controls be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items.

Appendix E
Land Use Control Implementation Plans

Land Use Control Implementation Plan
Site 10/11 – Air Station
US Coast Guard Base Kodiak

Revision 2

August 2014

Site 10/11 – Air Station
Land Use Control Implementation Plan

1.0 Site Location

US Coast Base Kodiak is located approximately 5 miles south of the town of Kodiak, Alaska on Kodiak Island. Site 10/11, Air Station and Paint Storage Building, is located within the industrial area in the southern portion of Base Kodiak (Figure 1).

2.0 Site Description

During World War Two (WWII), the U.S. Navy established a base on Kodiak Island to protect the Gulf of Alaska and serve as an intermediate point between installations at Cold Bay and Sitka. Site 10, Air Station, includes three hangars, several aircraft fueling stations, and oil/water separator, the Air Station fuel farm, and a large tarmac area where helicopters and C-130 aircraft are serviced and fueled. Site 11, the Paint Storage Building, includes a small building currently used for storing and dispensing paint and paint-related solvents. Because the sites are adjacent to each other, they are addressed as one site and are referred to Site 10/11.

Two major releases are known to have occurred at the site, both located east of Hangar 1. The first release was a leak of an estimated 220,000 gallons of JP-5 from a pipeline associated with the Air Station fuel farm. The USCG discovered the leak and repaired it in May 1987. Between 1989 and 1992 approximately 118,000 gallons of spilled product were recovered. The second release occurred in April 1992 and consisted of 41,000 gallons of JP-5. Between 1992 and 1995 approximately 27,000 gallons were recovered.

Site 10/11 is bounded to the southwest by Inner Womens Bay. The ground slopes steeply upward to the northwest and southeast, and more gradually to the northeast toward the base residential areas. The subsurface geology consists of sand and gravel deposits, and has a relatively high hydraulic conductivity. Groundwater gradients are typically flat in the area of the Site 10/11tarmacg, but they are influenced by a sheet pile wall located between the bay and the tarmac. This wall is located at depth within the dike between the edge of the tarmac and Inner Womens Bay. The wall was originally installed to allow filling of the site for the tarmac. It is thought that discontinuities in the sheet pile wall were caused by shifting of the wall during the 1964 earthquake that struck Alaska. The sheet pile wall acts a as a barrier between the site groundwater and the bay.

In 2004 it was estimated that free product was potentially present on the groundwater table over approximately 9 acres across this Site. During more recent analyses (2002 through 2004) detection of free product in wells installed to recover product has been intermittent, indicating that little floating product remains in the subsurface at the site. Free product that remains on the site poses a low risk to the bay. The sheet pile wall likely provides a barrier between the floating product on the groundwater interface and the bay, despite the wall's discontinuities. The relatively flat gradient of the site groundwater would also further slow any migration of the free product and associated contaminants.

A 2001 corrective measures study proposed implementation of a system to recover residual free product floating on the groundwater table under the tarmac area by pumping groundwater from wells. The corrective action also included monitoring groundwater in 10 wells to track changes in petroleum product contamination beneath the tarmac. The Site 10/11 Interim Action Work Plan (Hart Crowser 2002) recommended a phased action plan to monitor free product at the site, and to recover it to the extent possible. Between September and November 2002 surface stormwater, groundwater and sediments were sampled and analyzed. Ten Additional groundwater monitoring wells were installed in April 2003, and groundwater was sampled and analyzed in May and November 2003. Sampling events continued through September 2004.

At the conclusion of the 2004 monitoring period it was determined that stormwater from the A1-1 outfall and the groundwater from the seeps along the beach complied with Sate of Alaska surface water criteria. Concentrations of groundwater from seeps were also below the state groundwater criteria. Analytical results for surface water, outfall, seep, and tarmac runoff samples were below EcoTox criteria. As of 2004, groundwater in the vicinity of the historical spills continued to exceed Alaska surface water criteria. With the exception of benzene, state groundwater criteria were not exceeded in the groundwater monitoring rounds performed in 2003. Between May 2003 and September 2004 4,361 milliliters of free product were removed from site wells. At the end of 2004 the monitoring network and deployed recovery devises appeared sufficient in addressing the issue.

In October 2005 a biological reconnaissance was conducted along the shoreline adjacent to Site 10/11. Surveys conducted to identify signs of hydrocarbon seeps or sheens and effects of major habitat alternations revealed a small area at the southeast end of the site where sediment contained iron precipitates sometimes indicative of hydrocarbon contamination in a marine environment. No sheen, odor, or other direct evidence of hydrocarbons was observed, and no evidence indicated that the possible chemical contaminants were influencing species' distribution or health.

Land use on Site 10/11 will continue to be industrial indefinitely, consistent with ongoing support services to aircraft using Base Kodiak.

3.0 Site Remedy

The selected remedy for Site 10/11 is to continue passive removal of petroleum products from existing wells. Wells will be monitored through the end of 2007. Institutional controls will also be implemented.

Based on information available to date, and based on the continued use of this area for BASE Kodiak activities, it is anticipated that contaminated groundwater will remain at the site for an undetermined time period.

4.0 Land Use Control Objective

To remain protective of human health and the environment, the property is restricted to industrial use, with engineering controls in place to limit access to petroleum-contaminated soils and groundwater. The area affected by these restrictions is shown on Figure 2.

5.0 Specific Land Use Implementation Measures

For Site 10/11, Air Station, the Land Use Controls consist of the following:

- Any intrusive activity at this site will require review and approval by Base Kodiak Facilities Engineer, and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that petroleum contaminated soil may be present and appropriate worker health and safety measures must be taken.
- Any soils removed for utility or other work must be tested for the presence of petroleum above ADEC Method 2 cleanup levels prior to off-site disposal.

6.0 Annual Reports and Five Year Reviews

The annual report for this site will be prepared in accordance with the Land Use Control Assurance Plan, Section 9.0, using the results of the inspection items identified in Attachment A of this Implementation Plan.

7.0 Decision Documents

The reader is referred to the following documents for additional information and background on this site:

United States Coast Guard (USCG). 2005 (February). *2004 Summary Report for Environmental Sampling and Analysis and Product Recovery Results, USCG ISC Kodiak, Site 10/11, Kodiak, Alaska*. Prepared by Hart Crowser.

United States Coast Guard (USCG). 2005 (October). *Biological Reconnaissance of the Shoreline Adjacent to Site 10/11 United States Coast Guard Base Kodiak, Alaska*. Prepared by Hart Crowser.

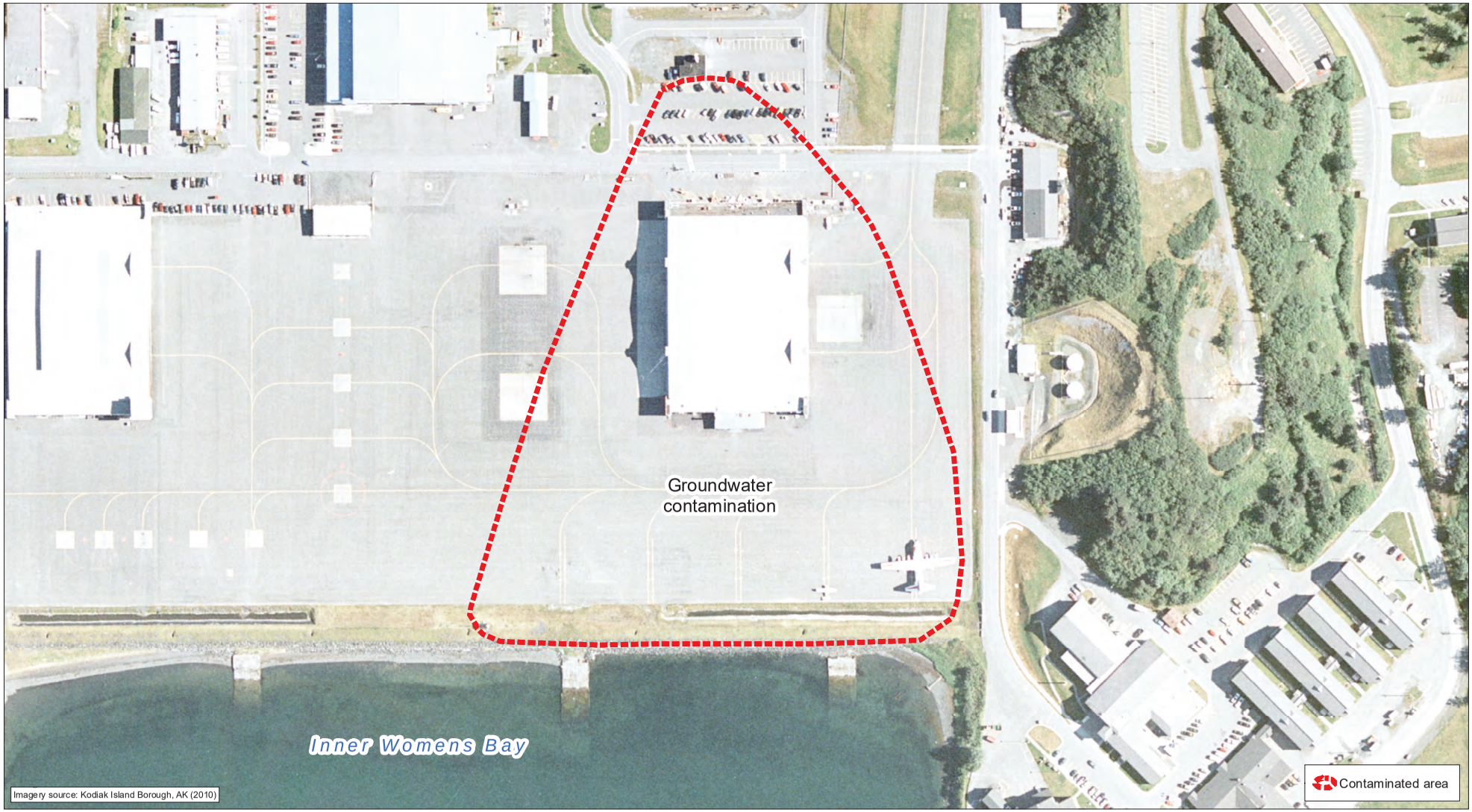
Prepared by pwurden, 4/21/2014, \\bel-srv03\GIS\DATA\Projects\Washington\USACE_008898\Kodiak_Ground_Water_221078\Map_Docs\LUCAP\5338_LUCAP inspection sites_CEH_100512.mxd

WindWard environmental LLC

0 0.25 0.5 Miles

0 0.5 1 Kilometers

Figure 1
LUCAP inspection sites
United States Coast Guard
Base Kodiak
Kodiak, AK



Wind Ward environmental LLC

0 200 400 Feet

0 50 100 Meters

Figure 2: Site 10/11
United States Coast Guard
Base Kodiak
Kodiak, AK

Prepared by pwarden, 4/21/2014, \\beluga\GIS\GISDATA\Projects\Washington\USACE_09089BK\Kodiak_Ground_Water_22107\Map_Docs\LUCAP\S339_LUCAP site 10-11_CEH_100512.mxd

Attachment A
Site 10/11 – Air Station
Annual Inspection Checklist

Date: _____ Date of previous inspection: _____
Name: _____ Date of next inspection: _____

Land Use Control	Inspection Items and Findings
Any intrusive activity at this site will require review and approval by Base Kodiak Facilities Engineer and appropriate measures taken for the type of intrusive activity. Dig permit issuance will require notification of the contractor that contaminated media may be present and appropriate worker health and safety measures must be taken.	Have any dig permits been issued for this area in the last year? **Yes No** Have contractors been notified of presence of contaminated medias, and have health and safety plans been prepared as appropriate? **Yes No**
Any soils or cover materials removed for utility or other work must be replaced to prevent potential human health exposures. Soils must be tested for petroleum hydrocarbons prior to disposal.	If removed during intrusive activities, have soils been appropriately handled? **Yes No**
The Coast Guard will notify EPA and ADEC upon the discovery of any unauthorized change in land use.	Did any unauthorized land use changes occur within the last year? **Yes No** On what date were the regulatory authorities notified? _____

Comments:

Attachment B
Site 10/11 – Air Station
Land Use Controls

Five Year Review Criteria

Date: _____ Date of previous 5-year review: _____

Name: _____ Date of next 5-year review: _____

Every 5 years the facility will prepare a review of the remedy effectiveness and submit the report to the implementing agency. Site specific reports will be combined and submitted as a single package to implementing agencies.

Procedure for 5 Year Review:

- Confer with Base Kodiak Commanding Officer to determine if any change in land use is anticipated in the next 5 years.
- Evaluate current regulatory policies and requirements for closing sites with contaminants or waste in place.
- Have any factors change to impact risk (e.g., report of a new release, construction, significant erosion)
- Have cleanup levels changed?
- Should LUCs be amended or removed?
- Review actions taken in response to the annual checklist to determine if repetitive problems are present that would benefit from an alternate solution.

Once the above steps have been taken, prepare a report addressing each one of the bulleted items and place in the Land Use Control File.

This page intentionally blank

APPENDIX B:
STORMWATER POLLUTION PREVENTION PLAN

This page intentionally blank

STORMWATER POLLUTION PREVENTION PLAN

USCG BASE KODIAK

October 2015

This page intentionally left blank

Table of Contents

CHAPTER 1 OVERVIEW AND CERTIFICATION 1-7

1-1 BACKGROUND AND SCOPE 1-7
1-1 CERTIFICATION 1-8

CHAPTER 2 PLANNING AND ORGANIZATION 2-1

2-1 OVERVIEW 2-1
2-2 STORMWATER POLLUTION PREVENTION TEAM 2-2
2-3 SITE DESCRIPTION 2-3
2-3.1 Mission and Activities at BASE Kodiak 2-3
2-3.2 Impervious Surface Estimate 2-4
2-3.3 Receiving Waters 2-4
2-3.4 Wetlands 2-4
2-3.5 Water Quality Standards 2-4
2-3.5.1 Water Quality Impairment Status 2-4

CHAPTER 3 DESCRIPTION OF FACILITY AND POTENTIAL POLLUTANT SOURCES 3-1

3-1 INVENTORY OF MSGP SECTOR ASSOCIATED FACILITIES AND POTENTIAL POLLUTANT SOURCES 3-1
3-2 COMMONLY USED/HANDLED MATERIALS 3-5
3-3 EXPOSED MATERIAL AND EQUIPMENT 3-5
3-4 SPILLS AND RELEASES 3-5
3-4.1 Spill Evaluation 3-9
3-5 RECORDS AND DOCUMENTATION 3-9
3-6 BENCHMARK STORMWATER MONITORING DATA 3-10
3-7 GENERAL LOCATION MAP AND SITE MAP 3-13
3-8 DESCRIPTION OF POTENTIAL POLLUTANT SOURCES 3-18
3-8.1 Potential Stormwater Pollutant Sources by Sector 3-18
3-8.1.1 Treatment, Storage and Disposal Facility Sector (K) 3-18
3-8.1.2 Landfill Sector (L) 3-18
3-8.1.3 Land Transport and Warehousing Sector (P) 3-18
3-8.1.4 Water Transportation (Q) 3-18
3-8.1.5 Air Transportation Sector (S) 3-18
3-8.1.6 Domestic Treatment Works Sector (T) 3-19
3-9 NON-STORMWATER DISCHARGES 3-19
3-9.1 1987 Sewer Storm Separation Study 3-19
3-9.2 1988 Sanitary Sewer Inflow/Infiltration Study 3-19
3-9.3 Results of Dye Testing 3-20
3-9.4 1993 Dye Testing 3-21
3-9.5 1996 Dye Testing 3-21
3-9.6 Sewer Upgrade Projects 3-22
3-9.7 2000-2001 Facility Floor Drain Investigation 3-22

CHAPTER 4 POLLUTION PREVENTION CONTROL MEASURES 4-1

4-1 OVERVIEW 4-1
4-2 CONTROL MEASURES/BEST MANAGEMENT PRACTICES 4-1
4-2.2 Core Best Management Practices 4-1
4-2.2.1 BMP 1: Minimize Exposure 4-1
4-2.2.2 BMP 2: Good Housekeeping 4-2
4-2.2.3 BMP 3: Maintenance 4-2
4-2.2.4 BMP 4: Spill Prevention and Response Procedures 4-2
4-2.2.5 BMP 5: Erosion and Sediment Control 4-3
4-2.2.6 BMP 6: Management of Runoff 4-4
4-2.2.7 BMP 7: Salt Storage Piles (or Piles Containing Salt) 4-5

4-2.2.8 BMP 8: Employee Training……4-5
4-2.2.9 BMP 9: Non-Stormwater Discharges……4-6
4-2.3 Sector-Specific Best Management Practices……4-7
4-2.3.1 BMP K-1: Landfill Preventive Maintenance……4-7
4-2.3.2 BMP P-1: Vehicle and Equipment Good Housekeeping Measures……4-7
4-2.3.3 BMP Q-1: Water Transportation Good Housekeeping Measures……4-8
4-2.3.4 BMP S-1: Air Transportation Good Housekeeping Measures……4-8
4-2.3.5 BMP T-1: Treatment Works Control Measures……4-10

CHAPTER 5 MONITORING, EVALUATION, AND TRAINING……5-11

5-1 OVERVIEW……5-11
5-2 MONITORING ACTIVITIES……5-11
5-2.1 Visual Stormwater Monitoring……5-11
5-2.1.1 Visual Assessment Documentation and Corrective Action……5-12
5-2.2 Stormwater Benchmark Monitoring……5-13
5-2.2.2 Reporting Benchmark Monitoring Data to DEC……5-16
5-2.2.3 Benchmark Evaluation……5-16
5-3 ANNUAL COMPREHENSIVE SITE INSPECTIONS……5-17
5-3.1 Comprehensive Site Inspection Documentation……5-17
5-3.2 Comprehensive Site Inspection Corrective Actions……5-18
5-3.3 Conditions Requiring Review and Revision to Eliminate Problem……5-18
5-3.4 Conditions Requiring Review to Determine if Modifications Are Necessary……5-19
5-4 ROUTINE FACILITY INSPECTIONS……5-19
5-4.1 Routine Facility Inspection Documentation……5-20
5-5 TRAINING GUIDANCE……5-20

List of Tables

TABLE 1-1 BASE KODIAK INDUSTRIAL ACTIVITIES COVERED BY THE MULTI-SECTOR GENERAL PERMIT……1-7

TABLE 2-1 FACILITY DATA SHEET……2-1

TABLE 2-2 STORMWATER POLLUTION PREVENTION TEAM……2-2

TABLE 2-3 STORMWATER POLLUTION PREVENTION TEAM SUPPORT PERSONNEL……2-2

TABLE 2-4 WATER QUALITY IMPAIRMENT CATEGORY……2-5

TABLE 3-2 COMMONLY USED/HANDLED MATERIALS……3-5

TABLE 3-3: SPILLS AND RELEASES……3-5

TABLE 3-4 SPILL EVALUATION SUMMARY……3-9

TABLE 3-5 PERMIT MONITORING BENCHMARKS FOR EACH SECTOR……3-11

TABLE 3-6 BENCHMARK STORMWATER SAMPLING OVERVIEW……3-12

TABLE 3-7 RESULTS OF 1993 DYE TESTING AT LOCATIONS IN THE INDUSTRIAL AREA……3-21

TABLE 3-8 SANITARY SEWER UPGRADE PROJECTS……3-22

TABLE 4-1 MANAGEMENT OF RUNOFF……4-4

TABLE 5-1 QUARTERLY VISUAL STORMWATER MONITORING OUTFALLS……5-12

TABLE 5-2 BENCHMARK MONITORING……5-14

TABLE 5-2A WATER HARDNESS RANGE……5-16

TABLE 5-3 SECTOR-SPECIFIC ANNUAL COMPREHENSIVE SITE INSPECTION REQUIREMENTS……5-18

TABLE 5-4 SECTOR-SPECIFIC ROUTINE INSPECTION REQUIREMENT……5-19

List of Figures

FIGURE 3-1 STORMWATER OUTFALLS KEY MAP 3-14
FIGURE 3-2 STORMWATER OUTFALLS NORTHERN PORTION 3-15
FIGURE 3-3 INDUSTRIAL AREA & AIR STATION 3-16
FIGURE 3-4 STORMWATER OUTFALLS NYMAN PENINSULA 3-17

Attachments

Attachment A: 2015 MSGP and NOI Documentation
Attachment B: Acronyms and Definitions
Attachment C: Forms
Attachment D: Benchmark Monitoring Data
Attachment E: Best Management Practices Plan – USCG BASE Kodiak Bulk Fuel Storage Facility

This page intentionally left blank

Chapter 1 Overview and Certification

1-1 Background and Scope

On November 16, 1990 (55 FR 47990), the Environmental Protection Agency (EPA) established regulations to control the amount of pollutants that accumulate in stormwater and discharge into waters of the United States. Facilities that discharge stormwater "associated with industrial activity" must comply with 40 CFR 122.26 and obtain a National Pollutant Discharge Elimination System (NPDES) permit. The primary means to obtain an NPDES stormwater permit is through compliance with the Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP). The State of Alaska Department of Environmental Conservation (DEC) has been responsible for administering the permit since 2009. DEC issued a new MSGP permit (AKR060000) on 19 February 2015. The United States Coast Guard (USCG) BASE Kodiak has elected to obtain NPDES stormwater permit coverage under this permit. The permit is designated as the 2015 MSGP in this document. The 2015 MSGP is included as Attachment A.

The 2015 MSGP is a broad-based pre-published permit that identifies actions necessary to achieve compliance. The permit specifies 30 industrial types of facilities (sectors) that trigger the requirement for permit coverage (i.e., if a facility engages in one or more of these 30 sectors they are "industrial" and permit coverage is required). Table 1-1 lists industrial operations conducted by BASE Kodiak:

Table 1-1 BASE Kodiak Industrial Activities Covered By the Multi-Sector General Permit

Sector	Sector Name	Industrial Activities Covered
K	Hazardous Waste Treatment, Storage, or Disposal	Stormwater discharges associated with hazardous waste treatment, storage, or disposal facilities.
L	Landfills and Land Application Sites	Stormwater discharges associated with landfills.
P	Land Transportation	Stormwater discharges associated with land transporting and warehouse facilities engaged in vehicle and equipment maintenance and equipment cleaning.
Q	Water Transportation	Stormwater discharge associated with water transportation facilities.
S	Air Transportation Facilities	Stormwater discharges associated with air transportation facilities engaged in air transportation and airport and aircraft service and maintenance.
T	Treatment Works	Stormwater discharges associated with domestic wastewater treatment works.

Upon finalization of this SWPPP, BASE Kodiak will submit a Notice of Intent (NOI) to DEC to obtain permit coverage under the 2015 MSGP. Documentation that BASE Kodiak filed the NOI will be contained in Attachment A. This document will be modified when control measures are changed due to corrective actions or regulatory requirements.

BASE Kodiak leases a portion of its property to the Alaska Department of Transportation (AKDOT) for operation of the Kodiak Airport. Additionally, AKDOT subleases certain areas to private companies such as Kodiak Transfer. Prior to 2006, the airport and leased areas were incorporated in BASE Kodiak's SWPPP and BASE Kodiak had responsibility for stormwater compliance. AKDOT now has independent permit coverage and BASE Kodiak is no longer directly responsible for activities on AKDOT leased property (including the sublet areas).

1-1 Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____

Title: _____

Signature: _____
(Commanding Officer or designated/authorized representative[1])

[1] Signature requirement per the 2015 MSGP: "For a municipality, state, federal, or other public agency, either a principal executive officer or ranking elected official shall sign the application; in this subsection, a principal executive officer of an agency means: the chief executive officer of the agency or a senior executive officer having responsibility for the overall operations of a principal geographic unit or division of the agency."

Chapter 2 Planning and Organization

2-1 Overview

Stormwater runoff is part of the natural hydrologic cycle. However, human activities can alter natural drainage patterns and add pollutants to rainwater and snowmelt that run off the earth's surface and enter streams, rivers, lakes, and coastal waters. DEC, through the NPDES permitting process, requires that industrial activities develop and implement a SWPPP.

The 2015 MSGP requires development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP must contain the following elements:

- Identification of permittee;
- Stormwater pollution prevention team;
- Site description;
- Summary of potential pollutant sources;
- Description of control measures;
- Schedules and procedures;
- Signature requirements.

The five major steps/processes used to develop and maintain the BASE Kodiak SWPPP are:

- Planning and organization
- Assessment
- Stormwater control measure (and/or Best Management Practices (BMPs)) identification (selection and plan design)
- Stormwater control measure implementation and training
- Evaluation and monitoring

The stormwater pollution prevention process follows a plan-do-check-act process. The intent is to identify and evaluate potential pollutant sources, develop ways to minimize impacts through BMPs and training, implement those BMPs, and monitor/inspect to determine effectiveness. If the monitor/inspection aspect reveals a need for further actions, the process is repeated.

Table 2-1 provides BASE Kodiak summary information.

Table 2-1 Facility Data Sheet

Site Name	U.S. Coast Guard BASE Kodiak
Location	Kodiak, Alaska
Geographic Location	57º45'00" N, 152º30'00" W
Owner/Operator	U.S. Coast Guard
Telephone	1-907-487-5320
Point of Contact	Commanding Officer Attn: Chief, Environmental Division BASE Kodiak P.O. Box 195025 Kodiak, AK 99619-5025
Applicable MSGP Sectors	K (treatment, storage, and disposal)

	L (landfill) P (land transportation and warehousing) Q (water transportation) S (air transportation) T (treatment works)
Number of Employees	~2,500 employees and dependent personnel
Receiving Waters	Womens Bay and St. Paul Harbor
NPDES Permitting Authority	DEC

2-2 Stormwater Pollution Prevention Team

The Stormwater Pollution Prevention Team at BASE Kodiak is responsible for assisting the Stormwater Program Manager in developing and revising the SWPPP, as well as maintaining control measures and taking corrective actions where required. The team is comprised of the staff positions listed in Table 2-2. Table 2-3 lists staff positions that may support the team by providing technical or other support/input on an as-needed basis.

Table 2-2 Stormwater Pollution Prevention Team

Position/Title	Telephone	Team Responsibilities
BASE Kodiak Assistant Facilities Engineer	907-487-5320 X 2226	Responsible for oversight of base environmental programs.
BASE Kodiak Environmental Division Chief	907-487-5320 X 2249	Responsible for daily management and direction of environmental compliance efforts for BASE Kodiak environmental programs. Ensures that stormwater pollution prevention BMPs are implemented, that regular inspections are performed, and that all records (inspections, maintenance, training, monitoring, and spill) are maintained. Ensures that appropriate training is provided and the SWPPP is evaluated and updated as needed.
BASE Kodiak Stormwater Program Manager	907-487-5320 X 2208	Stormwater Pollution Prevention Team leader. Maintains official copy of the SWPPP; performs periodic inspections and audits of BMPs; maintains records of inspections, maintenance, training, monitoring, and spills for BASE Kodiak, tenant commands and lessees. Schedules meetings of team as needed.
Air Station (AIRSTA) Kodiak Facility Coordinator	907-487-5003	Ensures that control measures/BMPs are implemented in AIRSTA areas. Ensures that regular inspections are performed and that all records (inspections, maintenance, training, monitoring, and spill) are maintained for AIRSTA and copies are provided to the Stormwater Program Manager. Ensures that appropriate training is provided to AIRSTA staff.
Environmental Protection Specialist, Base Operations Support Services (BOSS) Contractor	907-487-5474	Ensures that BMPs are implemented in BOSS Contractor areas. Ensures that proper spill prevention and response actions are taken to prevent or minimize stormwater pollution. Ensures that regular inspections are performed and that all records (inspections, maintenance, training, monitoring, and spills) are maintained for BOSS Contractor and copies are provided to the Stormwater Program Manager. Ensures that appropriate training is provided to BOSS Contractor staff.

Table 2-3 Stormwater Pollution Prevention Team Support Personnel

Position/Title	Telephone	Team Responsibilities
Staff Engineers/ Technicians, Design & Technical Sections, Facilities Engineering Department, BASE Kodiak	907-487-5320	Assist BASE Stormwater Program Manager and other Stormwater Pollution Prevention team members as needed.

Table 2-3 Stormwater Pollution Prevention Team Support Personnel

Position/Title	Telephone	Team Responsibilities
Legal Officer, BASE Kodiak (and MLC Environmental Legal Officer)	907-487-2212	Remains current on NPDES stormwater regulations and permit requirements. Provides legal counsel as needed.
Naval Facilities Engineering Command Northwest	(360) 396-0033	Provides technical and regulatory support as requested.

2-3 Site Description

BASE Kodiak is located on the northeast portion of Kodiak Island, Alaska, approximately 8 miles south of the city of Kodiak. The facility is the U.S. Coast Guard's largest shore facility, occupying approximately 23,000 contiguous acres, including much of the Buskin River valley and Womens Bay. Between the various USCG operating and support commands, there are approximately 1,100 military and 1,400 military dependents. The BASE provides support for USCG facilities, aircraft, and vessels throughout Alaska.

Many of the buildings and structures at the facility date from World War II when the facility was constructed as a naval base. Kodiak was a major staging area for North Pacific operations during World War II. A naval submarine base and air station was constructed at Womens Bay and an army outpost, Fort Greely, was established near the Buskin River in April 1941, remaining until decommissioned in December 1944. Bunkers and gun emplacements were built at Chiniak, Long Island, and Fort Abercrombie. After the war, Navy and Army activities were phased out. The USCG took over the facilities in 1972.

2-3.1 Mission and Activities at BASE Kodiak

The USCG is a military, multi-mission, maritime service within the Department of Homeland Security and one of the nation's five armed services. Its core roles are to protect the public, the environment, and U.S. economic and security interests in any maritime region in which those interests may be at risk. This includes international waters and America's coasts, ports, and inland waterways.

The USCG provides unique benefits to the nation because of its distinctive blend of military, humanitarian, and civilian law-enforcement capabilities. To serve the public, the USCG has five fundamental roles:

- Maritime Safety: Eliminate deaths, injuries, and property damage associated with maritime transportation, fishing, and recreational boating. The service is always ready to respond to calls for help at sea.
- Maritime Security: Protect America's maritime borders from all intrusions by: (a) halting the flow of illegal drugs, aliens, and contraband into the United States through maritime routes; (b) preventing illegal fishing; and (c) suppressing violations of federal law in the maritime arena.
- Maritime Mobility: Facilitate maritime commerce and eliminate interruptions and impediments to the efficient and economical movement of goods and people, while maximizing recreational access to and enjoyment of the water.
- National Defense: Defend the nation as one of the five U.S. Armed Services. Enhance regional stability in support of the National Security Strategy, utilizing the Coast Guard’s unique and relevant maritime capabilities.
- Protection of Natural Resources: Eliminate environmental damage and degradation of natural resources associated with maritime transportation, fishing, and recreational boating.

BASE Kodiak is the only USCG facility that supports both cutters and aircraft. Personnel assigned to BASE Kodiak play a key role in USCG operations in western Alaska. Along with providing services for visiting cutters from the Pacific area, the BASE Kodiak team provides administrative, logistical, and family support to 13 operational units on Kodiak. These units combine to make the Kodiak complex the largest operational base in the USCG.

Primary activities at BASE Kodiak relate to cutter (vessel) and aircraft support including maintenance, fueling, piers, security, taxiways, runways, roads, hangers, utilities, bulk fuel, administration support, waste management/treatment, equipment and vehicle storage, de/anti-icing, snow management, and communication. Secondary activities include housing, recreation, childcare, food service, vehicle maintenance, shopping, and vehicle fueling.

2-3.2 Impervious Surface Estimate

The whole of BASE Kodiak covers 23,000 acres, which includes about 8,200 acres of mostly undeveloped watershed or 35% of the total base land area. The main industrial core area is 214 acres, about 46% of which is impervious. Overall, assuming the non-industrial areas are 15% impervious and the watershed portion has no impervious area, the overall BASE Kodiak impervious area is about 10%.

2-3.3 Receiving Waters

Stormwater from the core BASE Kodiak industrial area discharges into Womens Bay and St. Paul Harbor. See Figure 3-4. Closed Navy and Coast Guard landfills indirectly discharge into the Buskin River after flowing through Red Lake and Lake Louise respectively. See Figure 3-2. The west side of Nyman Peninsula discharges stormwater into Womens Bay and the east side discharges into St. Paul Harbor. See Figure 3-4.

2-3.4 Wetlands

No significant drainage from industrial areas goes into wetlands. The base's primary wetland in terms of source water and habitat quality is an approximate 380-acre area west of Buskin Lake. This wetland is in the designated upper BASE Kodiak watershed outside the core BASE Kodiak industrial area.

The Buskin River is bordered by riverine habitats and riparian wetlands. The mouth of the Buskin River is a marine and estuarine wetland.

Throughout the lower Buskin Watershed (downstream of the Buskin Lake), there are numerous isolated shrub bogs and emergent wetlands that vary significantly in size.

Detailed wetland information can be found in the document: Dames & Moore, Revised Final Wetland Delineation Study, US Coast Guard Integrated Support Command, Kodiak, Alaska, May 14, 1999.

2-3.5 Water Quality Standards

Water Quality Standards in the state of Alaska are contained in 18 ACC 70 (amended as of April 8, 2012). The primary applicable fresh water resources associated with BASE Kodiak are the Buskin River and Lake Louise. The primary applicable marine waters associated with BASE Kodiak are St Paul Harbor and Womens Bay.

2-3.5.1 Water Quality Impairment Status

The Clean Water Act (CWA) mandates that each state develop a program to monitor the quality of its surface waters. Based on the monitoring program, the state must regularly prepare a report categorizing water bodies with regard to water quality. In Alaska, the most recent report is Alaska's Final

2014 Integrated Water Quality Monitoring and Assessment Report, December 23, 2013. Water bodies are placed into one or five categories as follows:

Category 1: Water Quality Standards Attained for All Uses. Water bodies are placed in this category if there are data to support a determination that the water quality standards and all of the uses are attained.

Category 2: Water Quality Standards Attained for Designated Uses. Water bodies are placed in this category if some of the water quality standards for the designated uses are attained.

Category 3: Data or Information Insufficient. Water bodies are placed in Category 3 if data or information is insufficient to determine that the water quality standards for any of the designated uses are attained.

Category 4: Impaired Waterbody. Impaired but Total Maximum Daily Load (TMDL) not required. Waters have been determined to be impaired but do not need a TMDL. Category 4 waters are divided into three sub-categories:

- 4a TMDL Completed
- 4b Other Pollution Control Requirements are Reasonably Expected to Result in Attainment of the Water Quality Standard in a Reasonable Period of Time
- 4c Impairment is not caused by a Pollutant. Water bodies are placed in this category if the impairment is not caused by a pollutant affecting water quality, e.g., degraded riparian habitat.

Category 5: Impaired Waterbodies on the Section 303(d) List. Water bodies are placed in Category 5 if the water quality standard(s) are not attained, i.e., the water body is impaired for one or more designated uses by a pollutant(s) and requires a TMDL or water body recovery plan to attain Alaska's water quality standards (18 AAC 70).

Table 2-4 lists the impairment category for surface water bodies on or adjacent to BASE Kodiak.

Table 2-4 Water Quality Impairment Category

Water body	Category	Note
Buskin Lake	3	Waters for which there is insufficient or no data and information to determine if any designated use is attained
Buskin River	3	
Lake Louise	3	
Red Lake and Anton Road Pond	4a	Placed on the 1994 Section 303(d) list for iron and manganese pollution. A TMDL for metals (iron and manganese) for Red Lake and Anton Road Pond was developed in March 2013 and approved by EPA in June 2013. The DEC Contaminated Sites Program is coordinating with the USCG and the United States Army Corps of Engineers throughout BASE Kodiak to continue systematic investigations, monitoring programs and cleanup at sites under the Resource Conservation and Recovery Act (RCRA) hazardous waste management facility permit.
St. Paul Harbor	3	Waters for which there is insufficient or no data and information to determine if any designated use is attained
Women's Bay	3	

Chapter 3 Description of Facility and Potential Pollutant Sources

3-1 Inventory of MSGP Sector Associated Facilities and Potential Pollutant Sources

Table 3-1 lists facilities and areas on BASE Kodiak that are "industrial" per the MSGP triggering permit coverage and therefore defines the focus of the SWPPP. Table 3-1 cross-references location of facilities and areas on Figures 3-1 through 3-4; the table describes operations, provides inventories of materials, and identifies potential pollutant sources. Table 3-1 also summarizes significant aspects of the SWPPP as detailed in other chapters.

Building	Building Name	Figure	Sector	Description and Potential Pollutant Sources	Outfall(s)	Inspection/Monitoring Frequency (see Chapter 5 and Attachment D)
N48	Hazardous Waste Storage Building and LOWS	3-4	K.1	The Hazardous Waste Storage Building is located at the north end of the Nyman Peninsula, south of the Steam Plant. A RCRA Part B permit has been approved for this facility. All materials are stored in closed containers on pallets in secondary containment. The types of materials/waste include waste solvents, waste paints and paint-related material, spent batteries, and other hazardous wastes. The storage area has seven blind sumps and no drains. A component of the facility is the Liquid Oily Water Separator (LOWS) facility. The LOWS facility is a chemically-enhanced batch oil/water separation system, located at the former location of N-56. The system is designed to treat oily liquids received by and generated at BASE Kodiak consisting of oily water, oil/water emulsions, and used oils. The reclaimed oil is used for fuel at the steam plant. LOWS primarily processes bilge water prior to discharge into the sanitary sewer.	IA-2 (IA-2A)	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly
LF-1	Coast Guard Landfill	3-2	L.1	The Coast Guard Landfill, estimated at 10 acres, is located in the Buskin River drainage area one mile north of the Kodiak Airport. The USCG operated this landfill from approximately 1972 until 1987. The landfill was used for domestic waste disposal. Metal scrap and concrete debris were disposed in the west side of the landfill. When the landfill was closed, a combination of leachate collection and runoff diversion was installed. Water collected in the leachate collection/runoff diversion system is ditched and then piped to the sanitary sewer at the BASE Kodiak wastewater treatment plant. During the summer of 2000, an impervious clay liner was installed that significantly reduced the amount of rainwater infiltrating into the landfill and subsequent inflow into the sanitary sewer.	LF-1	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly
LF-2	Navy Landfill	3-2	L.2	The Navy Landfill covers 15 acres located approximately one-quarter mile southwest of the Coast Guard Landfill. Waste was disposed here from the 1940s to the early 1970s. In 1992, leachate from the landfill was observed seeping into three depressions that may have flowed into a lake at the toe of the landfill referred to as "Red Lake," due to its distinctive rust color. The three depressions were filled during installation of a fence around the landfill. The landfill was capped during the summer of 2000. The cap has reduced if not eliminated risk to groundwater in the area.	LF-2	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly
19* *Note: Building 19 will be removed in 2016.	BOSS Maintenance Shop (Metal, Wood, and Pipe Shop)	3-3	P.2	Building 19, located near Hangar 2, houses the metal, wood, and pipe shops operated by the BOSS Contractor. There is minimal outdoor storage associated with this building. A sawdust collection system is situated on the west side. Three oversized catch basins are east of building 19 (on the upper part of the embankment in the gravel parking area) that act as settling basins.	IA-3	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual.
N19/ N20/ N21/ N22	JP5 Fill Stand, "day" tanks, and pump house	3-3	NA	Stormwater discharges from these facilities are authorized by a separate NPDES permit (AK-003142-9), and therefore the stormwater discharges are not a component of this SWPPP. It is included for reference. This complex of aircraft fueling related facilities is located on the east side of Seafarer Drive near building 10. The complex includes two "day" tanks (N19 & N20), the fill stand (N22), and the pump house (N21). The day tanks are fed from the supply tanks N10 or N12 located on Nyman Peninsula to the southwest of this area. The "day" tanks and the fill stand have secondary containment that can, via valve, be discharged either to the storm drain or to Hangar 1 Oil/Water Separator (OWS). Drainage from N21 also goes to the Hangar 1 OWS.	NA	
N1/N1A	Public Works Garage/ Heavy Equipment Maintenance	3-4	P.4	Building N1 is located northeast of Hangar 3. The building has 12 bays for vehicle maintenance, a painting preparation booth, a paint booth, offices, and a janitorial supply room. The BOSS Contractor occupies this building and performs maintenance on BASE fleet vehicles. An enclosed vehicle and equipment wash rack is located on the south side of the building. The wash rack drains to the sanitary sewer. Each bay has a floor drain that is connected to a 500-gallon OWS chamber that is connected to the sanitary sewer. These OWSs are checked annually and pumped out by BOSS Contractor staff. Building N1A, attached to building N1, is used for maintenance of heavy equipment, such as large trucks, fire trucks, and cranes, by the BOSS Contractor. There are no floor drains in the facility. Types of items stored outside, adjacent to the building and across the street may include: trash trucks, tankers, and pickups. Items stored to the right on the grass may include compressors, backhoes, loaders, trucks, trailers, and old GSE units.	IA-3	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual.
26	Convenience Stores and BOSS offices	3-4	P.5	Building 26, constructed in the 1940s, is located near Building 27 and houses a number of activities. The first floor has a USCG convenience store and shipping and receiving area. A USCG furniture store is located on the second floor. The third floor serves as the BOSS Contractor warehouse for material used in other locations at BASE Kodiak. The loading and unloading area on the first floor is comprised of concrete loading docks under cover.	IA-3	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual.

Building	Building Name	Figure	Sector	Description and Potential Pollutant Sources	Outfall(s)	Inspection/Monitoring Frequency (see Chapter 5 and Attachment D)
27	Cold and Dry Storage Warehouse	3-4	P.6	The Cold and Dry storage building is a one-story structure located north of Building 26, on the corner of Cape Sarichef Street and Albatross Avenue. The building has a loading and unloading area comprised of a concrete dock under cover on the east side. Pallets, cardboard, and crates may be stored on the loading dock.	IA-3	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual.
N57	Floating Dock	3-4	Q.1	This is a seasonally installed floating dock for MWR and other recreational vessels located next to the Crab Cooker. No materials are stored on the dock. Fuel, hydraulic fluid, oil, could potentially be spilled from vessels. Non-potable water is supplied to the dock from a hose from the Crab Cooker building.	NA – Womens Bay	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: None. Comprehensive Site Inspection: Annual, if installed during the time of inspection. Benchmark Monitoring: None. There is no defined outfall associated with the dock.
N551	MWR Crab Cooker	3-4	Q.1	Fish cleaning and crab cooking are performed in this building. There is a fish grinder in the back that discharges into Womens Bay. Boats may be rinsed outside the building and discharge is into the Womens Bay. Sign requires "Low Pressure Fresh Water Rinse for Boats Only – No Detergents – No Oily Bilge Water Discharges – No Vehicle washing." The fish grinder discharge is in accordance with correspondence (e-mails) between E. DeNoyelles (BASE Kodiak), K. McKerney (DEC), and C. Cora (EPA Region X) from the February 2004 timeframe. Dumping of fish carcasses into the bay is prohibited.	NP-CC	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly
8	MWR Boathouse	3-4	Q.2	The MWR Boathouse is located at the north end of the Nyman Peninsula beside the Billiken Theater. The boathouse performs minor boat maintenance and repair including fiberglass repair, engine rebuilding and change-outs; boat storage; boat rinsing outside the building; and fuel storage and fueling. Vessel maintenance is conducted indoors. Vessel rinsing is conducted outdoors on the east side of the building with discharge into the storm sewer. This area was paved during 2015. Outdoor storage includes: pop-up type campers, fishing boats, and an unleaded fuel tank. Material potentially used and stored includes gasoline, paints, methyl ethyl ketone, acetone, oil, kerosene, gear oil, used gasoline, waste paint thinner, and used oil. To the south of the Boathouse is a former dry cleaning facility currently undergoing clean-up via air sparging. The five floor drains inside this facility discharge into the sanitary sewer. A storm drain is located just outside on the east side of the building.	NP-1a – Womens Bay	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly
614	Auto Hobby Shop and Port Operations	3-4	Q.3	The Auto Hobby Shop, built in 1992, is located on the west side of Nyman Peninsula, southwest of building N73 the Cutter Storage facility. The building provides the space, equipment, and supplies for Coast Guard personnel to perform maintenance on their own vehicles. The building also houses the Cutterman's Club, a recreational facility for seamen in port, and Port Operations offices. Types of chemicals used and stored include gear oil, lube oil, antifreeze, batteries, citrus cleaner, primer, paint, reducer, lacquer thinner, solvent, used gasoline, and waste chemicals. Outdoor storage includes vehicles, tires, and recycling containers.	NP-3	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly
613	Cargo Pier	3-4	Q.4	Located northwest of the Auto Hobby Shop, the USCG and other vessels making port calls to BASE Kodiak tie-up at the pier. Materials are not stored on the pier; however, materials/supplies are supplied to vessels using trucks, fork trucks, and portable cranes. Bowsers (~300-gallon portable tanks) are staged on the pier to collect bilge water. Vessel sewage is pumped pier-side via flexible hose to risers along the pier.	NA- direct to Womens Bay	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: None. Comprehensive Site Inspection: Annual. Benchmark Monitoring: None. There is no defined outfall/point of discharge.
S40	Fuel Pier	3-4	Q.5	Fuel is unloaded to tanks on Nyman Peninsula at this pier, and vessels are fueled at this facility. The pier is constructed of wood and steel. There is no defined outfall/point of discharge. Secondary containment is located under the set of valves on the pier.	NA- direct to Womens Bay	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: None. Comprehensive Site Inspection: Annual. Benchmark Monitoring: None. There is no defined outfall/point of discharge.
A512	BOSS Fuels	3-4	Q.6	The BOSS fuels building is located south of the Auto Hobby Shop and operated by the BOSS Contractor. The BOSS performs analyses of fuels and used oil in the facility. There is outdoor storage of a skimmer boat, zodiac, anchor chains, tank truck, and vacuum truck. One Hazardous Flammable locker is located in the back of the building (outside).	NP-3	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly

Building	Building Name	Figure	Sector	Description and Potential Pollutant Sources	Outfall(s)	Inspection/Monitoring Frequency (see Chapter 5 and Attachment D)
N73	Cutter Storage	3-4	Q.7	Located to the east of the Cargo Pier, this facility provides shore-based storage for Coast Guard vessels. There is storage outside, mainly to the northeast, and it includes vehicles, chain, buoys, pipe, sheet metal, gear, fittings, crane, chillers, wood blocking, plywood, rope, nets, rowboat, a propane tank on a trailer, and boat trailers. The surface is currently graveled, but plans are to pave the area if funding becomes available. In 2008, a Stormceptor stormwater treatment device was installed to serve this area.	NP-2a (Stormceptor outfall)	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly
N47	Equipment and Vehicle Storage	3-4	Q.8	This is an outdoor gravel-surfaced equipment and vehicle storage area northeast of the Cutter Storage facility. There is another separately fenced storage area behind adjacent. Equipment includes buoys, anchors, chains, and one AST. As many as 15 vehicles can be stored in the area..	NP-2a (This is the new Stormceptor outfall)	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly
14	Hangar 1	3-3	S.1	Hangar 1 is located about 2,000 feet southwest of the end of runway 36, at the head of Womens Bay. This hangar is the center of maintenance activity for C-130 aircraft based at BASE Kodiak. Aircraft maintenance performed inside the building includes: • Engine rebuilding and repair (T-56 shop) • Structural repair (metal shop) • Propeller repair (prop shop) • Rebuilding wheels and hydraulic lines • Welding • Aircraft washing in Bay 4 • Electrical repair • Painting - Paint Booth Engine fuel (gas) path cleaning is performed outside the building on the paved apron over the refueling pad. In this operation, gas path cleaner is introduced through lines into the engine. The engine is started and the gasoline path cleaner sprays out the exhaust. Depending on the engine undergoing cleaning, the waste is either allowed to discharge into the sanitary sewer or collected and sent off-station for disposal. Fueling pits are connected via underground lines to an oil/water separator at the northeast corner of Hangar 1. The oil/water separator discharges to Jewel Beach (outfall IA-3). Outside the hangar, there is one fueling pit (No. 4) for helicopters located on the tarmac. However, because it is necessary to fuel several helicopters at a time, and the fueling pit can accommodate only one, the Coast Guard also uses a fueling truck. The truck is a potential source of fuel that could drip or spill and enter the stormwater system. Types of chemicals used or stored include lubricants, solvents, small quantities of spray paints, thinners, strippers, other engine fluids, engine gasoline path cleaner, detergents, used fuels, used oils, and waste solvent.	IA-1	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Four samples annually during the deicing season (October – March)
20	Hangar 2	3-3	S.2	Hangar 2 is located north of Hangar 1, between Hangars 1 and 3. The facility is no longer active as an aircraft hangar. The hangar is being used by the BOSS Roads and Grounds Maintenance Department and other BOSS functions. It also houses Air Station supply and the HAZMIN Center. If hangar continues with this use, it should be considered sector P.	IA-1	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual.
15	Hangar 3	3-3	S.3	Hangar 3 is located northwest of Hangar 1. A wash rack is located in this facility, which discharges to sanitary sewer. The system can be routed to the storm sewer if the AFFF system activates. Helicopter engines are washed inside and outside on the northwest side of the building, with discharge to the sanitary sewer. Industrial activities include: fuel cell (gasoline tank) repairs, over-night storage of helicopters and C-130s, and product storage. There is a paint booth for helicopter parts located in the hangar. A diesel fuel pump is located outside on the retaining wall across the access road from the northeast corner of the building. Types of material used or stored include diesel, used oils & fuels, solvents, paints, thinner, primer, and stripper.	IA-4 & IA-1	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Four samples annually during the deicing season (October – March)
"A" "B"	AIRSTA Apron/Taxiway	3-3	S.4	In 2015, the entire area south of Hangar 2 was paved, and the apron around Hangars 1 and 3 is being repaved. Stormwater from the pavement is collected and either flows directly into Womens Bay or flows from the vicinity of the fueling pits through the oil/water separator near Hangar 1. This water is discharged to Jewel Beach. Industrial activities include fueling of airplanes and helicopters. Fuel, JP-5, is stored in large aboveground storage tanks within the AIRSTA fuel farm. Fuel pits are designed to collect spilled fuel and pipe it to the Hangar 1 oil/water separator.	IA-3	Routine Facility Inspection: Monthly during deicing season (October – March). At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Quarterly during the de-icing season.

Building	Building Name	Figure	Sector	Description and Potential Pollutant Sources	Outfall(s)	Inspection/Monitoring Frequency (see Chapter 5 and Attachment D)
N66	GSE and Fuel Trucks	3-3	S.5	The 8-bay GSE Building is located near the southeast corner of Hangar 2. The building houses vacuum trucks and other equipment used to support AIRSTA operations and HAZMIN storage. There is a series of four drains down the center of the building that drain to an oil/water separator, which is piped to the sanitary sewer. There is no long-term outdoor equipment/vehicle storage.	IA-1	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Four samples annually during the deicing season (October – March)
N94	GSE Building	3-3	S.6	Located northwest of building N1, GSE equipment is housed and maintained in this building. Outside storage includes fork trucks and a portable generator.	IA-3	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Four samples annually during the deicing season (October – March)
N90	Sand and Urea Storage	3-4	S.7	This warehouse facility, located near the intersection of Cape Sarichef Drive and Taxiway A (Alpha), is used to store runway snow and ice-control materials (sand & urea). The sand and urea is stored within the building with little to no contact with stormwater. Water that comes into contact with the urea drains to the wastewater treatment plant.	IA-3	Routine Facility Inspection: Monthly during deicing season (October – March). At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: Four samples annually during the deicing season (October – March)
-	Wastewater Treatment Plant	3-4	T.1	The wastewater treatment plant, built in 1976, is operated by the BOSS Contractor. The plant includes a bar screen, an activated sludge basin, and two secondary clarifiers. The typical flow rate through the plant is 0.7 million gallons per day (mgd), and the design capacity is 1.5 mgd. Sludge is trucked to the city of Kodiak for disposal. Truck loading takes place indoors. Types of chemicals that may be used or stored include lime, solvents, paints, gasoline, lubricants, used oil, polymer, and laboratory chemicals. The 16 floor drains drain to a sump that drains back to the head works. A former sewage sludge lagoon is located north of the wastewater treatment plant. This approximately 150-ft berm-sided square area is used during annual dewatering and cleaning of the aeration basins/digesters. Approximately 35-40 yards of material is deposited annually. The material is placed in the lagoon to allow it to dewater prior to landfill disposal. Dense grass grows in the lagoon.	IA-5	Routine Facility Inspection: Quarterly. At least one must be conducted during a period when a stormwater discharge is occurring. Visual Assessment: Quarterly. Comprehensive Site Inspection: Annual. Benchmark Monitoring: None.
-	Construction Sites and/or Areas of Soil Erosion	NA	NA	This is a general category for any construction activity or area that could result in soil erosion. This includes shoreline areas.	NA	Project specific but an overall inspection looking for soil erosion concerns must be incorporated into the annual Comprehensive Site Inspection.

Note A: The letter is the MSGP sector that corresponds to the facility/area. See Table 1-1 for Sector descriptions. The number is sequential for each sector. For cross-reference purposes, these same numbers are used in Figures 3-2 through 3-4.
MWR – Morale Welfare and Recreation
GSE – Ground Support Equipment
HAZMIN – Hazardous Material storage
BOSS – Base Operating Support Services Contractor
LOWS – Liquid Oily Water Separator

3-2 Commonly Used/Handled Materials

Table 3-2 provides a list of commonly used and handled materials throughout BASE Kodiak.

Table 3-2 Commonly Used/Handled Materials

Material	Location/Purpose
JP-5 Fuel	Fuel for aircraft and vessels Fuel for heating
Diesel Fuel	Fuel for vessels Fuel for heat Vehicle fueling
Gasoline	Vehicle and vessel fuel
Motor Oil	Vehicles and Equipment
Hydraulic Oil	Vehicles and Equipment
Paint	Facility Vehicle Equipment Vessel Maintenance
Solvents, cleaners compounds, and paint strippers.	Shops. Parts and equipment cleaning and degreasing.
De-Icing Compounds	Aircraft, roads, sidewalks, and taxiway. Compounds include urea, salts, and sand.
Bilge Water	Off-load from vessels and transfer to LOWS for treatment.
Sewage	Off-load from vessels and potential spills associated with the wastewater treatment plant and generally the sewage system. Discharge of treated sewage (effluent) from the BASE Kodiak wastewater treatment plant is authorized under a separate NPDES permit (AK-002064-8).
Hazardous Waste	General category of hazardous wastes that are transported and stored at BASE Kodiak.
Hazardous Materials	General category of hazardous material that are used and transported throughout BASE Kodiak.
Bulk Fuel Secondary Containment Stormwater	Release of stormwater from secondary containment associated with bulk fuel tanks is authorized under a separate NPDES permit (AK-003142-9).

3-3 Exposed Material and Equipment

Table 3-1 provides an inventory of materials and equipment stored outdoors that may be exposed to precipitation. Table 3-2 provides a list of commonly used and handled materials at BASE Kodiak that could be exposed to precipitation or spilled.

3-4 Spills and Releases

Table 3-3 is a list of spills and releases from years 2012 through July 2015.

Table 3-3: Spills and Releases

Date	Gallons	Product	Short Description of Spill	Water	Land
7/30/15	<1	10/30 motor oil	Dripped off side of closed oil container – Womens Bay.	X	
6/18/15	0.25	JP-5	Fuel cart hose expansion from the sun.		X
6/12/15	<1	JP-5	Fuel truck vent burp.		X

Date	Gallons	Product	Short Description of Spill	Water	Land
5/15/15	0.25	Used motor oil	Improper storage of used oil.		X
5/6/15	0.25	Diesel fuel	Poor storage of fuel transfer hose in locker – no dust caps installed on camlock fittings.	X	
4/29/15	0.2	Oil	Container fell out of personal vehicle.		X
3/25/15	10	JP-5	Aircraft C130 fuel pump maintenance.		X
1/22/15	0.062	9250 Lubricating engine oil	During transfer of lube oil drums from pier to cutter; during disconnection of hoses, oil sprayed and missed drip pan.	X	
1/8/15	<1	9250 Lubricating engine oil	Oil left on top of drums sitting on Cargo Pier displaced by rainwater.	X	
12/30/14	10	9250 Lubricating engine oil	Transfer hose coupling hose clamp failure.	X	
12/29/14	5-10	Hydraulic oil	Excavator hydraulic line parted/ruptured.	X	
9/10/14	400-1640	Diesel	Tank structural failure and operator error.	X	
9/8/14	1150	Diesel	Discharge from a NOAA vessel. Investigation still ongoing.	X	
9/8/14	1	Gasoline	Delivery truck mechanical failure.		X
8/19/14	0.125	Oil	ASW cooling system.	X	
6/27/14	10	AFFF	Mechanical failure.		X
5/23/14	0.125	Brake Fluid	Mechanical failure.		X
5/21/14	0.25	Hydraulic Fluid	Mechanical hose fitting failure.		X
5/19/14	<2	JP-5	Operator error.		X
5/2/14	<1	Hydraulic Oil	Mechanical hose rupture.		X
4/28/14	2	JP-5	Mechanical hose break-away.		X
4/14/14	0.025	Diesel	Unknown.		X
3/14/14	<1	Hydraulic Oil	Loader mechanical failure.		X
1/10/14	0.5	Engine Coolant	POV mechanical failure.		X
1/9/14	0.5	Ethylene Glycol	38ft boat mechanical operator rrror.		X
12/16/2013	0.125	Transmission Fluid	GV mechanical.		X
12/1/2013	1	Engine Oil	POV mechanical/neglect.		X
10/25/2013	5	JP-5	Fuel Stop Mechanical Failure		X
9/24/2013	0.5	Diesel	Vehicle overfill/utilized high flow nozzle.		X

Date	Gallons	Product	Short Description of Spill	Water	Land
9/23/2013	0.25	Engine Oil	Vehicle oil filter failure.		X
9/13/2013	1	Oil Base Paint	Improper disposal.		X
9/5/2013	0.025	Oil	Compressor mechanical failure.		X
8/26/2013	0.125	Hydraulic Oil	Forklift hose rupture.	X	X
7/26/2013	0.95	Engine Oil	Improper storage of used oil.		X
7/26/2013	0.375	Gasoline	ATV mechanical failure.		X
7/10/2013	1	Diesel	Portable steam unit/mechanical failure.		X
7/5/2013	0.9	Engine Oil	POV Improper Used Oil Storage		X
7/3/2013	1.5	JP-5	Fuel cart valve misaligned.		X
6/27/2013	1.5	JP-5	USMC C130 heat expansion venting.		X
6/26/2013	36	9250 Oil	Forklift operator error/misjudgment.		X
6/26/2013	1.25	Oil Base Paint	Forklift operator error/misjudgment.		X
6/16/2013	2	JP-5	Heat expansion of fuel causing plane to burp.		X
6/11/2013	1	Hydraulic Oil	Oil line leak.		X
5/31/2013	0.125	Engine Oil	Improper disposal.		X
5/22/2013	8	JP-5	Army aircraft wing hung over edge of pit; fuel spill traveled to storm drain.	X	X
5/13/2013	0.125	JP-5	Fuel truck leaking hose and rising air temperature.		X
4/29/2013	0	Peanut Oil	Improper disposal.		X
4/29/2013	0.125	Engine Oil	POV.		X
2/13/2013	0.5	Diesel	POV diesel pump leak/mechanical failure.		X
1/30/2013	10	Hydraulic Oil	Loader hose rupture/mechanical failure.		X
11/15/2012	0.123	JP-5	Hose came off fuel truck.		X
11/26/2012	10	Diesel	Portable steam unit/improper fueling procedures.		X
10/21/2012	0.125	Transmission fluid	POV		X
10/13/2012	0.125	Transmission fluid	POV		X
10/8/2012	0.25	Engine oil	F-350 GV improper maintenance by midtown vendor/loose oil filter.		X
9/24/2012	0.5	Engine oil	Alaska Food for Less delivery truck oil leak.		X

Date	Gallons	Product	Short Description of Spill	Water	Land
9/23/2012	0.125	Engine oil	POV leak.		X
8/21/2012	50	Used oil/water	Truck operator error/tank overfill.		X
8/20/2012	5	JP-5	N-21 Fuel Station, failed coupling assembly On fuel cart during pressure test.		X
8/16/2012	0.0001	Gasoline	Exchange parking, unknown.		X
8/14/2012	750	JP-5	Regulating valve failure.		X
8/13/2012	0.125	Engine Oil	105 Polaris Dr., poor housekeeping.		X
8/13/2012	0.5	oil	N-38, car leak.		X
7/31/2012	2	Insulator Oil	When the tower was lifted off the base insulator, oil started seeping out from the seals at the bottom of the porcelain insulators. With the tower being suspended in the air, we had to wait until it was clear before it was safe to contain the leaking oil.		X
7/25//2012	50	Diesel	Fire Engine fuel tank holding straps broke causing fuel tank to drag while engine was driving. It was dragged approximately 2 miles.		X
7/10/2012	1.25	Lube Oil	Member left old oil filter gasket on while changing filters resulting in leak.		X
6/25/2012	0.125	Lube Oil	Govt. housing, overflow while adding oil to POV.		X
6/25/2012	0.5	Lube Oil	A512, failed oil filter during KSS test drive.		X
6/13/2012	1	Diesel	330, Fuel leaking from diesel truck on driveway.		X
5/12/2012	2	Hydraulic Oil	CGC Spar, unknown.	X	
4/20/2012	15	Lube Oil	N1 car wash, hydraulic line ruptured on the garbage truck.		X
4/19/2012	0.03125	Lube Oil	N38 parking, POV oil leak.		X
4/17/2012	0.5	Lube Oil	N39, POV had a oil leak.		X
4/10/2012	1	Sewage	Small spill while offloading C-130.		X
4/9/2012	2	JP-5	14, Pressure build up in the line, when maintenance personnel attempted to attach the fuel hose, fuel shot out.		X
3/28/2012	0.25	Lube Oil	N20 parking, leaking container in the bed of a POV.		X
2/29/2012	0.5	Diesel	938, Overfill alarm was set too high and the automatic shutoff did not work properly while fueling heating tank.		X
1/25/2012	8	Diesel	N94, Fuel tank leak on the snow blower.		X
1/13/2012	0.25	Hydraulic Oil	N20 elevator shaft, not specified.		X

Date	Gallons	Product	Short Description of Spill	Water	Land
1/11/2012	1.5	JP-5	20, Tank expansion on fuel cart while defueling a plane.		X

3-4.1 Spill Evaluation

Most spills over this time period were small and the vast majority were on land. Table 3-4 summarizes the spills listed in Table 3-3. Diesel was the product, in terms of volume, most spilled. The volume of JP-5 was considerably less, but it was spilled more frequently than diesel. The volume of hydraulic fluid spilled was small; however, the number of spill events was the highest. Spills to water involved primarily petroleum products and many could have been avoided if extra steps were taken to avoid any carelessness. Training should emphasize slowing down to think through actions and consequences.

Table 3-4 Spill Evaluation Summary

Material Spilled	Volume Spilled (gallon)	% of Total Volume spilled	# of Spill Events	% of Total Spill Events
JP-5	792.1	21%	16	20%
Diesel	2851.78	74%	12	15%
Hydraulic Fluid	201.46	5%	42	53%
Gasoline	1.38	<1%	3	4%
Non-POL	14.25	<1%	6	8%

3-5 Records and Documentation

BASE Kodiak may use the inspection forms included in Attachment C to document inspections. BASE Kodiak will maintain records of monitoring activity and results, copies of reports, and similar data for a period of three years after the date permit coverage expires.

The following types of records are maintained in the BASE Kodiak Facilities Engineering Department, Environmental Division records room, along with the master copy of the SWPPP:

- Descriptions and dates of any incidences of significant spills, leaks, or other releases that resulted in discharges of pollutants to waters of the U.S., the circumstances leading to the release and actions taken in response to the release, and measures taken to prevent the recurrence of such releases;
- Records of employee training, including date training received;
- Documentation of maintenance and repairs of control measures, including the date(s) of regular maintenance, date(s) of discovery of areas in need of repair/replacement, and for repairs, date(s) that the control measure(s) returned to full function, and the justification for any extended maintenance/repair schedules;
- Inspection reports, including the Routine Facility Inspection Reports, the Quarterly Visual Assessment Reports, and the Comprehensive Site Inspection Reports;
- Description of any deviations from the schedule for visual assessments and/or monitoring and the reason for the deviations (e.g., adverse weather or it was impracticable to collect samples within the first 30 minutes of discharge);
- Description of corrective action taken, including triggering event and dates when problems were discovered and modifications occurred;

- Documentation of any benchmark exceedances and how they were responded to, including either (1) corrective action taken, (2) a finding that the exceedance was due to natural background pollutant levels, or (3) a finding that no further pollutant reductions were technologically available and economically practicable and achievable in light of best industry practice; and
- Documentation to support any determination that pollutants of concern are not expected to be present above natural background levels if discharged directly to impaired waters, and that such pollutants were not detected in the discharge or were solely attributable to natural background sources.

3-6 Benchmark Stormwater Monitoring Data

Stormwater sampling data collected to meet the requirements of the NPDES MSGP are maintained electronically along with this plan in the BASE Kodiak Facilities Engineering Department, Environmental Division records room. Attachment D presents the results of benchmark monitoring (stormwater sampling) conducted from March 2010 to June 2015. Monitoring results were evaluated relative to the 2008 MSGP benchmark values to help predict future levels. Table 3-5 presents benchmark values for each sector under the 2015 MSGP. Table 3-6 summarizes which parameters at which outfalls will likely exceed the 2015 MSGP benchmark levels.

Table 3-5 Permit Monitoring Benchmarks for Each Sector

Sector	K	L	Q	S
Ammonia Ammonia as N	2.14 mg/L			2.14 mg/L
Magnesium	0.064 mg/L			
Chemical Oxygen Demand	120 mg/L			120 mg/L
Biochemical Oxygen Demand				30 mg/L
Total Suspended Solids		100 mg/L		
pH				6.5-8.5
Aluminum			0.75 mg/L	
Iron		1.0 mg/L	1.0 mg/L	
Arsenic Saltwater Freshwater	 0.069 mg/L 0.15 mg/L			
Cadmium Saltwater Freshwater	 0.04 mg/L *			
Cyanide Saltwater Freshwater	 0.001mg/L 0.022 mg/L			
Lead Saltwater Freshwater	 0.21 mg/L *		 0.21 mg/L *	
Mercury Saltwater Freshwater	 0.0018 mg/L 0.0014 mg/L			
Selenium Saltwater Freshwater	 0.29 mg/L 0.005 mg/L			
Silver Saltwater Freshwater	 0.0019 *			
Zinc Saltwater Freshwater			 0.09g/L *	

*Hardness Dependent – see Table 5-2a

Table 3-6 Benchmark Stormwater Sampling Overview

Outfall	Sector Association	Summary
IA-1	S - Air Transportation	Sampling at this location under the 2008 MSGP ended in 2010 because of four quarters of compliance. Sampling under the 2015 MSGP will include ammonia, COD, BOD, and pH. Based on past results and stability of operations, exceedances are not expected.
IA-2	K - Hazardous Waste Treatment, Storage Or Disposal Facilities	Magnesium: Results from 6 monitoring events evaluated. All results exceed the 2015 MSGP benchmark of 0.064 mg/l respectively. The average was 23 mg/l and the maximum was 70.6 mg/l in May 2014. This value in May 2014 appears to be an anomaly compared with the other results, which were significantly lower, albeit still above the benchmark. The elevated magnesium levels are attributed to application of magnesium salts used to deice roads. There are no water quality criteria or drinking water quality standards for magnesium. Recommendation is to continue to minimize usage of sanding/deicing materials on roads when possible. Sampling for all other required constituents at this location under the 2008 MSGP ended prior to 2014 because of four quarters of compliance. Sampling under the 2015 MSGP will include ammonia, magnesium, arsenic, cadmium, cyanide, lead, mercury, selenium, and silver. All parameters except for magnesium are not expected to be exceeded in the future.
IA-3	S - Air Transportation	Sampling at this location under the 2008 MSGP ended in 2011 because of four quarters of compliance. Sampling under the 2015 MSGP will include ammonia, COD, BOD, and pH. Based on past results and stability of operations, exceedances are not expected.
NP-1A	Q – Water Transportation	Sampling at this location for lead and zinc under the 2008 MSGP ended in 2010 because of four quarters of compliance. Aluminum: Results from 6 monitoring events were evaluated. The average value of 11.35 mg/L exceeds the 2015 MSGP benchmark value of 0.75 mg/L. Iron: Results from 5 monitoring events were evaluated. The average value of 24.31 substantially exceeds the 2015 MSGP benchmark value of 1.0 mg/L. The location of this outfall is next to the MWR Boathouse. All materials are stored indoors and work on boats is conducted indoors. However, until late in 2014, the outside area by the storm drain was filled with sediment. It was clean during 2015 inspections, and the stormwater had significantly lower levels of aluminum and iron in samples taken in 2015. The property is located next to a remediation system that has aluminum piping and the boathouse building roof has aluminum. The roof water was sampled in 2015 and elevated aluminum was not found. The roof water will be sampled again, and more investigation regarding potential causes needs to be conducted at this area. Ultimate drainage from this storm drain is at NP-2, which has just been added to outfalls that will be sampled in the future. Sampling under the 2015 MSGP will include aluminum, iron, lead, and zinc. Lead and zinc are not expected to be exceeded in the future.
NP-2	Q - Water Transportation	Sampling under the 2015 MSGP will include aluminum, iron, lead, and zinc. This will be a new sampling point under the 2015 MSGP.

Table 3-6 Benchmark Stormwater Sampling Overview

Outfall	Sector Association	Summary
NP-2A	Q - Water Transportation	Sampling at this location for lead and zinc under the 2008 MSGP ended in 2010 because of four quarters of compliance. Aluminum: Results from 7 monitoring events were evaluated. The average value of 3.96 mg/L exceeds the 2015 MSGP benchmark value of 0.75 mg/L. Iron: Results from 7 monitoring events were evaluated. The average value of 5.45 exceeds the 2015 MSGP benchmark value of 1.0 mg/L. Both iron and aluminum levels can be influenced by the quantity of exposed metal equipment that is stored on the ground near the Stormceptor. When funding becomes available, several improvements are planned for this area. Sampling under the 2015 MSGP will include aluminum, iron, lead, and zinc. Lead and zinc are not expected to be exceeded in the future.
NP-3	Q – Water Transportation	Sampling at this location under the 2008 MSGP ended in 2011 because of four quarters of compliance. Sampling under the 2015 MSGP will include aluminum, iron, lead, and zinc. Based on past results and stability of operations, exceedances are not expected.
NP-CC	Q – Water Transportation	Sampling under the 2015 MSGP will include aluminum, iron, lead, and zinc. This will be a new sampling point under the 2015 MSGP.
LF-1	L – Coast Guard Landfill	Sampling at this location under the 2008 MSGP ended in 2011 because of four quarters of compliance. Sampling under the 2015 MSGP will include TSS and iron. Based on past results and stability of operations, exceedances are not expected.
LF-2	L - Navy Landfill	Sampling for TSS at this location ended in 2010 because of four quarters of compliance. Iron: Results from 5 monitoring events were evaluated. The average value of 1.83 mg/l exceeds the 2015 MSGP benchmark value of 1.0 mg/l. However, this is a significant drop from past years of monitoring. Over time, it should continue to drop. Sampling under the 2015 MSGP will include TSS and iron. TSS is not expected to be exceeded in the future

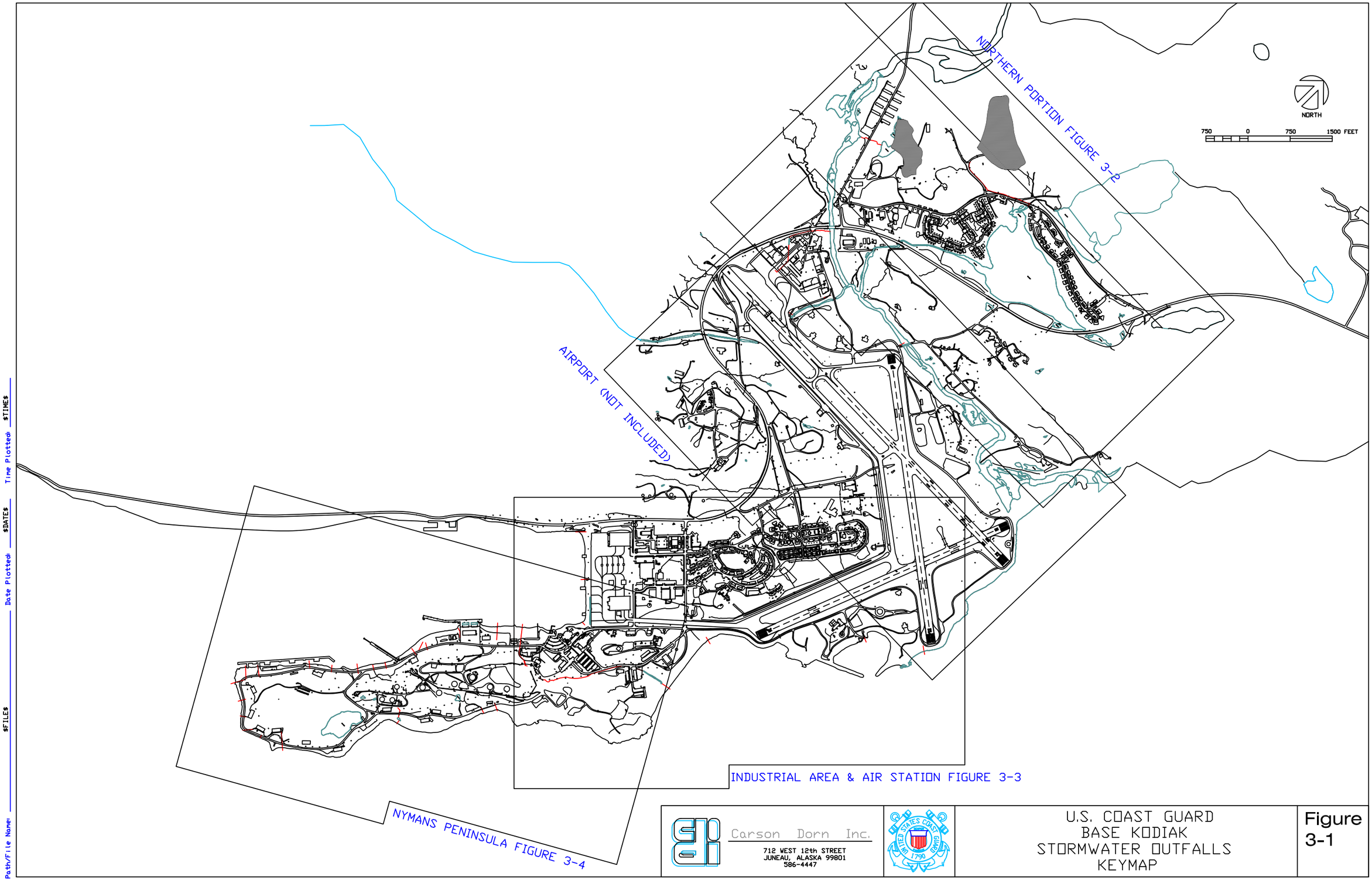
3-7 General Location Map and Site Map

Figures 3-1 through 3-4 show the areas of BASE Kodiak affected by the MSGP. These figures include the following information:

- General layout of BASE Kodiak;
- Significant structures and impervious areas,
- Drainage areas including direction of flow;
- Outfall locations and receiving waters;
- Existing structural control measures;
- Facilities and areas associated with an industrial sector per the MSGP; and
- Stormwater monitoring locations.

Figure 3-1 Stormwater Outfalls Key Map

This page intentionally blank



Path/File Name: $FILE$ Date Plotted: $DATE$ Time Plotted: $TIME$

Carson Dorn Inc.
712 WEST 12th STREET
JUNEAU, ALASKA 99801
586-4447

U.S. COAST GUARD
BASE KODIAK
STORMWATER OUTFALLS
KEYMAP

Figure 3-1

This page intentionally blank

Figure 3-2 Stormwater Outfalls Northern Portion

This page intentionally blank

ANTON LARSON BAY ROAD

BUSKIN LAKE

COAST GUARD LANDFILL (CLOSED) L.1

Note: Leachate is discharged into the Base Kodiak sanitary sewer. The discahrge is included in NPDES permit AK-002064-8.

LF-1

NAVY LANDFILL (CLOSED) L.2

LF-2

RED LAKE

LAKE LOUISE

REZANOF HWY.

BUSKIN RIVER

LEGEND

- BENCHMARK SAMPLING POINT
- OPTIONAL BENCHMARK SAMPLING POINT
- OUTFALL
- WATERSHED
- DIRECTION OF SURFACE FLOW
- VISUAL MONITORING LOCATION

NORTH

250 0 250 500 FEET

MSGP ASSOCIATED FACILITIES

- L.1 COAST GUARD LANDFILL
- L.2 NAVY LANDFILL

Path/File Name: $FILE$ Date Plotted: $DATE$ Time Plotted: $TIME$

Carson Dorn Inc.
712 WEST 12th STREET
JUNEAU, ALASKA 99801
586-4447

U.S. COAST GUARD BASE KODIAK STORMWATER OUTFALLS NORTHERN PORTION

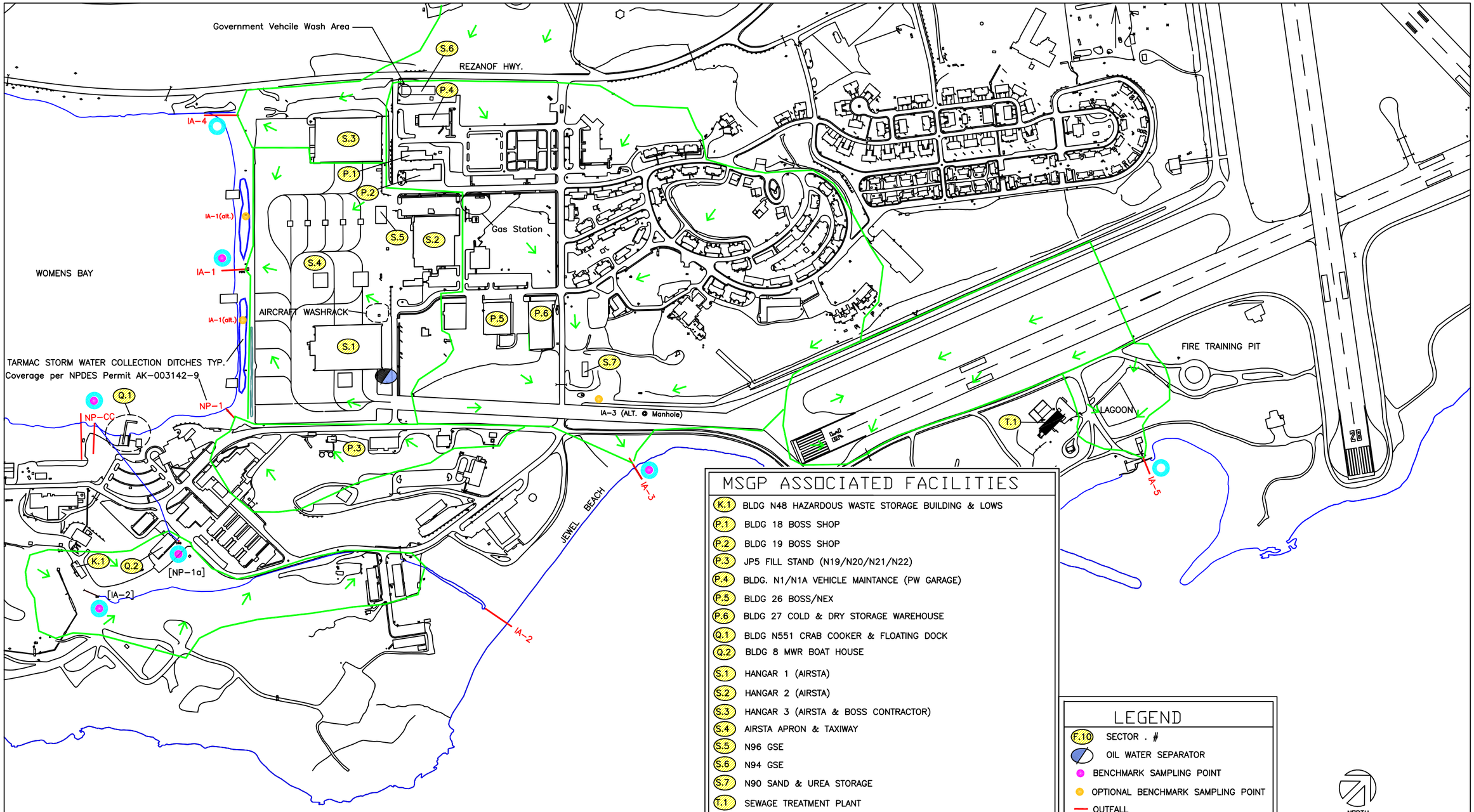
Figure 3-2

UPDATE: 08/2015 BY: BRIDWELL/WHITE

This page intentionally blank

Figure 3-3 Industrial Area & Air Station

This page intentionally blank



MSGP ASSOCIATED FACILITIES

- K.1 BLDG N48 HAZARDOUS WASTE STORAGE BUILDING & LOWS
- P.1 BLDG 18 BOSS SHOP
- P.2 BLDG 19 BOSS SHOP
- P.3 JP5 FILL STAND (N19/N20/N21/N22)
- P.4 BLDG. N1/N1A VEHICLE MAINTANCE (PW GARAGE)
- P.5 BLDG 26 BOSS/NEX
- P.6 BLDG 27 COLD & DRY STORAGE WAREHOUSE
- Q.1 BLDG N551 CRAB COOKER & FLOATING DOCK
- Q.2 BLDG 8 MWR BOAT HOUSE
- S.1 HANGAR 1 (AIRSTA)
- S.2 HANGAR 2 (AIRSTA)
- S.3 HANGAR 3 (AIRSTA & BOSS CONTRACTOR)
- S.4 AIRSTA APRON & TAXIWAY
- S.5 N96 GSE
- S.6 N94 GSE
- S.7 N90 SAND & UREA STORAGE
- T.1 SEWAGE TREATMENT PLANT

LEGEND

- F.10 SECTOR . #
- OIL WATER SEPARATOR
- BENCHMARK SAMPLING POINT
- OPTIONAL BENCHMARK SAMPLING POINT
- OUTFALL
- WATERSHED
- DIRECTION OF FLOW
- VISUAL MONITORING LOCATION

NORTH

250 0 250 500 FEET

Carson Dorn Inc.
712 WEST 12th STREET
JUNEAU, ALASKA 99801
586-4447

U.S. COAST GUARD
BASE KODIAK
STORMWATER OUTFALLS
ISC INDUSTRIAL AREA INCLUDING AIR STATION

Figure 3-3

UPDATE: 08/2015 BY: BRIDWELL/WHITE

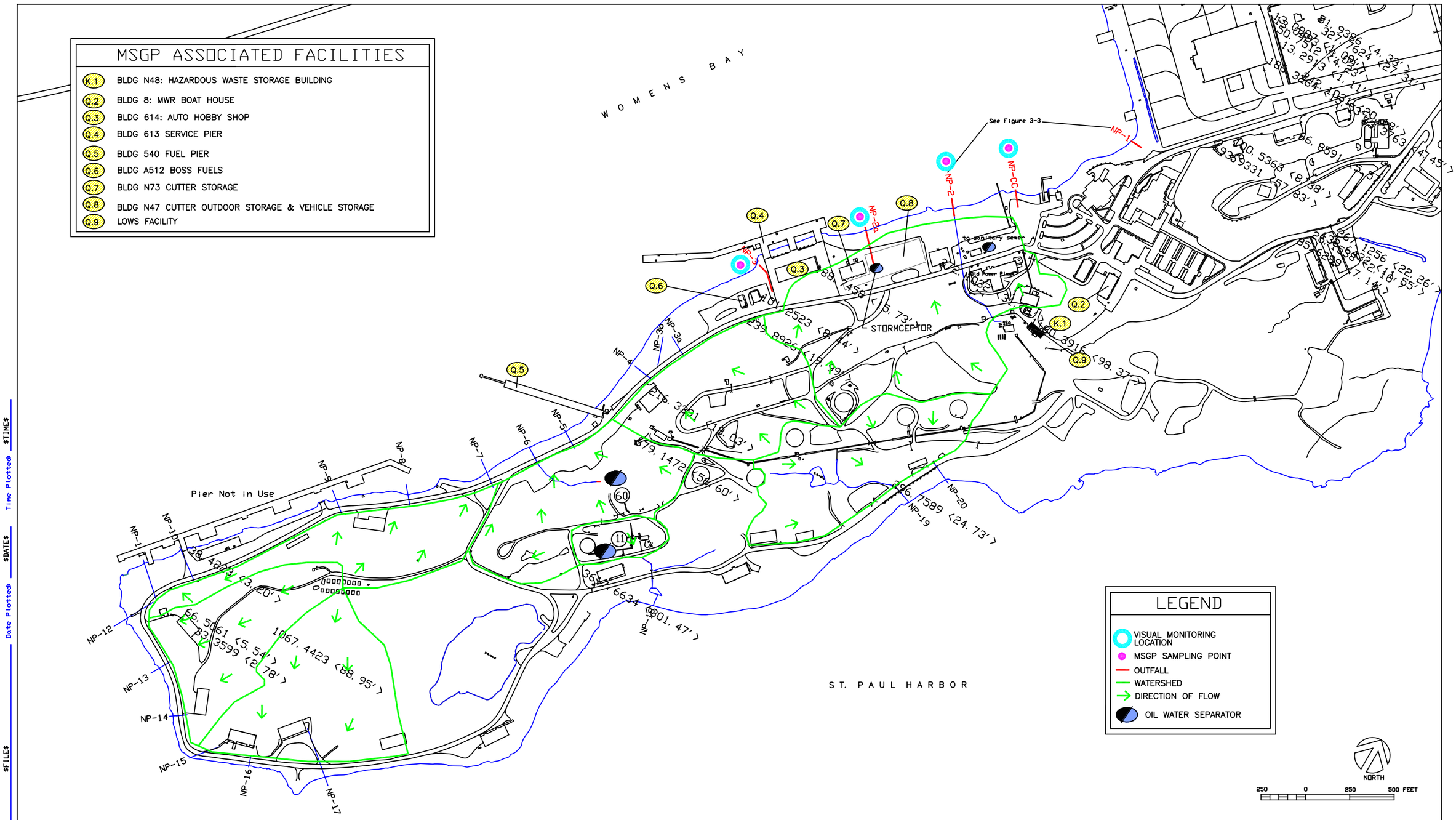
This page intentionally blank

Figure 3-4 Stormwater Outfalls Nyman Peninsula

This page intentionally blank

MSGP ASSOCIATED FACILITIES

K.1	BLDG N48: HAZARDOUS WASTE STORAGE BUILDING
Q.2	BLDG 8: MWR BOAT HOUSE
Q.3	BLDG 614: AUTO HOBBY SHOP
Q.4	BLDG 613 SERVICE PIER
Q.5	BLDG 540 FUEL PIER
Q.6	BLDG A512 BOSS FUELS
Q.7	BLDG N73 CUTTER STORAGE
Q.8	BLDG N47 CUTTER OUTDOOR STORAGE & VEHICLE STORAGE
Q.9	LOWS FACILITY



Carson Dorn Inc.
712 WEST 12th STREET
JUNEAU, ALASKA 99801
586-4447

U.S. COAST GUARD
BASE KODIAK
STORMWATER OUTFALLS
NYMANS PENINSULA

Figure 3-4

UPDATE: 08/2015 BY: BRIDWELL/WHITE

Path/File Name: $FILE$ Date Plotted: $DATE$ Time Plotted: $TIME$

This page intentionally blank

3-8 Description of Potential Pollutant Sources

Potential pollutant sources are activities where operations could be exposed to precipitation. They may include: fueling, engine maintenance, and repair; pressure washing, painting, sanding, blasting, welding, and metal fabrication; loading/unloading areas; locations used for the treatment, storage, or disposal of wastes; and liquid storage tanks, liquid storage areas (e.g., paint, solvents, resins), and material storage areas (e.g., blasting media, aluminum, steel, scrap iron). The types of discharges contained in the drainage areas of the outfalls (e.g., stormwater and air conditioner condensate) are described later in this section.

For each area of the facility that generates stormwater discharges associated with industrial activity with a reasonable potential for containing pollutants, a prediction of the direction of flow is identified on Figures 3-1 through 3-4, and the types of pollutants that are likely to be present in stormwater discharges associated with industrial activities are described in the next section. Specific potential pollutants from each facility/area are included in Table 3-1. Below is general sector-specific information on potential pollutant sources.

3-8.1 Potential Stormwater Pollutant Sources by Sector

The following sections provide general descriptions and potential pollutant sources for each of the listed sectors. Table 3-1 provides more facility/area specific information on potential pollutant sources.

3-8.1.1 Treatment, Storage and Disposal Facility Sector (K)

Potential pollutants from activities at the Hazardous Waste Storage Building and areas surrounding the building on Nyman Peninsula include diesel, JP-5, gasoline, perchloroethene, metals, and other solvents.

3-8.1.2 Landfill Sector (L)

Potential stormwater pollutants from the Navy Landfill include leachate that may contain solvents, paint constituents, and fuels, and runoff from building debris that may contain metals and other constituents. These constituents could potentially be detected in runoff from the landfill and in surface water that flows under Anton Larsen Bay Road into the Buskin River. See Figure 3-2.

3-8.1.3 Land Transport and Warehousing Sector (P)

Primary potential stormwater pollutants that originate in the industrial area include fuels (JP-5, gasoline, and diesel), metals, and solvents. Stormwater from the industrial area flows into Womens Bay and/or St. Paul Harbor on either side of Nyman Peninsula.

3-8.1.4 Water Transportation (Q)

Potential pollutants from the water transportation sector include bilge water, sewage, fuels, lubricants, paints (including overspray and paint chips), grinding/sanding debris, and materials/wastes being loaded/unloaded from vessels. Stormwater enters Womens Bay. See Figure 3-4

3-8.1.5 Air Transportation Sector (S)

Potential pollutants include deicing compounds (such as urea), fuels, and solvents. Outfalls draining only the runways or taxiways might have only fuels, urea, and glycol as potential contaminates.

3-8.1.6 Domestic Treatment Works Sector (T)

Potential pollutants from the activities at the Wastewater Treatment Plant and areas surrounding the building include treatment chemicals such as lime, sludge, sewage, screenings, fuel, and oil.

3-9 Non-Stormwater Discharges

Over the past quarter century, BASE Kodiak has completed projects and upgrades to eliminate the potential for non-stormwater discharges to surface waters. Non-stormwater discharges include any water used directly in a manufacturing process (process water), non-contact cooling water, vehicle wash water, or sanitary wastes. If such connections are discovered at BASE Kodiak, notify the BASE Kodiak Environmental Division at 487-5320.

BASE Kodiak has used different techniques to eliminate non-stormwater discharges. They include sewer upgrades, infiltration and inflow studies, dye testing, plant schematic review, and site visits. The following sections summarize the work BASE Kodiak has completed to eliminate such discharges.

3-9.1 1987 Sewer Storm Separation Study

In 1987, the USCG retained Peratrovich, Nottingham & Drage, Inc. to continue an ongoing study to identify and document sources of infiltration and inflow to the sewer system at the base. Storm sewer lines were often parallel to or crossing the sanitary sewer lines, and were interconnected at some locations. Interconnections of storm lines with the sanitary sewer system identified in this study included the following locations in or near areas of industrial activity:

- Manhole (MH) A5A near the northeast corner of Hangar 1: stormwater into sanitary system
- MH 4B2A in subdivision between Albatross and Fisherman's Bend: stormwater into sanitary system
- MH B6A at north corner of the intersection of Cape Sarichef Street and Polaris Avenue: infiltration and suspected inflow from stormwater
- MH located 30 feet north of MH A5A2, by taxiway D at Airport: potential sewer inflow to storm line

Disconnecting the storm and sewer line interconnection at MH A5A was completed in 1988. The other interconnections identified have been completed in subsequent projects.

3-9.2 1988 Sanitary Sewer Inflow/Infiltration Study

In 1988, Rolland Jones conducted a study of inflow/infiltration potential and sewer capacity at BASE Kodiak for USCG Seventeenth District. The study included essentially the entire BASE sewer system, partitioned into 11 areas. Of these 11 areas, three included areas where industrial activities are conducted and thus are pertinent to this Plan. These three areas were:

- Landfill (Area 2): sewer lines that collect leachate and diverted runoff from the closed Coast Guard Landfill.
- Barracks and Pier Area (Area 6): includes library, theater, Personnel Activities Center, Enlisted Person's Barracks, steam power plant, gymnasium, and ship berthing facilities.
- Hangar Facility (Area 8): includes the AIRSTA hangars, stores, and the Ready Crew Berthing Facility.

General conclusions from this study included findings that many lines were the original wood stave or vitrified clay pipelines that had exceeded their design life. Inverts installed in the 1940s were found in most cases to be below the water table and thus the sewer lines were subject to infiltration pressure. This

excess depth was considered a significant source of infiltration into the sanitary sewer. These findings are probably equally true for the storm sewer lines that were installed in the 1940s. Recommendations in the report included the following:

- Landfill: Proceed with existing plans to divert the landfill leachate from the sanitary sewer system.
- Barracks and Pier Area: Remove and replace the wood stave and vitrified clay pipelines. Raise invert elevations, where possible. Inspect and test service laterals of buildings that must be connected; replace or repair as necessary to meet EPA standards. Inspect all manholes and rehabilitate, as needed, to meet EPA standards.
- Hangar Facilities: Perform an internal inspection of sewer lines using television camera. Inspect and test service laterals of buildings that must be connected; replace or repair as necessary to meet EPA standards. Inspect all manholes and rehabilitate, as needed, to meet EPA standards.
- Airport: Replace wood stave pipe along the runways. Disconnected side sewers that are no longer in use from manholes. Rehabilitate or replace manholes.

Work has been completed in response to the recommendations as follows:

- Landfill: Separation of the landfill leachate collection system from the sanitary sewer is not cost effective because the leachate requires treatment prior to discharge to a surface water body. Treatment requirements would mandate the installation of a new facility.
- A Corrective Actions Plan, which included a formal capping of the Coast Guard Landfill, was completed summer 2000. An impervious clay liner cap significantly reduced the rainwater infiltration and subsequent inflow to the storm sewer system.
- Barracks and Pier Area: Indoor drains and bathroom facilities in buildings A512 (Oil Laboratory), 549 (National Oceanographic & Atmospheric Administration Facility) and the MWR Boathouse have been hooked to the sanitary sewer.
- Hangar Facilities: Although the sewer lines have not been television inspected, an estimated 70 percent of the connections have been repaired or replaced.
- Airport: The wood stave piping along the runway was replaced and manholes rehabilitated in 1990 and 1991.

3-9.3 Results of Dye Testing

The storm and sanitary sewer systems at BASE Kodiak represent about 50 years of design, construction, and maintenance by three major branches of government service (Army, Navy, and Coast Guard), supporting various defense, law, enforcement, and search and rescue programs. Some of the pipelines are original. These apparently survived the 1964 earthquake. Many portions of the sewer systems have been completely replaced. Each new construction program has added more complexity to the systems. Consequently, the existing underground network of sanitary and storm sewer lines is not completely documented. Ongoing efforts to maintain and repair the systems have sustained the two systems over the past five decades.

Since 1988, the Facilities Engineering Department at BASE Kodiak has conducted several major projects that have identified and repaired cross-connections of the sanitary sewer system with the storm sewer. Four additional large projects were conducted between 1992 and 1996 to upgrade existing sanitary lines and to repair any remaining interconnections. Brief descriptions of these projects and smaller dye testing projects are presented in the following paragraphs.

3-9.4 1993 Dye Testing

During the preparation of the original Stormwater Pollution Prevention Plan in 1993, Science Applications International Corporation conducted a review of existing BASE Kodiak storm and sanitary sewer drawings. The purpose of this review was to determine:

- Locations of storm sewer lines and storm drains
- Whether building floor drains were connected to storm or sanitary sewer lines
- Location of stormwater treatment units such as oil/water separators
- Location of interconnections between storm and sanitary lines.

Due to the age of some of the drawings and their lack of detail, drain connections were not determined in all cases. No interconnections were documented on the drawings reviewed. Previous sewer upgrade projects conducted by the Facilities Engineering Department at the BASE have identified areas where possible interconnections may exist. All interconnections identified during upgrade projects have been repaired. There remained a few areas where interconnections could still exist.

The NPDES Permit for stormwater discharges from industrial activities requires that the SWPPP for a facility include a certification that all stormwater outfalls have been evaluated or tested for the presence of non-stormwater discharges. To check for non-stormwater discharges and interconnections, the USCG conducted dye testing.

In each of the industrial areas and Kodiak Airport locations in which the destination of the drain was uncertain, dye testing was proposed. In late 1993, dye testing was performed to ascertain whether the drains identified were connected to the sanitary system or to the stormwater drainage system. Dyes and water were added to the drains in each location. The nearest downstream sanitary and storm manhole covers were monitored for evidence of the dye. Results of the study are presented in the Table 3-7.

Table 3-7 Results of 1993 Dye Testing at Locations in the Industrial Area

Location	Determination
Oil/water separator at Hangar 1	Effluent from the oil/water separator flows into the stormwater collection system and discharges at Jewel Beach.
Trench around wash bay 4 in Hangar 1	Wash Bay 4 flows into the sanitary system.
Trench along northeast side of Hangar 1	This drain flows to the Hangar 1 oil/water separator.
Fuel pit trench on tarmac near Hangar 2	This drain flows to the oil/water separator at Hangar 1.
Vehicle Maintenance Building (N1) floor drains	The interior floor drains flow to the sanitary sewer. The vehicle wash rack was originally hooked to the storm sewer (Brown, pers. com.). However, based on the dye test, the flow does not reach the bay and likely drains to the ground due to a plugged storm sewer pipe.
Boat House floor drain	Floor drain flows to the sanitary sewer.
Building 614 cleaning bay drains	These drains flow directly to Inner Womens Bay via the storm sewer.
Laboratory Building (A512) drain under safety shower and sink in laboratory	Drains flow to the sanitary sewer.
Steam Generation Plant boiler blow down and sump	The sump connects to the oil/water separator at N-56, and then flows to the oil/water separator at N-6, which discharges to the bay.

3-9.5 1996 Dye Testing

The BOSS Contractor performed additional dye testing in 1996. The purpose of this dye testing was to remove uncertainty in specific locations in Hangar 2 regarding the potential for non-stormwater

discharges entering the storm system. Specifically, the results of the study would be used to ascertain whether the floor drains and the nose bay in Hangar 2 flow have connections to the storm sewer.

Results indicated that the floor drains and nose bay drains that were located and tested discharge to the storm sewer.

3-9.6 Sewer Upgrade Projects

BASE Kodiak has conducted several sewer upgrade projects to identify and eliminate infiltration sources into the sanitary sewer system. Table 3-8 outlines some of these upgrades completed between 1994 and 1996.

Table 3-8 Sanitary Sewer Upgrade Projects

Action	Description
Replace Lake Louise Housing Sewer Lines	Approximately 4,000 linear feet of sewer line between Nemetz and Lake Louise housing areas were replaced in 1994.
Aviation Hill Sewer Replacement	As the new housing development is constructed on Aviation Hill, existing sewer lines are being replaced. This project began in 1996.
Sewer Line and Manhole Improvement Project	This project included a comprehensive television survey to identify any remaining interconnections between the storm and sanitary sewer systems and to provide the Coast Guard with a better understanding of inflow and infiltration sources. The television survey was conducted in 1994. Improvements included replacement of approximately 10,000 linear feet of sewer line and 30 manholes in various locations throughout the BASE Kodiak in 1995 and 1996.
Comprehensive Manhole Survey	Visual inspections were performed on 268 manholes throughout the facility in 1995. In addition to the residential manholes, 50 manholes at the Kodiak Airport, 83 manholes in the industrial area, and 9 manholes at the Coast Guard Landfill were inspected. Only four sanitary/storm sewer cross-connections were identified. Two of these were connections of the storm sewer into the sanitary sewer in the Upper Government Hill residential. The other two were sanitary lines that connected into the storm sewer in the industrial area. The connections have been separated.

One of the Coast Guard's objectives in performing the studies and implementing sewer upgrades is to reduce the quantity of water coming into the sewage treatment plant during periods of high loading. Part of this problem may be attributable to stormwater that is directed into the sanitary system (e.g., from the Coast Guard Landfill), as well as to old lines that allow groundwater to infiltrate the system. With the knowledge provided from television studies, the Coast Guard is better able to manage future stormwater quality issues.

3-9.7 2000-2001 Facility Floor Drain Investigation

In early fiscal year 2001, a project was undertaken to investigate facility floor drains throughout BASE Kodiak. This project was completed fall of 2001. The project included field investigations, dye-testing, and an extensive records review to determine the destination of all the floor drains around the complex. All floor drains connected to the stormwater system have been permanently plugged to prevent a non-stormwater discharge.

Chapter 4 Pollution Prevention Control Measures

4-1 Overview

This chapter outlines and describes the pollution prevention control measures (including Best Management Practices (BMPs)), and other controls that will be used throughout the BASE to prevent and/or minimize exposure of manufacturing, processing, and material storage areas (including loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations) to rain, snow, snowmelt, and runoff.

The two types of BMPs are Non-Structural and Structural. Typical Non-Structural BMPs include non-physical means to minimize pollution such as good housekeeping practices and minimizing exposure. Typical structural BMPs are generally a physical device or means to remove pollutants from stormwater or reduce the amount of stormwater discharged to the receiving water. Structural BMPs may include such measures as oil/water separators and infiltration of runoff on-site.

For the most part BMP 6 (4-2.2.6), Management of Runoff, contains structural BMPs in-use at BASE Kodiak.

4-2 Control Measures/Best Management Practices

The following BMPs are applicable to industrial activities at BASE Kodiak. A separate Best Management Practices Plan for the Bulk Storage Facility was prepared in 2014 and is presented in Attachment E.

4-2.2 Core Best Management Practices

4-2.2.1 BMP 1: Minimize Exposure

Minimize the exposure of manufacturing, processing, and material storage areas (including loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations) to rain, snow, snowmelt, and runoff by either locating these industrial materials and activities inside or protecting them with storm resistant coverings (MSGP section 4.2.1). In minimizing exposure, pay particular attention to the following:

- Use grading, berming, or curbing to prevent runoff of contaminated flows and divert run-on away from these areas;
- Locate materials, equipment, and activities so that leaks are contained in existing containment and diversion systems (confine the storage of leaky or leak-prone vehicles and equipment awaiting maintenance to designated areas);
- Clean up spills and leaks promptly using dry methods (e.g., absorbents) to prevent the discharge of pollutants;
- Use drip pans and absorbents under or around leaky vehicles and equipment or store indoors;
- Use spill/overflow protection equipment;
- Drain fluids from equipment and vehicles prior to on-site storage or disposal;
- Perform cleaning operations indoors, under cover, or in bermed areas that prevent runoff and run-on and also that capture any overspray; and
- Ensure that all wash water drains to a proper collection system (i.e., not the stormwater drainage system).
- Provide training to emphasize that nothing except plain water can ever be allowed to enter storm drain systems (no soap, no oil, no sediment, etc.). Provide signage in shops as a reminder.

The discharge of vehicle and equipment wash water, including tank cleaning operations, is not authorized to discharge into the stormwater system, directly to surface water, or on the ground.

4-2.2.2 BMP 2: Good Housekeeping

Keep clean all exposed areas that are potential sources of pollutants, using such measures as sweeping at regular intervals, keeping materials orderly and labeled, and storing materials in appropriate containers (MSGP section 4.2.2). BASE Kodiak will implement the following:

- Keep workspace floors and adjacent areas clean by the use of brooms, shovels, vacuum cleaners, or cleaning machines as appropriate. Clean a minimum of once per work day at the end of each work shift.
- Inspect accumulated water (snow melt, rain water, etc.) in shop spaces for the presence of POLs prior to disposal. Collect heavily POL-contaminated liquids for proper disposal, only liquids with minimal POL can be discharged to floor drains (those properly protected by the use of oil/water separators and/or connected to the sanitary sewer system – wastewater treatment plant).
- Promptly clean up minor spills and leaks using rags, absorbents, or other dry methods. Do not leave used dry absorbents in locations that allow exposure to precipitation.
- Keep exterior waste and recycling receptacles closed except when depositing waste and recycling. Do not place liquids in waste receptacles.
- Do not pour or allow materials/wastes to drain into the storm drains.
- Ensure that waste, garbage, recycled materials, and floatable debris are not discharged to receiving waters by keeping exposed areas free of such materials or by intercepting them before they are discharged.
- Ensure that waste and materials containers are properly labeled and that stored liquids are provided with secondary containment.

4-2.2.3 BMP 3: Maintenance

BASE Kodiak will regularly inspect, test, maintain, and repair industrial equipment and systems to avoid situations that may result in leaks, spills, and other releases of pollutants in stormwater discharged to receiving waters (MSGP section 4.2.3). BASE Kodiak will maintain control measures (such as oil/water separators) used to treat stormwater in effective operating condition. BASE Kodiak will maintain nonstructural control measures (e.g., spill response supplies available, personnel appropriately trained). When control measures are identified, corrective actions must be documented within 14 days including a timeline for completion. BASE Kodiak has a program of recurring inspection and maintenance of stormwater management devices and pollution prevention equipment as follows:

- Maintain equipment in proper working order. Routinely inspect for leaks or conditions that could lead to discharges of oils, lubricants, fuel, or other fluids.
- BASE Kodiak preventive maintenance program includes timely inspection and maintenance of stormwater management devices (e.g., cleaning oil/water separators, catch basins) as well as inspection, testing, maintaining, and repairing facility equipment and systems to avoid breakdowns or failures that may result in discharge of pollutants to surface waters. The BOSS Contract/contractor provides most facility and equipment preventative maintenance.
- BASE Kodiak cleans out storm drain manholes and culverts on an annual basis.
- BASE Kodiak inspects and maintains roadside ditches and swales semi-annually.
- Oil/water separators are inspected on a regular basis. Oil/Water separators are cleaned out and/or repaired as necessary to ensure adequate performance. Scheduled cleaning occurs annually.

4-2.2.4 BMP 4: Spill Prevention and Response Procedures

BASE Kodiak implements the following prevention and response procedures during fueling of vehicles and equipment to prevent spills and respond to accidental releases (MSGP section 4.2.4).

- BASE Kodiak maintains an Integrated Emergency Response and Prevention Plan (IERPP) to manage applicable operations. The IERPP specifies a program of inspection, training, personnel, equipment and facility requirements relative to spill prevention and response.
- Above-ground storage tanks are either double-walled tanks or installed inside of secondary containment berms.
- Use spill containment pallets or specially constructed containment systems or other appropriate weather protection when storing liquid materials outside.
- Post spill response procedure signs at facilities that house industrial operations.
- Fuel vehicles and equipment at the consolidated gasoline station or the truck-loading stand.
- Do not overfill or top off fuel tanks.
- Control spills immediately. Contain small spills using absorbent material such as kitty litter. Do not wash petroleum spills into the storm drain or sanitary sewer.
- Thoroughly inspect fueling areas after spills to ensure proper cleanup has been performed.
- Both the consolidated gasoline station and the truck loading stand have canopies installed over the pumps/hose connect areas.
- Plainly label containers that could be susceptible to spillage or leakage to encourage proper handling and facilitate rapid response if spills or leaks occur.
    - Note: (1) The truck-loading stand is configured with secondary containment. Collected stormwater is either discharged into the oil/water separator near Hangar 1 or Womens Bay. (2) Secondary containment stormwater from the truck stand and tanks N60, N10, N12, N19, and N20 is authorized per NPDES permit AK-003142-9.

4-2.2.5 BMP 5: Erosion and Sediment Control

Soil erosion and sediment controls are measures used to reduce the amount of soil particles that are carried off a land area and deposited in a receiving water (MSGP section 4.2.5).

- For construction activities: The BASE Kodiak Environmental Division reviews construction projects prior to construction to check for soil erosion and sediment controls aspects that may need to be incorporated in the project. The construction contractor will obtain a NPDES Construction General Permit for sites over one acre. For sites less than one acre, BASE Kodiak will consider the following objectives to minimize soil erosion.
    - Minimize the amount of disturbed soil;
    - Minimize runoff from offsite areas from flowing across disturbed areas;
    - Use flow velocity dissipation devices at discharge locations and within outfall channels where necessary to reduce erosion and/or settle out sediment;
    - Stabilize exposed areas;
    - Use structural and/or non-structural measures to minimize on-site erosion and sedimentation
- For non-construction activities BASE Kodiak will:
    - Minimize the off-site vehicle tracking of raw, final, or waste materials or sediments, and the generation of dust;
    - Use flow velocity dissipation devices at discharge locations and within outfall channels where necessary to reduce erosion and/or settle out sediment.

4-2.2.6 BMP 6: Management of Runoff

BASE Kodiak will divert, infiltrate, reuse, contain, or otherwise reduce stormwater runoff to minimize pollutants in stormwater discharges (MSGP section 4.2.6). Various facility infrastructure and other structural controls are used throughout BASE Kodiak to manage and control stormwater/stormwater runoff. Table 4-1 outlines structural BMPs used at BASE Kodiak.

Table 4-1 Management of Runoff

Structural Control Measures
Coast Guard and Navy Landfills (Sector L): • The Coast Guard and Navy Landfills have both been closed and capped with clay liners and/or geotextile materials designed to minimize rainwater intrusion • The landfill caps consist of a top layer of vegetated (grass) topsoil to minimize erosion – both caps are sloped so that rainwater from the landfill surfaces does not pond. Runoff is collected in the surround ditch/swale systems for absorption and natural attenuation of any possible pollutants in the runoff. • The Coast Guard Landfill has buried perforated piping that serves as a leachate collection system – the system is connected to and discharges into the sanitary sewer system. • Brush/grass is cut by the BOSS Contractor on a regular basis to maintain the integrity of the landfill caps.
Treatment Works (Sector T): • A berm surrounds the sludge lagoon to prevent release of sludge and entrained liquid including rainwater.
Air Transportation (Sector S): • A portion of the stormwater runoff from the tarmac surrounding the hangars is collected in a series of stormwater drains/manholes that are piped through an oil/water separator. • The Air Station tarmac is adjacent to Womens Bay – the bay and tarmac are separated by collection ditches.
Land Transportation and Warehousing (Sector P): • The loading docks at buildings 26 and 27 are covered to minimized exposure to precipitation. • There are three large catch basins east of where building 19 was located (on the upper part of the embankment in the gravel parking area) to enhance removal of solids entrained in stormwater.
General: • Waste and recycling containers are covered to minimize exposure to precipitation. • Many catch basins have built-in sumps to settle-out larger debris from stormwater. • BASE Kodiak will minimize the tracking or blowing of raw, final, or waste materials from areas of no exposure to exposed areas. • BASE Kodiak will place velocity dissipation devices at discharge locations and

Table 4-1 Management of Runoff

Structural Control Measures
along the length of any outfall channel if they are necessary to provide non-erosive flow velocity from the structure to a water course. • BASE Kodiak will minimize the discharge of solid material, including floatable debris, from outfalls. • Floor drains are plugged in work spaces that used to discharge into the storm sewer. Other floor drains in work spaces are connected to the sanitary sewer. If floor cleaning wastewater may contain POLs and/or drips and small leaks occur, have an oil/water separator installed in the downstream discharge line. • Aircraft engine gasoline path cleaning wastewater is collected and either discharged into the sanitary sewer or disposed of off-island. • Aircraft washing is only conducted at locations noted in Table 3-1 with wastewater discharging into the sanitary sewer.
Oil/Water Separators: The following oil/water separators discharge into the storm sewer or directly to surface water: • Hangar 1 (Building 14) – the oil/water separator at Hangar 1 is designed to remove residual JP-5 from stormwater runoff, fuel/defueling pits, and the taxiway. Secondary containment at the N21 (truck stand) complex is directed to this separator. The separator discharges to Jewel Beach. • Bulk Storage Tanks N11 and N60 – These bulk fuel storage tanks are located on Nyman Peninsula. The secondary containments from these two tanks are treated by separate oil/water separators. Discharge is into St. Paul Harbor. The discharge of stormwater from these facilities is regulated under NPDES permit AK-002064-8. See Attachment C. • The Building 12 Old Power Plant separator treats stormwater and groundwater from the former power plant. This separator discharges into the sanitary sewer.

4-2.2.7 BMP 7: Salt Storage Piles (or Piles Containing Salt)

BASE Kodiak will (MSGP section 4.2.7):

- Enclose or cover storage piles of salt, or piles containing salt, used for deicing or maintenance of paved surfaces;
- Implement appropriate measures to minimize exposure resulting from adding to or removing materials from the pile(s); and
- Store bulk sand and urea inside building N90.

4-2.2.8 BMP 8: Employee Training

BASE Kodiak will train employees who work in areas where industrial materials or activities are exposed to stormwater, or who are responsible for implementing activities necessary to meet the conditions of this SWPPP (e.g., inspectors, maintenance personnel), including members of the Pollution Prevention Team (MSGP section 4.2.9). Training must cover both the specific control measures (BMPs) used to achieve effluent limits, and monitoring, inspection, planning, reporting, and documentation requirements. Training is conducted at least annually.

Independent/third party contractors, and other occasional or infrequent workers in industrial settings, will be informed, upon commencing work operations, about general stormwater control measures and the specific requirements for the sectors they work in and will be required to perform in accordance with these practices.

The level of training provided, for both full time and occasional workers, will be commensurate with each worker's assignments and responsibilities.

Training may be accomplished in a number of ways:

- Through workshops, classes, working groups, and/or shop level tailgate briefings.
- Through discussions and presentations at pollution prevention team meetings, periodic environmental compliance briefings, and similar group gatherings.
- Through signs/posters posted in significant locations in facilities.

Training documentation and records will include the date and the type of training. Records of formal stormwater pollution prevention training will be maintained along with the SWPPP in the BASE Kodiak Environmental Division Records Room.

Note: Chapter 5 contains guidance to help formulate training.

4-2.2.9 BMP 9: Non-Stormwater Discharges

Only discharges of stormwater are authorized. Prohibited non-stormwater discharges include any water used directly in a manufacturing process (process water), non-contact cooling water, vehicle wash water, or sanitary wastes (MSGP section 4.2.10).

The 2015 MSGP, however, does authorize the following non-stormwater discharges:

- Discharges from fire-fighting activities;
- Fire hydrant flushing;
- Potable water, including waterline flushing;
- Uncontaminated condensate from air conditioners, coolers, and other compressors and from the outside storage of refrigerated gasses or liquids;
- Irrigation drainage;
- Landscape watering provided all pesticides, herbicides, and fertilizer have been applied in accordance with the approved labeling;
- Pavement wash waters where no detergents are used and no spills or leaks of toxic or hazardous material have occurred (unless all spilled material has been removed);
- Wheel wash water that does not use detergents;
- Routine exterior building wash down that does not use detergents or hazardous cleaning products;
- Uncontaminated ground water or spring water;
- Foundation or footing drains where flows are not contaminated with process materials; and
- Incidental windblown mist from cooling towers that collects on rooftops or adjacent portions or your facility, but not intentional discharges from the cooling tower (e.g., "piped" cooling tower blowdown or drains).

If non-stormwater discharges are observed, notify the BASE Kodiak Environmental Division at 487-5320 (X 2208).

4-2.3 Sector-Specific Best Management Practices

4-2.3.1 BMP K-1: Landfill Preventive Maintenance

BASE Kodiak will maintain the landfill leachate collections systems to prevent commingling of leachate with stormwater, the integrity and effectiveness of any intermediate or final cover (including repairing the cover as necessary), and to minimize the effects of settlement, sinking, and erosion.

4-2.3.2 BMP P-1: Vehicle and Equipment Good Housekeeping Measures

BASE Kodiak implements the following good housekeeping measures associated with land transportation and warehousing activities:

- *Material Storage Areas*: Maintain material storage containers (e.g., for used oil/oil filters, spent solvents, paint wastes, hydraulic fluids) to prevent contamination of stormwater and plainly label them (e.g., "Used Oil," "Spent Solvents," etc.). Implement the following (or other equivalent measures), as practicable: storing the materials indoors; installing berms/dikes around the areas; minimizing runoff of storm water to the areas; using dry cleanup methods; and treating and/or recycling collected storm water runoff.
- *Vehicle and Equipment Maintenance Areas*: Minimize contamination of stormwater runoff from all areas used for vehicle/equipment maintenance. Implement the following (or other equivalent measures), as practicable: Performing maintenance activities indoors; using drip pans; keeping an organized inventory of materials used in the shop; draining all parts of fluid prior to disposal; prohibiting wet cleanup practices if these practices would result in the discharge of pollutants to storm water drainage systems; using dry cleanup methods; treating and/or recycling collected storm water runoff; minimizing run on/runoff of storm water to maintenance areas.
  Buildings 614, Auto Hobby Shop, N1, Public Works Garage, N1A, Heavy Equipment Maintenance, and N94, Ground Support Equipment, and a lot located on Nyman Peninsula are designated areas for leaky or leak prone vehicle/equipment storage. Promptly empty drip pans when not in use. Thoroughly drain oil filters, engine parts, and similar components containing oils, fluids, and fuels before disposal. Do not use wet clean up practices if these practices would result in the discharge of pollutants to stormwater drainage systems. Consider paving the storage areas on Nyman and adding a bio-swale to better manage run-off from this area.
- *Vehicle/Equipment Cleaning Areas*: Minimize contamination of stormwater runoff from areas used for vehicle/equipment cleaning. Implement the following (or other equivalent measures), as practicable: performing all cleaning operations indoors; covering the cleaning operation; ensuring all washwater drains to a proper collection system (i.e., not the storm water drainage system); treating and/or recycling collected washwater, or other equivalent measures.
  Outdoor vehicle, equipment, and unpressurized, plain water vessel rinsing is acceptable. The following restrictions apply:
  - The intent of the rinsing is to remove debris/dirt and salt water only.
  - Use only potable water.
  - Conduct rinsing over a pervious surface such as gravel or grass, when feasible.
  - Do not use detergent or solvents.
  - Do not use a pressure washer.
  - If an oil sheen is observed, stop the operation.
- *Stormwater Management*: Consider installing berms/dikes around storage, maintenance, fueling, and cleaning areas; minimizing runoff of stormwater to the areas; using dry cleanup methods; and treating and/or recycling collected stormwater runoff.

- *Fueling Areas*: Minimize contamination of stormwater runoff from fueling areas. Cover the fueling area; use spill/overflow protection and cleanup equipment; minimizing stormwater run-on/runoff to the fueling area; using dry cleanup methods; and consider treating and/or recycling collected stormwater runoff.

4-2.3.3 BMP Q-1: Water Transportation Good Housekeeping Measures

BASE Kodiak will implement the following water transportation associated good housekeeping measures:

- *Pressure Washing*: Pressure washing of vessels is not allowed without prior approval from the BASE Kodiak Environmental Division (487-5320 X 2208). Rinsing of small vessels to remove salt water is allowed per BMP P-1. Additionally, fresh water engine flushing to remove residual salt water is allowed.
- *Blasting and Painting*:
    - Exterior blasting to remove old paint and/or preparation for new paint is not allowed without written approval and implementation guidelines from the BASE Kodiak Environmental Division. Ensure spent abrasives and paint chips are effectively managed to prevent discharge into receiving waters or the storm sewer systems. Construct containments for blasting and painting activities. Store virgin and used/waste blast media indoors. When possible/practical conduct painting operations indoors, ideally in a spray booth.
    - Outdoor spray painting operations shall be enclosed, covered, or contained to the maximum extent practical to prevent over spray from reaching receiving waters.
    - Do not conduct outdoor spray painting during windy conditions unless the work area is properly contained; or when wind conditions make containment impossible/impractical.
    - Have absorbent materials and other cleanup materials readily available for immediate cleanup of spills.
    - Mix paints, thinners, and solvents indoors when possible. If outdoor mixing is required, conduct it in a designated area with secondary containment.
- *Material Storage Areas*: Store and plainly label all containerized materials (e.g., fuels, paints, solvents, waste oil, antifreeze, batteries) in a protected/covered, secure location away from drains. Minimize the contamination of precipitation or surface runoff from the storage areas. Specify which materials are stored indoors, and consider containment or enclosure for those stored outdoors.
- *Engine Maintenance and Repair Areas:* Minimize the contamination of precipitation or surface runoff from all areas used for engine maintenance and repair. Consider the following (or their equivalents): performing all maintenance activities indoors, draining all parts of fluid prior to disposal, prohibiting the practice of hosing down the shop floor, using dry cleanup methods, and treating and/or recycling stormwater runoff collected from the maintenance area.
- *Material Handling Areas*: Minimize the contamination of precipitation or surface runoff from material handling operations and areas (e.g., fueling, paint and solvent mixing, disposal of process wastewater streams from vessels). Consider the following (or their equivalents): covering fueling areas, using spill and overflow protection, mixing paints and solvents in a designated area (preferably indoors or under a shed), and minimizing runoff of stormwater to material handling areas.

4-2.3.4 BMP S-1: Air Transportation Good Housekeeping Measures

BASE Kodiak will implement the following air transportation associated good housekeeping measures:

- *Aircraft, Ground Vehicle and Equipment Maintenance Areas:* Minimize the contamination of stormwater runoff from areas used for aircraft, ground vehicle and equipment maintenance (including the maintenance conducted on the terminal apron and in dedicated hangers). Drain all parts of fluids prior to disposal. When feasible, perform maintenance activities indoors. At BASE Kodiak, hanger drains discharge into the sanitary sewer and wet clean-up methods are acceptable.
- *Aircraft, Ground Vehicle and Equipment Cleaning Areas*: Clearly demarcate these areas on the ground using signage or other appropriate means. Wastewater from aircraft washing and equipment cleaning areas must discharge into the sanitary sewer.
- *Aircraft, Ground Vehicle and Equipment Storage Areas*: Store all aircraft, ground vehicles and equipment awaiting maintenance in designated areas only and minimize the contamination of stormwater runoff from these storage areas. Consider the following control measures, including any BMPs (or their equivalents): storing aircraft and ground vehicles indoors; using drip pans for the collection of fluid leaks; and perimeter drains, dikes or berms surrounding the storage areas.
- *Material Storage Areas*: Maintain the containers of stored materials (e.g., used oils, hydraulic fluids, spent solvents, and waste aircraft fuel) in good condition, to prevent or minimize contamination of stormwater. Also plainly label the containers (e.g., "Used Oil," "Contaminated Jet A," etc.). Minimize contamination of precipitation/runoff from these areas. Consider the following control measures (or their equivalents): storing materials indoors; storing waste materials in a centralized location; and installing berms/dikes around storage areas.
- *Airport Fuel System and Fueling Areas:* Minimize the discharge of fuel to the storm sewer/surface waters resulting from fuel servicing activities or other operations conducted in support of the airport fuel system. Consider the following control measures (or their equivalents): implementing spill and overflow practices (e.g., placing absorptive materials beneath aircraft during fueling operations); using only dry cleanup methods; and collecting stormwater runoff.
- *Source Reduction:* Minimize, and where feasible eliminate, the use of urea and glycol-based deicing chemicals, in order to reduce the aggregate amount of deicing chemicals used and/or lessen the environmental impact. Chemical options to replace ethylene glycol, propylene glycol and urea include: potassium acetate; magnesium acetate; calcium acetate; and anhydrous sodium acetate.
    - *Runway Deicing Operations*: Minimize contamination of stormwater runoff from runways as a result of deicing operations. Evaluate whether over-application of deicing chemicals occurs by analyzing application rates, and adjust as necessary, consistent with considerations of flight safety. Also, consider these control measure options (or their equivalents): metered application of chemicals; pre-wetting dry chemical constituents prior to application; installing a runway ice detection system; implementing anti-icing operations as a preventive measure against ice buildup.
    - *Aircraft Deicing Operations*: Minimize contamination of stormwater runoff from aircraft deicing operations. Determine whether excessive application of deicing chemicals occurs and adjust as necessary, consistent with considerations of flight safety. This evaluation should be carried out by the personnel most familiar with the particular aircraft and flight operations in question (versus an outside entity such as the airport authority). Consider using alternative deicing/anti-icing agents as well as containment measures for all applied chemicals. Also consider these control measure options (or their equivalents) for reducing deicing fluid use: forced-air deicing systems, computer-controlled fixed-gantry systems, infrared technology, hot water, varying glycol content to air temperature, enclosed-basket deicing trucks, mechanical methods, solar radiation, hangar storage, aircraft covers, and

thermal blankets. Also, consider using ice-detection systems and airport traffic flow strategies and departure slot allocation systems[2].

- *Management of Runoff*: Where deicing operations occur, implement a program to control or manage contaminated runoff to minimize the amount of pollutants being discharged from the site. Consider these control measure options (or their equivalents): a dedicated deicing facility with a runoff collection/ recovery system; using vacuum/collection trucks; storing contaminated stormwater/deicing fluids in tanks and releasing controlled amounts to the sanitary sewer system; collecting contaminated runoff in a wet pond for biochemical decomposition (be aware of attracting wildlife that may prove hazardous to flight operations); and directing runoff into bioswales or other infiltration measures. Also consider recovering deicing materials when these materials are applied during non-precipitation events (e.g., covering storm sewer inlets, using booms, installing absorptive interceptors in the drains, etc.) to prevent these materials from later becoming a source of stormwater contamination. Used deicing fluid should be recycled whenever possible.

4-2.3.5 BMP T-1: Treatment Works Control Measures

Routine transfers of sludge from the BASE Kodiak wastewater treatment plant will take place undercover/indoors.

[2] Note: BASE Kodiak conducts very little deicing since aircraft are staged inside heated hangers. If deicing were to occur, BASE Kodiak would use glycol.

Chapter 5 Monitoring, Evaluation, and Training

5-1 Overview

This chapter describes specific monitoring, evaluation, and training requirements associated with the stormwater pollution prevention efforts for BASE Kodiak.

5-2 Monitoring Activities

Evaluation of stormwater pollution prevention efforts consists of a schedule of inspections, examinations, and compliance evaluations designed to identify potential pollution problems and to verify that the SWPPP is functioning properly. Monitoring and evaluative activities include day-to-day efforts along with specific scheduled activities. The 2015 MSGP requires four types of regular inspections and monitoring activities as follows:

- Quarterly Visual Stormwater Monitoring – The 2015 MSGP requires conducting and documenting a "quarterly visual examination of a stormwater discharge associated with industrial activity from each outfall." These inspections are typically done at the same outfall location that benchmark monitoring (see below) is conducted.
- Stormwater Benchmark Monitoring – This effort is the collection and analysis of stormwater samples. The term "benchmark" refers to 2015 MSGP defined levels that the results are evaluated against. If results are above benchmark, additional control measures/BMPs may be warranted to further reduce concentrations.
- Annual Comprehensive Site Inspection – The 2015 MSGP requires conducting the inspection at least once a year. The inspection must include all areas where industrial materials or activities are exposed to stormwater, and areas where spills and leaks have occurred within the past 3 years.
- Routine Facility Inspections – The 2015 MSGP requires "you must have a qualified facility personnel inspect all areas of the facility where industrial material or activities are exposed to stormwater." For the most part, these inspections are required on a quarterly basis.

5-2.1 Visual Stormwater Monitoring

The 2015 MSGP requires collection of a stormwater sample from each sector-associated outfall on a quarterly basis and conducting a visual assessment. Visual assessment must be made:

- Of a sample in a clean, clear glass, or plastic container, and examined in a well-lit area;
- On samples collected within the first 30 minutes of an actual discharge from a storm event. If it is not possible to collect the sample within the first 30 minutes of discharge, the sample must be collected as soon as practicable and you must document why it was not possible to take samples within the first 30 minutes. In the case of snowmelt, samples must be taken during a period with a measurable discharge from your site; and
- For storm events, discharges that occur at least 72 hours (3 days) from the previous discharge. The 72-hour (3-day) storm interval does not apply if you document that less than a 72-hour (3-day) interval is representative for local storm events during the sampling period.
- At least one quarterly visual assessment must capture snowmelt discharge.
- Visually inspect the sample for the following water quality characteristics:
    - Color;
    - Odor;
    - Clarity;
    - Floating solids;

- Settled solids;
- Suspended solids;
- Foam;
- Oil sheen; and
- Other obvious indicators of stormwater pollution.

- No analytical tests are necessary for these samples, however samples can be collected at the same time as benchmark samples. Appendix B includes a form that to record visual monitoring.

Table 5-1 presents the required outfalls for quarterly visual monitoring.

Table 5-1 Quarterly Visual Stormwater Monitoring Outfalls

Sector	Outfall(s) To Be Examined (Figure #)
K- Treatment, Storage and Disposal Facility	IA-2 (3-3)
L - Landfill Areas	LF-1 (3-2), LF-2 (3-2)
P - Land Transportation and Warehousing	IA-3 (3-3)
S - Air Transportation Areas	IA-1 (3-3), IA-3 (3-3), IA-4 (3-3)
T - Treatment Works	IA-5 (3-3)
Q - Water Transportation	NP-1a (at catch basin C48) (3-4), NP-2 (3-4), NP-2a (3-4), NP-3 (3-4), NP-CC (3-4)[3]

When adverse weather conditions prevent the collection of samples during the quarter, take a substitute sample during the next qualifying storm event. If no visual assessment can be conducted during the quarter due to adverse weather conditions, document this in the SWPPP. Adverse conditions are those that are dangerous or create inaccessibility for personnel, such as local flooding, high winds, or electrical storms, or situations that otherwise make sampling impractical, such as drought or extended frozen conditions.

5-2.1.1 Visual Assessment Documentation and Corrective Action

Visual examination reports will be maintained on-site in the BASE Kodiak, Environmental Division Records Room. Visual assessment findings are not required to be sent to DEC. At a minimum, documentation of the visual assessment will include:

- Sample location(s);
- Sample collection date and time, and visual assessment date and time for each sample;
- Personnel collecting the sample and performing visual assessment, and their signatures;
- Nature of the discharge (i.e., runoff or snowmelt);
- Results of observations of the stormwater discharge;
- Probable sources of any observed stormwater contamination;
- If applicable, why it was not possible to take samples within the first 30 minutes of discharge.

Document the discovery of any unacceptable conditions (listed below) on the Visual Assessment Log (Attachment C) or a similar form. Complete documentation with within 24 hours of making such discovery. Subsequently, within 14 days of such discovery, document any corrective action deficiency, or if no corrective action is needed, the basis for that determination. Specific documentation required within 24 hours is detailed below:

[3] For the Cargo Pier, Fuel Pier, and Floating Dock, there is no distinct outfall pipe or location from which to collect a sample for visual monitoring. For these facilities, visual monitoring will not be conducted. Quarterly inspections will be conducted for these facilities – one of which annually must take place during a rainfall event. Note: the Floating dock is removed during the winter.

- Identification of the condition triggering the need for corrective action review;
- Description of the problem identified; and
- Date the problem was identified.

Within 14 days, document:

- Summary of corrective action taken or to be taken (or, if you determine that corrective action is not necessary, the basis for this determination);
- Notice of whether SWPPP modifications are required as a result of this discovery or corrective action;
- Date corrective action initiated; and
- Date corrective action completed or expected to be completed.

If you determine that changes are necessary following your review, any modifications to your control measures must be made before the next storm event if possible or as soon as practicable following that storm event.

When the quarterly outfall qualitative samples correspond with the visual inspection, perform the inspection while collecting the outfall benchmark samples.

5-2.2 Stormwater Benchmark Monitoring

The 2015 MSGP requires quarterly stormwater benchmark monitoring. After collection of the first four quarterly samples, if the average of the four monitoring values exceeds the benchmark value, then additional control measures may be required. The figures in Chapter 3 show the benchmark monitoring locations. For some outfalls, the visual monitoring location is not the same as the stormwater monitoring location. This was designed to achieve a more representative stormwater sample as some outfalls discharge much further downstream from the MSGP industrial area. Stormwater from other non-MSGP regulated areas would commingle with the MSGP regulated area possibly causing non-representative results. BASE Kodiak monitors the following sectors (see Table 5.2 for benchmark monitoring requirements under the 2015 MSGP):

K: Hazardous Waste Treatment, Storage, and Disposal. Stormwater discharges are monitored quarterly.

L: Landfills. Stormwater discharges are monitored quarterly.

P: Land Transportation and Warehousing. Benchmark monitoring is not required for outfalls discharging stormwater associated with land transportation and warehousing.

Q: Water Transportation. Benchmark monitoring is required for outfalls associated with Water Transportation. Since the Fuel Pier, Cargo Pier, and Floating Dock have no defined outfalls, no benchmark monitoring is conducted. Stormwater discharges are monitored quarterly.

S: Air Transportation. Airport facilities that use 100,000 gallons or more of glycol-based deicing/anti-icing chemicals and/or 100 tons or more of urea on an average annual basis must monitor their stormwater discharges from areas where deicing/anti-icing activities. Total BASE Kodiak and Kodiak Airport combined urea usage is close to 100 tons per year and so benchmark monitoring will continue to be conducted. Stormwater discharges are monitored quarterly.

Upon consultation with the U.S. Fish and Wildlife Service, per the 2000 MSGP, BASE Kodiak agreed to perform additional sampling at Outfall IA-1 to determine if petroleum products were present in the effluent. The additional sampling agreed upon with the U.S. Fish and Wildlife Service was for BTEX and diesel range organics (DRO). BASE Kodiak performed these analyses for 14 years and found no elevated

BTEX or DRO. BASE Kodiak will discontinue monitoring of these parameters with issuance of the 2015 MSGP unless requested to continue.

T: Treatment Works. Benchmark monitoring is not required for outfalls discharging stormwater associated with Treatment Works.

5-2.2.1 Benchmark Monitoring

Table 5-2 summarizes benchmark monitoring requirements. Monitoring can be conducted at a greater frequency than required or for a longer timeframe if desired or to compensate for monitoring periods where samples could not be obtained. The table below includes changes for discharge to saltwater, where appropriate.

Table 5-2 Benchmark Monitoring

Outfall (Sector)	Parameters	Sampling Frequency	Benchmark Cut-Off Concentration	Note
IA-1[4] (S)	BOD COD Ammonia pH	Four samples annually during the deicing season (Oct – Mar).	30 mg/L 120 mg/L 2.14 mg/L 6.5 – 8.5 s.u.	
IA-4 (S)	BOD COD Ammonia pH	Four samples annually during the deicing season (Oct – Mar).	30 mg/L 120 mg/L 2.14 mg/L 6.5 – 8.5 s.u.	
IA-3 (P, S)	BOD COD Ammonia pH	Four samples during the deicing season (Oct – Mar).	30 mg/L 120 mg/L 2.14 mg/L 6.5 – 8.5 s.u	
IA-2 (K)	Ammonia Total Magnesium COD Total Arsenic Total Cadmium Total Cyanide Total Lead Total Mercury Total Selenium Total Silver	Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly	2.14 mg/L 0.064 mg/L 120 mg/L 0.069 mg/L 0.04 mg/L 0.001 mg/L 0.21 mg/L 0.0018 mg/L 0.29 mg/L 0.0019 mg/L	
IA-5 (T)	No Benchmark Monitoring required.			
NP-1a (Q)	Total Aluminum Total Iron Total Lead Total Zinc	Quarterly Quarterly Quarterly Quarterly	0.75 mg/L 1.0 mg/L 0.21 mg/L 0.09 mg/L	
NP-2 (Q)	Total Aluminum Total Iron Total Lead Total Zinc	Quarterly Quarterly Quarterly Quarterly	0.75 mg/L 1.0 mg/L 0.21 mg/L 0.09 mg/L	

HD – Hardness Dependent, See Table 5-2a

[4] Sampling can take place directly from Outfall IA-1 or from the tarmac stormwater collection ditch(s). Note the sampling location on sampling documentation.

Table 5-2 Benchmark Monitoring

Outfall (Sector)	Parameters	Sampling Frequency	Benchmark Cut-Off Concentration	Note
NP-2a (Q)[6]	Total Aluminum Total Iron Total Lead Total Zinc	Quarterly Quarterly Quarterly Quarterly	0.75 mg/L 1.0 mg/L 0.21 mg/L 0.09 mg/L	
NP-3 (Q)	Total Aluminum Total Iron Total Lead Total Zinc	Quarterly Quarterly Quarterly Quarterly	0.75 mg/L 1.0 mg/L 0.21 mg/L 0.09 mg/L	
NP-CC (Q)	Total Aluminum Total Iron Total Lead Total Zinc	Quarterly Quarterly Quarterly Quarterly	0.75 mg/L 1.0 mg/L 0.21 mg/L 0.09 mg/L	
LF-1 (L)	TSS Total Iron	Quarterly Quarterly	100 mg/l 1.0 mg/L	
LF-2 (L)	TSS Total Iron	Quarterly	100 mg/l 1.0 mg/L	
Red Lake	Total Iron Total Arsenic Total Manganese	Once/year[5] Once/year Once/year	NA NA NA	Impairment Sampling
Buskin River	Hardness	Once during the first quarter sampling effort	NA	Ambient sample of Buskin River. Some metal benchmarks are hardness dependent. Using the hardness result verify benchmark values herein listed are correct.
Buskin River Tributary	Hardness	Once during the first quarter sampling effort	NA	see note above

[5] 2015 MSGP (7.2.1.5) states: If the average concentration of a pollutant exceeds a benchmark value, and the permittee has determined that its presence is attributable solely to the presence of that pollutant in the natural background, the permittee is not required to perform corrective action or additional benchmark monitoring… However, certain conditions must be met and DEC must be notified on the final quarterly benchmark monitoring report.

[6] Sampling stormwater directly from the piers was not deemed feasible and is therefore not specified.

Table 5-2a Water Hardness Range

Water Hardness Range	Cadmium mg/L	Lead mg/L	Silver mg/L	Zinc mg/L
0 - <25 mg/L	0.0005	0.014	0.0007	0.04
25 - <50 mg/L	0.0008	0.023	0.0007	0.05
50 - <75 mg/L	0.0013	0.045	0.0017	0.08
75 - <100 mg/L	0.0018	0.069	0.0030	0.11
100 - <125 mg/L	0.0023	0.095	0.0046	0.13
125 - <150 mg/L	0.0029	0.122	0.0065	0.16
150 - <175 mg/L	0.0034	0.151	0.0087	0.18
175 - <200 mg/L	0.0039	0.182	0.0112	0.20
200 - <225 mg/L	0.0045	0.213	0.0138	0.23
225 - <250 mg/L	0.0050	0.246	0.0158	0.25
250+ mg/L	0.0053	0.262	0.0183	0.26

Collect a grab sample within the first 30 minutes from a discharge resulting from a measurable storm event or as soon as practicable after the first 30 minutes. If the 30-minute period is exceeded, document it in the SWPPP explaining why it was not possible to take a sample within the first 30 minutes. A measurable storm event is one that results in a discharge from the outfall. The storm event is proceeded by at least 72 hours of dry weather (or 72 hours since the last measurable storm event). In the case of snowmelt, the monitoring must proceed at a time when a measurable discharge occurs. For each monitoring event, except snowmelt monitoring, identify the date and duration (in hours) of the rainfall event, rainfall total (in inches) for that rainfall event, and time (in days) since the previous measurable storm event. For snowmelt monitoring, you must identify the date of the sampling event.

When adverse weather conditions prevent the collection of samples, take a substitute sample during the next qualifying storm event.

Collect one sample from each outfall identified in Table 5-2 on a quarterly basis (monitoring period). The monitoring periods are: January 1 – March 31
April 1 – June 30
July 1 – September 30
October 1 – December 31

5-2.2.2 Reporting Benchmark Monitoring Data to DEC

Submit all benchmark monitoring data to DEC using the 2015 MSGP discharge monitoring report (MDMR) form no later than 30 days after receiving the complete laboratory results for all monitored outfalls for the reporting period. If no discharge occurs during the benchmark monitoring period, BASE Kodiak must still report no discharge for this monitoring period.

5-2.2.3 Benchmark Evaluation

After the first four quarters of benchmark monitoring, take an average of the results. If the average is at or below the benchmark, monitoring for this parameter can cease for the duration of the permit. If the average is above the benchmark, investigate causes and recommend corrective actions. Monitoring must continue until four quarters have an average at or below the benchmark.

5-3 Annual Comprehensive Site Inspections

The BASE Kodiak Stormwater Program Manager and/or appropriate Stormwater Pollution Prevention Team representatives will conduct the annual site compliance inspections. If an outside entity conducts the inspection, it must be conducted by qualified personnel and at least one member of the stormwater pollution prevention team must participate.

The comprehensive site inspection must be conducted annually and be completed by December 31. The report must be submitted to DEC with the annual report by February 15 of the year following the reporting year.

The inspection must cover all areas of the facility affected by the MSGP (sector-specific facilities/areas). Specifically, the inspection will encompass all facilities/areas in Table 3-1. Additionally the Stormwater Pollution Prevention Team may address any issues identified during routine facility inspections, concerns expressed in past inspection reports, concerns based on benchmark monitoring data, and construction site management. SWPPP BMPs are discussed in Chapter 4. Inspection forms that may be used to complete the evaluation are included in Attachment B.

Inspections will examine the following:

- Industrial materials, residue, or trash that may have or could come into contact with stormwater;
- Leaks or spills from industrial equipment, drums, tanks, and other containers;
- Offsite tracking of industrial or waste materials, or sediment where vehicles enter or exit the site;
- Tracking or blowing of raw, final, or waste materials from areas of no exposure to exposed areas; and
- Control measures needing replacement, maintenance, or repair.

5-3.1 Comprehensive Site Inspection Documentation

BASE Kodiak will develop a Site Inspection report using the Annual Reporting Form included as Appendix I of the 2015 MSGP (Attachment A). The inspection documentation will include:

- The date of the inspection;
- The name(s) and title(s) of the personnel making the inspection;
- Inspection findings for at least those facilities/areas identified in Tables 3-1 and 5-3;
- All observations relating to the implementation of control measures including:
    - previously unidentified discharges from the site,
    - previously unidentified pollutants in existing discharges,
    - evidence of, or the potential for, pollutants entering the drainage system,
    - evidence of pollutants discharging to receiving waters at all facility outfall(s), and the condition of and around the outfall, including flow dissipation measures to prevent scouring, and
    - additional control measures needed to address any conditions requiring corrective action identified during the inspection.
- Any required revisions to the SWPPP resulting from the inspection;
- Any incidents of noncompliance observed or a certification stating the facility is in compliance with the MSGP (if there is no noncompliance); and
- A statement, signed and certified in accordance with 2015 MSGP Appendix B, Subsection 11[7].

The annual Comprehensive Site Inspection may include, at the discretion of the inspector(s), additional documentation and/or guidance documentation to either augment the Annual Reporting Form or as separate documentation to address specific concerns.

As noted the 2015 MSGP has sector specific requirements for the Comprehensive Site Inspection. These are outlined in Table 5-3.

Table 5-3 Sector-Specific Annual Comprehensive Site Inspection Requirements

Sector	Industrial Activities Covered	Site Inspection Requirement
K	Hazardous Waste Treatment, Storage or Disposal	No sector-specific requirements for the annual inspection.
L	Landfills	No sector-specific requirement. Also, see Table 5-4.
P	Land Transportation and Warehousing	No sector-specific requirement. Also, see Table 5-4.
Q	Water Transportation	No sector-specific requirement. Also, see Table 5-4.
S	Air Transportation	Using only qualified personnel, conduct your annual site inspection during periods of actual deicing operations, if possible. If not practicable during active deicing because of weather, conduct the inspection during the season when deicing operations occur and the materials and equipment for deicing are in place.
T	Domestic Treatment Works	Include the following areas in all inspections: access roads grit, screenings, and other solids handling, storage, or disposal areas, sludge drying beds; dried sludge piles; compost piles; and septage or hauled waste receiving station.

5-3.2 Comprehensive Site Inspection Corrective Actions

Document the discovery of any unacceptable conditions (listed below) on the Annual Reporting Form within 24 hours of making such discovery. Subsequently, within 14 days of such discovery, document any corrective action deficiency, or if no corrective action is needed, the basis for that determination. Specific documentation required within 24 hours is detailed below:

- Identification of the condition triggering the need for corrective action review;
- Description of the problem identified; and
- Date the problem was identified.

Within 14 days, document the following in the Annual Reporting Form:

- Summary of corrective action taken or to be taken (or, if you determine that corrective action is not necessary, the basis for this determination);
- Notice of whether SWPPP modifications are required as a result of this discovery or corrective action;
- Date corrective action initiated; and
- Date corrective action completed or expected to be completed.

If you determine that changes are necessary following your review, any modifications to your control measures must be made before the next storm event if possible, or as soon as practicable following that storm event.

5-3.3 Conditions Requiring Review and Revision to Eliminate Problem

If any of the following conditions occur, review and revise the selection, design, installation, and implementation of control measures (BMPs) to ensure that the condition is eliminated and will not be repeated in the future:

- An unauthorized release or discharge (e.g., spill, leak, or discharge of non-stormwater not authorized by this or another NPDES permit);
- You become aware, or DEC determines, that your control measures are not stringent enough for the discharge to meet applicable water quality standards;
- An inspection or evaluation of your facility by an DEC official, or local, state, or tribal entity, determines that modifications to the control measures are necessary to meet the non-numeric effluent limits in this permit; or
- Control measures are not being properly operated and maintained.

5-3.4 Conditions Requiring Review to Determine if Modifications Are Necessary

If any of the following conditions occur, review the selection, design, installation, and implementation of your control measures to determine if modifications are necessary to meet the effluent limits in this permit:

- Construction or a change in design, operation, or maintenance significantly changes the nature of pollutants discharged in stormwater, or significantly increases the quantity of pollutants discharged; or
- The average of four quarterly sampling results exceeds an applicable benchmark. If less than four benchmark samples have been taken, but the results are such that an exceedance of the four quarter average is mathematically certain (i.e., if the sum of quarterly sample results to date is more than four times the benchmark level) this is considered a benchmark exceedance, triggering this review.

5-4 Routine Facility Inspections

The MSGP requires conducting routine inspections where industrial materials or activities are exposed to stormwater (Table 3-1) and of all stormwater control measures (Table 4-1). Table 3-1 summarizes the inspection frequency for each facility/area regulated under the MSGP at BASE Kodiak. At least once each calendar year, the routine facility inspection must be conducted during a period when a stormwater discharge is occurring. Table 5-4 notes the MSGP sector-specific routine facility inspection requirements.

Table 5-4 Sector-Specific Routine Inspection Requirement

Sector	Industrial Activities Covered	Sector-Specific Requirement
K	Hazardous Waste Treatment, Storage Or Disposal Facilities	No sector-specific inspection requirement
L	Landfills	Inspect inactive landfills at least quarterly. Qualified personnel must inspect landfill stabilization and structural erosion control measures, leachate collection, and treatment systems.
P	Land Transportation And Warehouse	Inspect all the following areas/activities: storage areas for vehicles/equipment awaiting maintenance, fueling areas, indoor and outdoor vehicle/equipment maintenance areas, material storage areas, vehicle/equipment cleaning areas and loading/unloading areas and any petroleum bulk fuel storage areas. Quarterly visual assessment of the bulk fuel storage areas should focus on identifying any potential leaks in tanks, pipelines, valves, etc., and implementing temporary spill containment measures until permanent corrective actions can be made.

Table 5-4 Sector-Specific Routine Inspection Requirement

Sector	Industrial Activities Covered	Sector-Specific Requirement
Q	Water Transportation	Include the following in all routine facility inspections: pressure washing area; blasting, sanding, and painting areas; material storage areas; engine maintenance and repair areas; material handling areas; and general yard area.
S	Air Transportation	Conduct routine facility inspections at least monthly during the deicing season - October through March. Using qualified personnel, conduct the annual site inspection during periods of actual deicing operations, if possible. If not possible during actual de-icing, conduct during the de-icing season when operations occur and materials and equipment for de-icing are in place.
T	Domestic Treatment Works	Include the following areas in all inspections: access roads; grit, screenings, and other solids handling, storage, or disposal areas; sludge drying beds; dried sludge piles; compost piles; and septage or hauled waste receiving station.

5-4.1 Routine Facility Inspection Documentation

Each routine facility inspection must be documented to include, at least:

- The inspection date and time;
- The name(s) and signature(s) of the inspector(s);
- Weather information and a description of any discharges occurring at the time of the inspection;
- Any previously unidentified discharges of pollutants from the site;
- Any control measures needing maintenance or repairs;
- Any failed control measures that need replacement;
- Any incidents of noncompliance observed; and
- Any additional control measures needed to comply with the permit requirements.

Upon completion of the inspection in each area, the BASE Kodiak Stormwater Program manager files copies of the completed inspection forms with the SWPPP in the BASE Kodiak Environmental Division Records Room.

5-5 Training Guidance

This section provides general guidance to help BASE Kodiak in developing/refining Stormwater Pollution Prevention training. It is intended for in-person formal training but could be used to help with other less formal training such as e-mails, posters, pamphlets, or articles.

Direct training to relay the following three main points:

1. Background. Provide the very basics of stormwater runoff. This aspect of the training should be brief. Most personnel will have some existing knowledge in this area. The intent is to develop that knowledge to the point where it is in a coherent framework setting the stage for follow-on training. Strive to answer questions such as:
    - What is stormwater?
    - What is considered to be a pollutant and what types of pollutants can stormwater runoff pickup? Explain how pollution can be entrained in stormwater. Make it specific to BASE Kodiak operations.
    - What are the potential impacts of those potential pollutants?

- How does stormwater runoff from BASE Kodiak get to surface waters and what if any treatment is provided on the way? Many people do not realize that generally little if any treatment is provided.

2. Regulation. This aspect of the training should be brief. The main intent is to impart that there is an existing regulatory framework that BASE Kodiak is obligated to comply. Provide the following points as a minimum:

    - BASE Kodiak has a Clean Water Act permit authorizing discharge of stormwater.
    - The permit requires BASE Kodiak to:
        - Identify potential sources of pollution that may reasonably be expected to affect the quality of stormwater discharges.
        - Describe and ensure the implementation of practices to reduce pollutants in stormwater.
        - Regular inspections are required; identify who will conduct the inspections.
        - BASE Kodiak is required to collect and analyze stormwater samples. If results are too high, additional restrictions may need to be implemented.

3. What is Required. Emphasize that the SWPPP requires BASE Kodiak to develop and implement BMPs to minimize stormwater pollution. Explain what BMP means. Relay the following:

    - Go through the applicable BMPs in Chapter 4. Be prepared to explain each BMP to provide answers on how each BMP specifically applies for each particular type of work. Be prepared for and volunteer to provide follow-up. For example, someone may be unsure if a particular work practice is acceptable or not. Volunteer to stop by and witness the practice to help with a determination.
    - Tailor the BMP discussion to the audience. Some BMPs only apply to a limited number of personnel and can be handled separately.
    - Try to create a casual training atmosphere where employees can bring up situations/operations that may contribute to stormwater pollution and openly discuss them. Volunteer to stop by and witness the practice and work with the organization to develop a BMP if applicable.
    - Training can be reinforced through the use of posters, pamphlets, e-mails, internal newsletters, intranet, videos, and attendance at other environmental/safety related meetings. Since people absorb information differently depending on the format used, it is most effective to present the information in a number of formats to accommodate these differences.

Acronyms & Definitions

The following tables provide a listing of acronyms used in this document and definitions of commonly used stormwater terms.

Table B-1 Acronyms

Acronym	Term
DEC	Alaska Department of Environmental Conservation
AKDOT	Alaska Department of Transportation
AIRSTA	Air Station
As	Arsenic
BETX	Benzene, Ethylbenzene, Toluene, Xylene
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BOSS	Base Operating Support Services Contractor
Cd	Cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGES	Coast Guard Exchange System
CGIS	Coast Guard Investigative Services
CMC	Command Master Chief
CSA	Command Staff Advisor
COD	Chemical Oxygen Demand
COMMSTA	Communications Station
Cr	Chromium
CSA	Command Staff Advisor
CWA	Clean Water Act
D17	District 17
DECA or DeCA	Defense Commissary Agency
DMR	Discharge Monitoring Report
DOT	Department of Transportation
DRO	Diesel Residual Organics
EPA	Environmental Protection Agency
ESU	Electronic Systems Support Unit
FD&CC or FDCC	Facilities Design and Construction Center
FR	Federal Register
HQ	Headquarters
ISC	Integrated Support Command
mgd	million gallons per day
µg/L	micrograms per liter
LORSTA	Loran Station
MCRC/F	Military Civil Rights Counselor/Facilitator
MLCPAC	Maintenance and Logistics Command Pacific
MSD	Marine Safety Detachment
MSDS	Material Safety Data Sheet
MSGP	Multi-Sector General Permit
MSO	Marine Safety Office
Ni	Nickel
NOI	Notice of Intent

USCG BASE Kodiak Stormwater Pollution Prevention Plan
Attachment B: Acronyms & Definitions

Table B-1 Acronyms

Acronym	Term
NOT	Notice of Termination
NPDES	National Pollution Discharge Elimination System
PACAREA	Pacific Area
Pb	Lead
OGA	Other Government Agency
QPC	Quality Performance Consultant
SEH	Safety and Environmental Health
SIC	Standard Industrial Classification
SVOA	Semi-Volatile Organic Compound
SWP2 Team	Stormwater Pollution Prevention Team
SWPPP	Stormwater Pollution Prevention Plan
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbon
USN	United States Navy
USPS	United States Postal Service
USCGC	United Stated Coast Guard Cutter
VOA	Volatile Organic Compound
WHEC	High Endurance Cutter
WMEC	Medium Endurance Cutter
Zn	Zinc

Table B-2 Definitions

Term	Definition
Aliquot	A discrete sample used for analysis.
Best Management Practices (BMPs)	Schedule of activities, prohibitions of practices, maintenance procedures, and other management practices used to prevent or reduce the pollution of waters. This includes treatment requirements, recycling, reduction, reuse, operating procedures, and practices to control facility site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
Biochemical Oxygen Demand (BOD)	The quantity of oxygen consumed during the biochemical oxidation of matter over a specified period of time, usually 5 days.
Clean Water Act (CWA)	The Clean Water Act is an act passed by the U.S. Congress to control water pollution. It was formerly referred to as the Federal Water Pollution Control Act of 1972 or Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500), 33 U.S.C. 1251 et. seq., as amended by: Public Law 96-483; Public Law 97-117; Public Laws 95-217, 97-117, 97-440, and 100-04.
Discharge Monitoring Report (DMR)	The form used (including any subsequent additions, revisions, or modifications) to report self-monitoring results by NPDES permittees. DMRs must be used by approved States as well as by EPA.
Discrete Sample	A single sample of wastewater taken at neither set time nor flow. Also known as a grab sample or single sample.
Effluent	Any discharge flowing from a conveyance.

Table B-2 Definitions

Term	Definition
Grab Sample	A discrete sample that is taken from a waste stream on a one-time basis with no regard for flow or time; an instantaneous sample that is analyzed separately.
Illicit Discharge	Any discharge to a municipal separate storm sewer that is not composed entirely of stormwater except discharges pursuant to an NPDES permit and discharges from fire fighting activities.
Multi-Sector General Permit	A general, nation-wide NPDES permit developed by the EPA to provide coverage for industrial activities at facilities. DEC now has jurisdiction over the permit.
National Pollutant Discharge Elimination System (NPDES)	The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 318, 402, and 405 of CWA
Outfall	Point source where an effluent is discharged into receiving waters.
Point Source	Any discernible, confined, and discrete conveyance from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff (see 40 CFR 122.3).
pH	A measure of the acidity of water or wastewater. A pH of 7 is neutral. A pH less than 7 is acidic, and a pH greater than 7 is basic.
Pollutant	Dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.
Stormwater Pollution Prevention Plan (SWPPP)	A document consisting of a series of steps and activities to, first, identify sources of pollution or contamination on your site, and, second, select and carry out actions to prevent or control the pollution of stormwater discharges.
Process Wastewater	Any water which, during manufacturing or processing, comes into direct contact with, or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.
Standard Industrial Classification (SIC) Code	A code number system used to identify various types of industries. The code numbers are published by the Superintendent of Documents, U.S. Government Printing Office. A particular industry may have more than one SIC code if it conducts several types of commercial or manufacturing activities on-site.
Stormwater	Stormwater runoff, snowmelt runoff, and surface runoff, and drainage
Stormwater Discharge Associated with Industrial Activity	Discharge from any conveyance which is used for collecting and conveying stormwater which is directly related to manufacturing processing or raw materials storage areas at an industrial plant
Stormwater Pollution Prevention Plan (SWPPP)	A document consisting of a series of steps and activities to, first, identify sources of pollution or contamination on your site, and, second, select and carry out actions to prevent or control the pollution of stormwater discharges.

Table B-2 Definitions

Term	Definition
U.S. Waters	All waters that are used, or may be used, in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide: all interstate waters, including interstate "wetlands;" all other waters, including intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use degradation, or destruction of which would affect or could affect commerce.

STORM WATER SAMPLING LOG

Ending Date Most Recent Storm Event: _____
DD/MM/YY

Precipitation Total – Most Recent Storm Event (inches): _____
Precipitation Total – Storm Event Sampled (inches): _____

Sample Location/Outfall: _____

Sample Date: _____
DD/MM/YY

Sample Time: _____

Sample ID: _____
(Sample Location Name – Storm Water Sample-Sector ID-Sample Number – Fiscal Yr-Fiscal YR QTR)

Weather:

Sky Conditions: _____

_____

Temperature (Degrees Fahrenheit): _____

Wind: Direction/Speed (in miles/hour): _____

Tides:

High Tide (Time/Height): _____

Low Tide (Time/Height): _____

Flow:

Outfall Flow (estimate): _____
(gallon/min = 2.228x10-3 cubic feet/sec)

Conditions at the Outfall:

Color/Odor/Clarity: _____

Floating/Suspended/Settled Solids: _____

Foam/Oily Sheen: _____

Other Indicators of Pollution: _____

Sample Containers:

Number/Type: _____

Analyses Required: _____

BASE Kodiak Air Station – Stormwater Routine Facility Inspection Form

Inspector:

Inspection Date:

Signature:

Building #	Building Name	Inspection Frequency	Sector #^	Control Measures (Based on your inspection indicate adherence to each Control Measure below. Discuss any observed problems/issue in the Note section.)										
				1: Minimize Exposure	2: Good Housekeeping	3: Maintenance	4: Spill Prevention and Response Procedures	5: Erosion and Sediment Control	6: Management of Runoff	7: Salt Storage	8: Employee Training	9: Non-Stormwater Discharges	P-1: Vehicle and Equipment Good Housekeeping Measures	S-1: Air Transportation Good Housekeeping
14	Hangar 1	Quarterly	S.1											
20	Hangar 2	Quarterly	S.2											
15	Hangar 3	Quarterly	S.3											
"A" "B"	Apron/Taxiway	**Monthly***	S.4											
N66	GSE and Fuel Trucks	Quarterly	S.5											
N94	GSE Building	Quarterly	S.6											

BASE Kodiak Base Operating Support Services (BOSS) Contractor – Stormwater Routine Facility Inspection Form

Inspector:

Inspection Date:

Signature:

Building #	Building Name	Inspection Frequency	Sector:#^	Control Measures (Based on your inspection indicate adherence to each Control Measure below. Discuss any observed problems/issue in the Note section.)												
				1: Minimize Exposure	2: Good Housekeeping	3: Maintenance	4: Spill Prevention and Response Procedures	5: Erosion and Sediment Control	6: Management of Runoff	7: Salt Storage	8: Employee Training	9: Non-Stormwater Discharges	P-1: Vehicle and Equipment Good Housekeeping Measures	Q-1: Water Transportation Good Housekeeping	S-1: Air Transportation Good Housekeeping	T-1: Treatment Works
19	BOSS Maintenance Shop	Q	P.1													
N19/N20/N21/N22	JP5 Fill Stand, “day” tanks, and pump house.	Q	NA													
N1/N1A	Garage	Q	P.4													
26	Stores and Offices	Q	P.5													
S40	Fuel Pier	Q	Q.5													
A512	BOSS Fuels	Q	Q.6													
N90	Sand and Urea Storage	Q/M*	S.7													
N2	Wastewater Treatment Plant	Q	T.1													
	NOTES															
M – Monthly Q – Quarterly *Conduct Monthly Inspections during the deicing season (October – March)																
CORRECTIVE ACTION/FOLLOW-UP																

BASE Kodiak Environmental – Stormwater Routine Facility Inspection Form

Inspector:

Inspection Date:

Signature:

Building	Building Name	Inspection Frequency	Sector. #[A]	Control Measures (Based on your inspection indicate adherence to each Control Measure below. Discuss any observed problems/issue in the Note section.)											
				1: Minimize Exposure	2: Good Housekeeping	3: Maintenance	4: Spill Prevention and Response Procedures	5: Erosion and Sediment Control	6: Management of Runoff	7: Salt Storage	8: Employee Training	9: Non-Stormwater Discharges	K-1: Landfill Preventive Maintenance	P-1: Vehicle and Equipment Good Housekeeping Measures	Q-1: Water Transportation Good Housekeeping
N48	Hazardous Waste Storage Building & LOWS	Quarterly	K.1										NA	NA	NA
LF-1	Coast Guard Landfill	Quarterly	L.1							NA				NA	NA
LF-2	Navy Landfill	Quarterly	L.2							NA				NA	NA
27	Cold and Dry Storage Warehouse	Quarterly	P.6										NA		NA
N57	Floating Dock	Quarterly	Q.1										NA		
N551	MWR Crab Cooker	Quarterly	Q.1										NA		
8	MWR Boathouse	Quarterly	Q.2										NA	NA	
614	Auto Hobby Shop/ Port Ops	Quarterly	Q.3										NA		
613	Cargo Pier	Quarterly	Q.4										NA		
N73	Cutter Storage	Quarterly	Q.7										NA	NA	
N47	Vehicle Storage	Quarterly	Q.8										NA		

BASE Kodiak Environmental – Stormwater Routine Facility Inspection Form

Inspector:

Inspection Date:

Signature:

Building	Building Name	Inspection Frequency	Sector. #[A]	Control Measures (Based on your inspection indicate adherence to each Control Measure below. Discuss any observed problems/issue in the Note section.)											
				1: Minimize Exposure	2: Good Housekeeping	3: Maintenance	4: Spill Prevention and Response Procedures	5: Erosion and Sediment Control	6: Management of Runoff	7: Salt Storage	8: Employee Training	9: Non-Stormwater Discharges	K-1: Landfill Preventive Maintenance	P-1: Vehicle and Equipment Good Housekeeping Measures	Q-1: Water Transportation Good Housekeeping
-	Construction Sites and/or Areas of Soil Erosion	Quarterly	NA										NA		NA

NOTES	

CORRECTIVE ACTION/FOLLOW-UP	

Form A-1: Annual Compliance Site Inspection Documentation for MSGP 2015

Facility Name: USCG Base, Kodiak Date:

Inspector Names:

Note: The numbers indicated below the column titles refer to numbers in the MSGP 2008, Appendix I Annual Reporting Form parts B and C. General Inspection Findings and Area Specific Findings.

Bldg, Area, or Outfall #	Sector	Brief Description	Condition Around Outfall or Building	Previously Unidentified Discharges of Pollutants from Stormwater or Non-stormwater.	Evidence or Potential for Pollutants entering the drainage System or receiving waters.	Control Measures in need of Maintenance or Repair.	Control measures failed and need replacement.	Additional Control Measures needed.	SWPPP Revision Required?	Incidents of non-compliance with Control Measures	Describe the Nature of any problems
14	S	Hangar 1									
20	S	Hangar 2									
15	S	Hangar 3									
“A” “B”	S	Apron/Taxiway									
N66	S	GSE and Fuel Trucks									
N94	S	GSE Building									
19	P	BOSS Maintenance Shop									
N19/N20/N21/N22	S	JP5 Fill Stand, “day” tanks, and pump house.									
N1/N1A	P	Garage									
26	P	Stores and Offices									
S40	Q	Fuel Pier									
A512	Q	BOSS Fuels									
N90	S	Sand and Urea Storage									
	T	Wastewater Treatment Plant									
N48	K	Hazardous Waste Storage Building & LOWS									
LF-1	L	Coast Guard Landfill									
LF-2	L	Navy Landfill									

Bldg, Area, or Outfall #	Sector	Brief Description	Condition Around Outfall or Building	Previously Unidentified Discharges of Pollutants from Stormwater or Non-stormwater.	Evidence or Potential for Pollutants entering the drainage System or receiving waters.	Control Measures in need of Maintenance or Repair.	Control measures failed and need replacement.	Additional Control Measures needed.	SWPPP Revision Required?	Incidents of non-compliance with Control Measures	Describe the Nature of any problems
27	P	Cold and Dry Storage Warehouse									
N57	Q	Floating Dock									
N551	Q	MWR Crab Cooker									
8	Q	MWR Boathouse									
614	Q	Auto Hobby Shop/ Port Ops									.
613	Q	Cargo Pier									
N73	Q	Cutter Storage									
N47	Q	Vehicle Storage									
NA	NA	Construction Sites and/or Areas of Soil Erosion									.
Outfalls											
IA-1	NA	Aircraft Parking Apron									
IA-2	NA	Jewel Beach South									
IA-3	NA	Jewel Beach									
IA-4	NA	Aircraft Parking Apron West									
IA-5	NA	Wastewater Treatment Plant									
LF-1	NA	Coast Guard Landfill									
LF-2	NA	Navy Landfill									
NP-1A	NA	Boat House									
NP-2	NA	Boat House/LOWs									
NP-2A	NA	Discharge from Stormcepter									
NP-3	NA	Auto Hobby and other near pier									
NP-CC	NA	Crab Cooker									

Table D: Benchmark Monitoring Data

Parameter	Sample Date	Location	Outfall	Result	Units	Exceeds Benchmark
Ammonia	3/1/2010	Air Station - Womens Bay ATS	IA-1	1.11	mg/L	
Biochemical Oxygen Demand	3/1/2010	Air Station - Womens Bay ATS	IA-1	BQL		
COD	3/1/2010	Air Station - Womens Bay ATS	IA-1	BQL		
pH	3/1/2010	Air Station - Womens Bay ATS	IA-1	6.77	mg/L	
Ammonia	3/16/2010	Air Station - Womens Bay ATS	IA-1	1	mg/L	
Biochemical Oxygen Demand	3/16/2010	Air Station - Womens Bay ATS	IA-1	ND		
COD	3/16/2010	Air Station - Womens Bay ATS	IA-1	97.2	mg/L	
pH	3/16/2010	Air Station - Womens Bay ATS	IA-1	7.03	mg/L	
Ammonia	3/17/2010	Air Station - Womens Bay ATS	IA-1	0.817	mg/L	
Biochemical Oxygen Demand	3/17/2010	Air Station - Womens Bay ATS	IA-1	BQL		
COD	3/17/2010	Air Station - Womens Bay ATS	IA-1	99.3	mg/L	
pH	3/17/2010	Air Station - Womens Bay ATS	IA-1	6.77	mg/L	
Ammonia	3/18/2010	Air Station - Womens Bay ATS	IA-1	0.67	mg/L	
Biochemical Oxygen Demand	3/18/2010	Air Station - Womens Bay ATS	IA-1	BQL		
COD	3/18/2010	Air Station - Womens Bay ATS	IA-1	145	mg/L	
pH	3/18/2010	Air Station - Womens Bay ATS	IA-1	6.59	mg/L	
Iron	5/17/2010	Air Station - Womens Bay ATS	IA-1	1.67	mg/L	X
TSS	5/17/2010	Air Station - Womens Bay ATS	IA-1	5.93	mg/L	
Lead	3/1/2010	Jewel Beach TSDF Sector	IA-2	.013	mg/L	
Ammonia	3/1/2010	Jewel Beach TSDF Sector	IA-2	0.112	mg/L	
Arsenic	3/1/2010	Jewel Beach TSDF Sector	IA-2	.007	mg/L	
Cadmium	3/1/2010	Jewel Beach TSDF Sector	IA-2	.0001	mg/L	
Cyanide	3/1/2010	Jewel Beach TSDF Sector	IA-2	.0022	mg/L	
Magnesium	3/1/2010	Jewel Beach TSDF Sector	IA-2	5.2	mg/L	X
Mercury	3/1/2010	Jewel Beach TSDF Sector	IA-2	ND		
Selenium	3/1/2010	Jewel Beach TSDF Sector	IA-2	ND		
Silver	3/1/2010	Jewel Beach TSDF Sector	IA-2	ND		
COD	3/1/2010	Jewel Beach TSDF Sector	IA-2	147	mg/L	
Lead	5/17/2010	Jewel Beach TSDF Sector	IA-2	.0052	mg/L	
Ammonia	5/17/2010	Jewel Beach TSDF Sector	IA-2	.041j	mg/L	
Arsenic	5/17/2010	Jewel Beach TSDF Sector	IA-2	.0031j	mg/L	
Cadmium	5/17/2010	Jewel Beach TSDF Sector	IA-2	ND		
Cyanide	5/17/2010	Jewel Beach TSDF Sector	IA-2	ND		
Magnesium	5/17/2010	Jewel Beach TSDF Sector	IA-2	2.08	mg/L	
Mercury	5/17/2010	Jewel Beach TSDF Sector	IA-2	ND		
Selenium	5/17/2010	Jewel Beach TSDF Sector	IA-2	ND		
Silver	5/17/2010	Jewel Beach TSDF Sector	IA-2	ND		
COD	5/17/2010	Jewel Beach TSDF Sector	IA-2	43.1	mg/L	
Ammonia	3/1/2010	Air Station - Jewell Beach ATS	IA-3	.0321	mg/L	
BOD	3/1/2010	Air Station - Jewell Beach ATS	IA-3	2.72	mg/L	
COD	3/1/2010	Air Station - Jewell Beach ATS	IA-3	140	mg/L	X
pH	3/1/2010	Air Station - Jewell Beach ATS	IA-3	7.02	mg/L	
Ammonia	3/16/2010	Air Station - Jewell Beach ATS	IA-3	1.43	mg/L	
BOD	3/16/2010	Air Station - Jewell Beach ATS	IA-3	3.37	mg/L	
COD	3/16/2010	Air Station - Jewell Beach ATS	IA-3	56	mg/L	
pH	3/16/2010	Air Station - Jewell Beach ATS	IA-3	7.43	mg/L	
Ammonia	3.16/2010	Air Station - Jewell Beach ATS	IA-3	0.733	mg/L	
BOD	3/16/2010	Air Station - Jewell Beach ATS	IA-3	ND		
COD	3/16/2010	Air Station - Jewell Beach ATS	IA-3	177	mg/L	X
pH	3/16/2010	Air Station - Jewell Beach ATS	IA-3	7.03	mg/L	

Table D: Benchmark Monitoring Data

Parameter	Sample Date	Location	Outfall	Result	Units	Exceeds Benchmark
Aluminum	3/1/2010	Nyman – Womens Bay	NP-1A	8.18	mg/L	X
Iron	3/1/2010	Nyman – Womens Bay	NP-1A	13.5	mg/L	X
Lead	3/1/2010	Nyman – Womens Bay	NP-1A	.021	mg/L	
Zinc	3/1/2010	Nyman – Womens Bay	NP-1A	0.124	mg/L	
Aluminum	5/17/2010	Nyman – Womens Bay	NP-1A	35.1	mg/L	X
Iron	5/17/2010	Nyman – Womens Bay	NP-1A	69.3	mg/L	X
Lead	5/17/2010	Nyman – Womens Bay	NP-1A	.0342	mg/L	
Zinc	5/17/2010	Nyman – Womens Bay	NP-1A	0.337	mg/L	X
Aluminum	3/1/2010	Stormceptor – Womens Bay	NP-2A	0.825	mg/L	X
Iron	3/1/2010	Stormceptor – Womens Bay	NP-2A	1.3	mg/L	X
Lead	3/1/2010	Stormceptor – Womens Bay	NP-2A	0.002	mg/L	
Zinc	3/1/2010	Stormceptor – Womens Bay	NP-2A	0.018	mg/L	
Aluminum	5/17/2010	Stormceptor – Womens Bay	NP-2A	0.376	mg/L	
Iron	5/17/2010	Stormceptor – Womens Bay	NP-2A	0.557	mg/L	
Lead	5/17/2010	Stormceptor – Womens Bay	NP-2A	.0017	mg/L	
Zinc	5/17/2010	Stormceptor – Womens Bay	NP-2A	0.0422	mg/L	
Aluminum	3/1/2010	Nyman – Womens Bay	NP-3	0.344	mg/L	
Iron	3/1/2010	Nyman – Womens Bay	NP-3	0.613	mg/L	
Lead	3/1/2010/	Nyman – Womens Bay	NP-3	0.001	mg/L	
Zinc	3/1/2010	Nyman – Womens Bay	NP-3	0.05	mg/L	
Aluminum	5/17/2010	Nyman – Womens Bay	NP-3	0.116	mg/L	
Iron	5/17/2010	Nyman – Womens Bay	NP-3	0.184j	mg/L	
Lead	5/17/2010	Nyman – Womens Bay	NP-3	0.0007	mg/L	
Zinc	5/17/2010	Nyman – Womens Bay	NP-3	0.108	mg/L	
Iron	3/1/2010	Red Lake		23.1	mg/L	X
Arsenic	3/1/2010	Red Lake		ND		
Iron	3/1/2010	Coast Guard Landfill Sector	LF-1	0.482	mg/L	
TSS	3/1/2010	Coast Guard Landfill Sector	LF-1	0.725	mg/L	
Iron	5/17/2010	Coast Guard Landfill Sector	LF-1	1.67	mg/L	X
TSS	5/17/2010	Coast Guard Landfill Sector	LF-1	5.93	mg/L	
Iron	3/1/2010	Navy Landfill Sector	LF-2	3.0	mg/L	
TSS	3/1/2010	Navy Landfill Sector	LF-2	3.12	mg/L	
Magnesium	1/24/2011	Jewel Beach TSDF Sector	IA-2	5.01	mg/L	X
COD	1/24/2011	Jewel Beach TSDF Sector	IA-2	34.4	mg/L	
Magnesium	3/8/2011	Jewel Beach TSDF Sector	IA-2	17.9	mg/L	X
COD	3/8/2011	Jewel Beach TSDF Sector	IA-2	177	mg/L	X
Magnesium	5/3/2011	Jewel Beach TSDF Sector	IA-2	18.8	mg/L	X
COD	5/3/2011	Jewel Beach TSDF Sector	IA-2	212	mg/L	X
Magnesium	8/18/2011	Jewel Beach TSDF Sector	IA-2	5.15	mg/L	X
COD	8/18/2011	Jewel Beach TSDF Sector	IA-2	66.9	mg/L	
COD	1/24/2011	Air Station –Jewel Beach ATS	IA-3	156	mg/L	X
COD	2/8/2011	Air Station –Jewel Beach ATS	IA-3	32.2	mg/L	
COD	2/10/2011	Air Station –Jewel Beach ATS	IA-3	73.4	mg/L	
COD	3/8/2011	Air Station –Jewel Beach ATS	IA-3	166	mg/L	X
Aluminum	1/24/2011	Nyman – Womens Bay	NP-1A	7.58	mg/L	X
Iron	1/24/2011	Nyman – Womens Bay	NP-1A	9.74	mg/L	X
Aluminum	2/10/2011	Nyman – Womens Bay	NP-1A	41.5	mg/L	X
Iron	2/10/2011	Nyman – Womens Bay	NP-1A	78.9	mg/L	X
Aluminum	5/3/2011	Nyman – Womens Bay	NP-1A	37.1	mg/L	X
Iron	5/3/2011	Nyman – Womens Bay	NP-1A	41	mg/L	X
Aluminum	8/18/2011	Nyman – Womens Bay	NP-1A	27.8	mg/L	X
Iron	8/18/2011	Nyman – Womens Bay	NP-1A	49.7	mg/L	X
Aluminum	1/24/2011	Stormceptor – Womens Bay	NP-2A	0.807	mg/L	X

USCG BASE Kodiak Stormwater Pollution Prevention Plan
Attachment D: Benchmark Monitoring Data

Table D: Benchmark Monitoring Data

Parameter	Sample Date	Location	Outfall	Result	Units	Exceeds Benchmark
Iron	1/24/2011	Stormceptor – Womens Bay	NP-2A	1.39	mg/L	X
Aluminum	2/10/2011	Stormceptor – Womens Bay	NP-2A	2.75	mg/L	X
Iron	2/10/2011	Stormceptor – Womens Bay	NP-2A	4.37	mg/L	X
Aluminum	5/3/2011	Stormceptor – Womens Bay	NP-2A	2.42	mg/L	X
Iron	5/3/2011	Stormceptor – Womens Bay	NP-2A	3.48	mg/L	X
Aluminum	8/18/2011	Stormceptor – Womens Bay	NP-2A	3.54	mg/L	X
Iron	8/18/2011	Stormceptor – Womens Bay	NP-2A	5.72	mg/L	X
Iron	8/24/2011	Red Lake		6.67	mg/L	X
Iron	1/24/2011	Navy Landfill Sector	LF-2	17.2	mg/L	X
Iron	2/10/2011	Navy Landfill Sector	LF-2	6.37	mg/L	X
Iron	5/3/2011	Navy Landfill Sector	LF-2	1.63	mg/L	X
Iron	8/18/2011	Navy Landfill Sector	LF-2	5.88	mg/L	X
Magnesium	10/14/2011	Jewel Beach TSDF Sector	IA-2	5.28	mg/L	X
COD	10/14/2011	Jewel Beach TSDF Sector	IA-2	43.1	mg/L	
Magnesium	3/27/2012	Jewel Beach TSDF Sector	IA-2	9.9	mg/L	X
COD	3/27/2012	Jewel Beach TSDF Sector	IA-2	14.9j	mg/L	
Magnesium	6/11/2012	Jewel Beach TSDF Sector	IA-2	2.24	mg/L	X
COD	6/11/2012	Jewel Beach TSDF Sector	IA-2	10.6j	mg/L	
Aluminum	10/14/2011	Nyman – Womens Bay	NP-1A	22.6	mg/L	X
Iron	10/14/2011	Nyman – Womens Bay	NP-1A	41.7	mg/L	X
Aluminum	3/27/2012	Nyman – Womens Bay	NP-1A	85.4	mg/L	X
Iron	3/27/2012	Nyman – Womens Bay	NP-1A	115	mg/L	X
Aluminum	6/11/2012	Nyman – Womens Bay	NP-1A	17.4	mg/L	X
Iron	6/11/2012	Nyman – Womens Bay	NP-1A	28.4	mg/L	X
Aluminum	9/4/2012	Nyman – Womens Bay	NP-1A	5.1	mg/L	X
Iron	9/4/2012	Nyman – Womens Bay	NP-1A	7.37	mg/L	X
Aluminum	10/14/2011	Stormceptor – Womens Bay	NP-2A	31.4	mg/L	X
Iron	10/14/2011	Stormceptor – Womens Bay	NP-2A	63.6	mg/L	X
Aluminum	3/27/2012	Stormceptor – Womens Bay	NP-2A	0.4	mg/L	
Iron	3/27/2012	Stormceptor – Womens Bay	NP-2A	0.64	mg/L	
Aluminum	6/11/2012	Stormceptor – Womens Bay	NP-2A	44.8	mg/L	X
Iron	6/11/2012	Stormceptor – Womens Bay	NP-2A	84.8	mg/L	X
Aluminum	9/4/2012	Stormceptor – Womens Bay	NP-2A	22.6	mg/L	X
Iron	9/4/2012	Stormceptor – Womens Bay	NP-2A	20.3	mg/L	X
Iron	9/4/2012	Red Lake		1420	mg/L	X
Arsenic	9/4/2012	Red Lake		ND		
Manganese	9/4/2012	Red Lake		0.518	mg/L	
Iron	10/14/2011	Navy Landfill Sector	LF-2	1.03	mg/L	X
Iron	6/11/2012	Navy Landfill Sector	LF-2	2.36	mg/L	X
Iron	9/4/2012	Navy Landfill Sector	LF-2	1.91	mg/L	X
Magnesium	11/8/2012	Jewel Beach TSDF Sector	IA-2	10.4	mg/L	X
Magnesium	3/7/2013	Jewel Beach TSDF Sector	IA-2	1.61	mg/L	X
Magnesium	5/1/203	Jewel Beach TSDF Sector	IA-2	30.3	mg/L	X
Magnesium	8/1/2013	Jewel Beach TSDF Sector	IA-2	17.1	mg/L	X
Aluminum	11/8/2012	Nyman – Womens Bay	NP-1A	0.87	mg/L	X
Iron	11/8/2012	Nyman – Womens Bay	NP-1A	0.564	mg/L	X
Aluminum	3/7/2013	Nyman – Womens Bay	NP-1A	4.101	mg/L	X
Iron	3/7/2013	Nyman – Womens Bay	NP-1A	4.57	mg/L	X
Aluminum	5/1/2013	Nyman – Womens Bay	NP-1A	1.23	mg/L	X
Iron	5/1/2013	Nyman – Womens Bay	NP-1A	1.83	mg/L	X
Aluminum	8/1/2013	Nyman – Womens Bay	NP-1A	3.7	mg/L	X
Iron	8/1/2013	Nyman – Womens Bay	NP-1A	6.39	mg/L	X
Aluminum	11/8/2012	Stormceptor – Womens Bay	NP-2A	6.49	mg/L	X

Table D: Benchmark Monitoring Data

Parameter	Sample Date	Location	Outfall	Result	Units	Exceeds Benchmark
Iron	11/8/2012	Stormceptor – Womens Bay	NP-2A	10.9	mg/L	X
Aluminum	3/7/2013	Stormceptor – Womens Bay	NP-2A	4.45	mg/L	X
Iron	3/7/2013	Stormceptor – Womens Bay	NP-2A	7.98	mg/L	X
Aluminum	5/1/2013	Stormceptor – Womens Bay	NP-2A	1.52	mg/L	X
Iron	5/1/2013	Stormceptor – Womens Bay	NP-2A	2.17	mg/L	X
Aluminum	8/1/2013	Stormceptor – Womens Bay	NP-2A	2.11	mg/L	X
Iron	8/1/2013	Stormceptor – Womens Bay	NP-2A	2.83	mg/L	X
Iron	11/8/2013	Navy Landfill Sector	LF-2	2.79	mg/L	X
Iron	3/7/2013	Navy Landfill Sector	LF-2	5.95	mg/L	X
Iron	5/1/2013	Navy Landfill Sector	LF-2	1.74	mg/L	X
Iron	8/1/2013	Navy Landfill Sector	LF-2	2.4	mg/L	X
Magnesium	2/24/2014	Jewel Beach TSDF Sector	IA-2	9.7	mg/L	X
Magnesium	5/7/2014	Jewel Beach TSDF Sector	IA-2	70.6	mg/L	X
Magnesium	7/29/2014	Jewel Beach TSDF Sector	IA-2	31.9	mg/L	X
Aluminum	12/4/2013	Nyman – Womens Bay	NP-1A	35.7	mg/L	X
Aluminum	2/24/2014	Nyman – Womens Bay	NP-1A	14.9	mg/L	X
Iron	2/24/2014	Nyman – Womens Bay	NP-1A	77.3	mg/L	X
Aluminum	5/7/2014	Nyman – Womens Bay	NP-1A	6.11	mg/L	X
Iron	5/7/2014	Nyman – Womens Bay	NP-1A	28.5	mg/L	X
Iron	7/29/2014	Nyman – Womens Bay	NP-1A	8.82	mg/L	X
Aluminum	2/24/2014	Stormceptor – Womens Bay	NP-2A	3.08	mg/L	X
Iron	2/24/2014	Stormceptor – Womens Bay	NP-2A	6.25	mg/L	X
Aluminum	5/7/2014	Stormceptor – Womens Bay	NP-2A	7.09	mg/L	X
Iron	5/7/2014	Stormceptor – Womens Bay	NP-2A	12.4	mg/L	X
Aluminum	7/29/2014	Stormceptor – Womens Bay	NP-2A	25.1	mg/L	X
Iron	7/29/2014	Stormceptor – Womens Bay	NP-2A	34.7	mg/L	X
Iron	8/4/2014	Red Lake		1.22	mg/L	X
Magnesium	8/4/2014	Red Lake		1.6	mg/L	X
Iron	12/4/2013	Navy Landfill Sector	LF-2	3.07	mg/L	X
Iron	2/24/2014	Navy Landfill Sector	LF-2	9.22	mg/L	X
Iron	5/7/2014	Navy Landfill Sector	LF-2	1.64	mg/L	X
Iron	7/29/2014	Navy Landfill Sector	LF-2	1.26	mg/L	X
Magnesium	11/28/2014	Jewel Beach TSDF Sector	IA-2	12.8	mg/L	X
Magnesium	2/9/2015	Jewel Beach TSDF Sector	IA-2	12.7	mg/L	X
Magnesium	6/25/2015	Jewel Beach TSDF Sector	IA-2	1.26	mg/L	X
Aluminum	11/28/2014	Nyman – Womens Bay	NP-1A	6.44	mg/L	X
Aluminum	2/9/2015	Nyman – Womens Bay	NP-1A	0.731	mg/L	X
Iron	2/9/2015	Nyman – Womens Bay	NP-1A	0.871	mg/L	X
Aluminum	6/25/2015	Nyman – Womens Bay	NP-1A	4.25	mg/L	X
Iron	6/25/2015	Nyman – Womens Bay	NP-1A	6.05	mg/L	X
Aluminum	11/28/2014	Stormceptor – Womens Bay	NP-2A	10.1	mg/L	X
Iron	11/28/2014	Stormceptor – Womens Bay	NP-2A	12.8	mg/L	X
Aluminum	2/9/2015	Stormceptor – Womens Bay	NP-2A	1.91	mg/L	X
Iron	2/9/2015	Stormceptor – Womens Bay	NP-2A	1.68	mg/L	X
Aluminum	6/25/2015	Stormceptor – Womens Bay	NP-2A	4.37	mg/L	X
Iron	6/25/2015	Stormceptor – Womens Bay	NP-2A	7.04	mg/L	X
Iron	11/28/2014	Red Lake		3.78	mg/L	X
Iron	5/25/2015	Red Lake		2.74	mg/L	X

This page intentionally left blank

APPENDIX C:
UNIFORM FEDERAL POLICY FOR QUALITY ASSURANCE PROJECT PLAN FOR GROUNDWATER AND SEEP MONITORING

This page intentionally blank

TABLE OF CONTENTS

WORKSHEET #1 & 2 – Title and Approval Page 1
WORKSHEET #3 & 5 – Project Organizational Chart 3
WORKSHEET #4 , 7, & 8 – Personnel Qualifications and Sign-Off Sheet 5
WORKSHEET #6 – Communication Pathways 9
WORKSHEET #9 – Project Planning Session Summary 13
WORKSHEET #10 – Conceptual Site Model 15
WORKSHEET #11 – Project/Data Quality Objectives 17
WORKSHEET #12 – MEASUREMENT PERFORMANCE CRITERIA 23
12.1 DATA QUALITY INDICATORS 23
12.2 MEASUREMENT PERFORMANCE CRITERIA WORKSHEETS 25
12.3 UVOST Measurement Performance Criteria 25
WORKSHEET #13 – Secondary Data Uses and Limitations 31
WORKSHEET #14 / 16 – Project Tasks & Schedule 35
WORKSHEET #15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits 37
15.1 SOIL AND GROUNDWATER PROJECT ACTION LEVELS 37
15.2 SURFACE WATER PROJECT ACTION LEVELS 37
15.3 Analytical Methods 37
WORKSHEET #17 – Sampling Design and Rationale 47
17.1 MONITORING Plan Summary 47
17.2 Baseline Monitoring Event 47
17.3 Long-Term Management Approach 57
17.4 Common Procedures 58
WORKSHEET #18 – Sampling Locations and Methods 61
18.1 Sample Identification Procedures 61
18.1 Sample Location and Methods 62
WORKSHEET #19 / 30 – Sample Containers, Preservation, and Hold Times 65
WORKSHEET #20 – Field Quality Control Summary 67
WORKSHEET #21 – Field Standard Operating Procedures 69
WORKSHEET #22 – Field Instrument Calibration, Maintenance, Testing, and Inspection 71
WORKSHEET #23 – Analytical Standard Operating Procedures 73
WORKSHEET #24 – Analytical Instrument Calibration 75
24.1 Instrument Calibration Requirements 75
24.2 Continuing Calibration Verification 76
24.3 Analytical Instrument Calibration Procedures 76
WORKSHEET #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection 77
WORKSHEET #26 / 27 – Sample Handling, Custody, and Disposal 79

TABLE OF CONTENTS (CONTINUED)

WORKSHEET #28 – ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION 83
28.1 Analytical Quality Control Samples 83
28.2 Quality Control Checks 85
28.3 Tables 87
WORKSHEET #29 – Project Documents and Records 93
WORKSHEET #31 , 32, & 33 – Assessments and Corrective Action 95
WORKSHEET #34 – Analytical Quality Control and Corrective Action 99
WORKSHEET #35 – DATA VERIFICATION PROCEDURES 101
WORKSHEET #36 – Data Validation Procedures 103
36.1 Laboratory Reporting Requirements 104
36.2 Analytical Data Package Requirements 104
36.3 Laboratory Data Deliverables 105
36.4 Laboratory Result Reporting Requirements 105
36.5 Laboratory Data Review and Evaluation 105
36.6 Chemical Data Quality Review Procedures 105
36.7 Chemical Data Quality Report 108
WORKSHEET #37 – DATA USABILITY ASSESSMENT 113
37.1 Summary of Usability Assessment Processes 113
37.2 Personnel Responsible for Performing the Usability Assessment 113
37.3 Usability Assessment Procedures and Documentation 114

TABLES

Table 4-1 Prime Contractor Personnel Qualifications 5
Table 6-1 Communication Pathways 9
Table 9-1 Project Planning Session Participants 13
Table 11-1 Site 10/11 Groundwater and seep Monitoring Data Quality Objectives 17
Table 12-1 Measurement Performance Criteria For Method AK102/AK103 27
Table 12-2 Measurement Performance Criteria For Method SW8260C 28
Table 12-3 Measurement Performance Criteria For Method SW8270D SIM 29
Table 13-1 Secondary Data Summary 31
Table 13-2 Secondary Data SOURCES 32
Table 14-1 Project Schedule – CMI Work Plan through CMI Report 35
Table 15-1 Project Action Limits and Laboratory Specific Reporting Limits for Soil 39
Table 15-2 PRoject Action Limits and Laboratory-Specific Reporting Limits for Groundwater and Seep Water 43

TABLE OF CONTENTS (CONTINUED)

Table 17-1 Well Status 49
Table 17-2 New Well Rationale 52
Table 17-3 Potential Baseline Groundwater Monitoring Locations 55
Table 18-1 Sample Identification 62
Table 18-2 Baseline Monitoring Event Sampling Locations and Methods 63
Table 18-3 Annual Long-Term MoniToRing Event Sampling Locations and Methods 64
Table 19-1 Sample Containers, Preservation, and Hold Times (SGS Anchorage) 65
Table 20-1 Field QC Summary 67
Table 21-1 Field Standard Operating Procedures 69
Table 22-1 Field Equipment Calibration, Maintenance, Testing, And Inspection 71
Table 23-1 Analytical Standard Operating Procedure References 73
Table 24-1 Analytical Instrument Calibration 76
Table 26-1 Sample Management 79
Table 28-1 Summary of Analytical Quality Control and Corrective Action for MethodS AK102 and AK10389
Table 28-2 Summary of Analytical Quality Control and Corrective Action for Methods SW8260C and SW8270D SIM 90
Table 29-1 Project Documents and Records 93
Table 31-1 Assessments 96
Table 31-2 Assessment Response and Corrective Action 97
Table 31-3 Reporting 98
Table 34-1 Data Verification and Validation Inputs 100
Table 35-1 Data Verification Procedures 101
Table 36-1 Chemical Data Quality Review procedures 103
Table 36-2 Chemical Data Quality Review Qualifiers 107
Table 36-3 General Data Qualifying Conventions 109
Table 37-1 Data Usability Assessment Table 117

ATTACHMENTS

Attachment C-1 Field Forms
Attachment C-2 Field Standard Operating Procedures
Attachment C-3 Analytical Standard Operating Procedures

This page intentionally blank

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
%	percent
%R	percent recovery
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AECOM	AECOM Technical Services
AED	automated external defibrillator
bgs	below ground surface
Brice	Brice Engineering, LLC
BS	Bachelor of Science
BTEX	benzene, toluene, ethylbenzene, and xylenes
CCV	continuing calibration verification
CEU	Civil Engineering Unit
CFR	Code of Federal Regulations
CL	control limit
cm	centimeters
CMI	Corrective Measures Implementation
CoC	chain-of-custody
CPR	cardiopulmonary resuscitation
CSM	conceptual site model
DL	detection limit
DoD	United States Department of Defense
DOT	Department of Transportation
DQI	data quality indicator
DQO	data quality objective
DRO	diesel-range organics
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
FD	field duplicate
FID	flame ionization detector
GAC	granular activated carbon
GC	gas chromatography
GC/MS	gas chromatography/mass spectroscopy
GNSS	Global Navigation Satellite System
GPS	global positioning system
HAZWOPER	hazardous waste operations and emergency response
HCl	hydrochloric acid
HQ	hazard quotient
ICAL	initial calibration
ICV	initial calibration verification
ID	identification
IDQTF	Intergovernmental Data Quality Task Force

ACRONYMS AND ABBREVIATIONS (CONTINUED)

IDW	investigation-derived waste
IS	internal standard
ISO	International Organization for Standardization
LCL	lower control limit
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MBA	Master of Business Administration
mg/kg	milligrams per kilogram
mL	milliliters
mL/min	milliliters per minute
MPC	measurement performance criteria
MS	matrix spike
MSD	matrix spike duplicate
µg/L	micrograms per liter
NA	not applicable
NAPL	non-aqueous phase liquid
NS	not specified
O&M	operations and maintenance
ORP	oxidation reduction potential
oz	ounce
PAH	polycyclic aromatic hydrocarbon
PAL	project action limit
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PE	Professional Engineer
PM	Project Manager
PMP	Project Management Professional
PPE	personal protective equipment
ppm	parts per million
PSL	Project Screening Level
PVC	polyvinyl chloride
QA	quality assurance
QAM	Quality Assurance Manual
QAP	Quality Assurance Plan
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RE	Reference Emitter
RF	response factor
RPD	relative percent difference

ACRONYMS AND ABBREVIATIONS (CONTINUED)

RRO	residual-range organics
RT	retention time
RTK	real-time kinematic
SDG	sample delivery group
SOP	standard operating procedure
SWMU	Solid Waste Management Unit
TAH	total aromatic hydrocarbons
TAqH	total aqueous hydrocarbons
TB	test blank
TLC	Teflon-lined cap
TLS	Teflon-lined septa
UCL	upper control limit
UFP-QAPP	Uniform Federal Policy – Quality Assurance Project Plan
USCG	United States Coast Guard
EPA	United States Environmental Protection Agency
UVOST	ultraviolet optical screening tool
VOA	volatile organic analysis
VOC	volatile organic compound

This page intentionally blank

EXECUTIVE SUMMARY

This Uniform Federal Policy - Quality Assurance Project Plan (UFP-QAPP) is provided as Appendix C to the Corrective Measures Implementation (CMI) Work Plan for Solid Waste Management Unit (SWMU) Site 10/11. This UFP-QAPP describes the procedures that will be followed while conducting groundwater and seep monitoring activities at Site 10/11 on United States Coast Guard (USCG) Base Kodiak on Kodiak Island, Alaska. This UFP-QAPP was prepared in accordance with the following guidance documents; *United States Department of Defense (DoD) Quality Systems Manual (QSM), Version 5.1* (DoD 2017); *18 Alaska Administrative Code (AAC) 75* (Alaska Department of Environmental Conservation [ADEC] 2018a); the ADEC *Field Sampling Guidance* (ADEC 2017a); the *UFP-QAPP Manual* (Intergovernmental Data Quality Task Force [IDQTF] 2005a); the *Optimized UFP-QAPP Worksheets* (IDQTF 2012); and the *UFP-QAPP Quality Assurance/Quality Control (QA/QC) Compendium: Minimum QA/QC Activities* (IDQTF 2005b).

This UFP-QAPP outlines the data quality objectives (DQOs) of site work as well as the methods and procedures that will be followed during the installation and sampling of groundwater wells, and sampling of seeps during the 2019 Baseline Sampling Event as well as during subsequent annual long-term monitoring events. The primary objectives of the Site 10/11 groundwater and seep monitoring activities are to establish a network of wells to act as sentry wells for future monitoring, evaluate the presence and thickness of free product, determine the current nature and extent of contamination in groundwater, and determine if contaminants are migrating offsite and into Inner Womens Bay by collecting seep samples. These objectives will be met during three field monitoring events:

- **2019 Baseline Sampling Event** – A baseline monitoring event will be performed in 2019. The objectives of the baseline monitoring event are as follows:
    - **Monitoring Well Installation** – Re-establish the monitoring well network by installing eight new wells to replace destroyed/damaged wells and fill previous data gaps
    - **Non-Aqueous Phase Liquid (NAPL) Survey** – Determine if free product exists in any of the Site 10/11 monitoring well and document the findings
    - **Groundwater Sampling** – Characterize the current nature and extent of groundwater contamination at the site above the groundwater cleanup standards at the site
    - **Seep Sampling** – Determine if seep samples exceed surface water cleanup standards

- **2020 and 2021 Annual Long-Term Monitoring Events** – Following the Baseline Monitoring Event, two additional annual monitoring events will be performed. The objectives of additional monitoring events are as follows:
    - **NAPL Survey**– Determine if free product exists in any of the Site 10/11 monitoring wells and document the findings
    - **Sentry Well Groundwater Sampling** – Determine if groundwater concentrations in designated sentry wells at Site 10/11 are above cleanup standards
    - **Seep Sampling** – Determine if seep samples exceed ADEC surface water criteria

ES.1 Work Plan Organization

This Appendix C of the CMI Work Plan contains the following sections:

- Executive Summary: Includes an introduction to this appendix and the appendix organization.
- Worksheets 1 through 37: The UFP-QAPP Workbook – A series of worksheets documenting the systematic planning process and data collection plans for the Site 10/11 baseline monitoring event.
- References: Provides a list of documents used to develop this UFP-QAPP.

In addition, the following attachments are included in this UFP-QAPP:

- Attachment C-1: Field Forms
- Attachment C-2: Field Standard Operating Procedures (SOPs)
- Attachment C-3: Analytical SOPs.

WORKSHEET #1 & 2 – TITLE AND APPROVAL PAGE

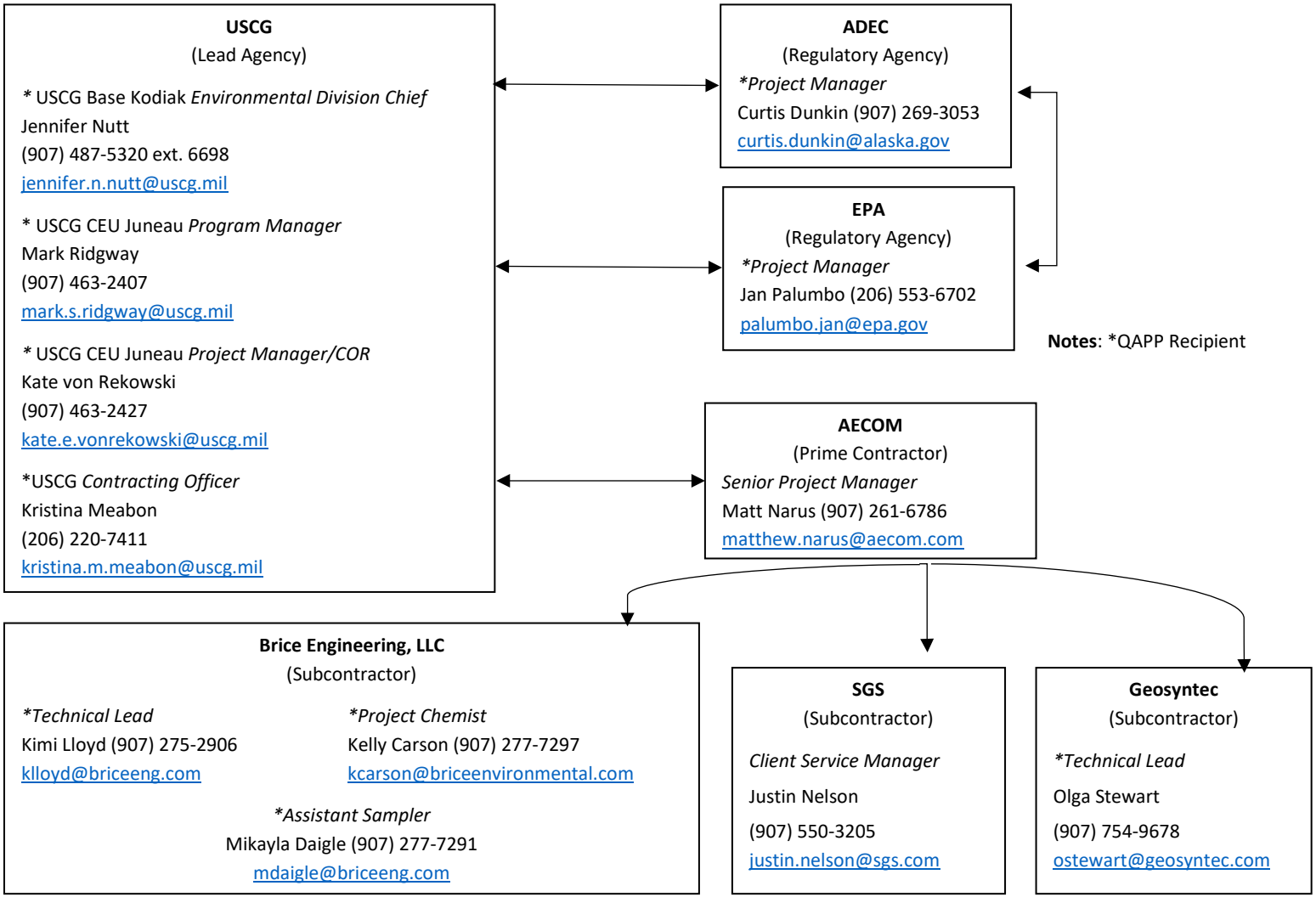
PROJECT INFORMATION	
SITE NAME:	Resource Conservation and Recovery Act (RCRA) SWMU Site 10/11
SITE LOCATION:	United States Coast Guard (USCG) Base Kodiak, Alaska
PROJECT NAME:	CMI Work Plan
CONTRACT NUMBER:	HSCG50-14-D-PSL008, Order 70Z08718FPXA70400
LEAD PREPARER'S ORGANIZATION	
LEAD ORGANIZATION NAME:	AECOM Technical Services (AECOM)
LEAD PREPARER'S PROJECT MANAGER:	Matt Narus
LEAD PREPARER'S PROJECT MANAGER SIGNATURE AND DATE:	
PREPARER'S ORGANIZATION	
ORGANIZATION NAME:	Brice Engineering, LLC (Brice)
PREPARER'S TECHNICAL LEAD:	Kimi Lloyd
PREPARER'S TECHNICAL LEAD SIGNATURE AND DATE:	
LEAD AGENCY	
ORGANIZATION NAME:	USCG Base Kodiak
LEAD AGENCY REPRESENTATIVE:	Jennifer Nutt
LEAD AGNECY REPRESENTATIVE SIGNATURE AND DATE:	
CONTRACTING ORGANIZATION	
ORGANIZATION NAME:	USCG Civil Engineering Unit (CEU) Juneau
CONTRACTING ORGANIZATION PROJECT MANAGER:	Kate von Rekowski
CONTRACTING ORGANIZATION PROJECT MANAGER SIGNATURE AND DATE:	
FEDERAL REGULATORY AGENCY	
REGULATORY AGENCY NAME:	United States Environmental Protection Agency (EPA)
REGULATORY AGENCY REPRESENTATIVE:	Jan Palumbo
REGULATORY AGENCY REPRESENTATIVE SIGNATURE AND DATE:	

WORKSHEET #1 & 2 – TITLE AND APPROVAL PAGE (CONTINUED)

STATE REGULATORY AGENCY	
STATE REGULATORY AGENCY NAME:	Alaska Department of Environmental Conservation (ADEC)
STATE REGULATORY AGENCY REPRESENTATIVE:	Curtis Dunkin
STATE REGULATORY AGENCY REPRESENTATIVE SIGNATURE AND DATE:	

WORKSHEET #3 & 5 – PROJECT ORGANIZATIONAL CHART

The following worksheet identifies relationships between all organizations involved in the project, including the lead organization and all prime contractor and subcontractor organizations.



This page intentionally blank

WORKSHEET #4 , 7, & 8 – PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

The following table identifies key prime contractor project personnel performing tasks in this Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP). Resumes are available upon request. Training records and certifications will be maintained onsite during project activities.

TABLE 4-1 PRIME CONTRACTOR PERSONNEL QUALIFICATIONS

NAME	PROJECT TITLE	RESPONSIBILITIES/ ROLE	EDUCATION/EXPERIENCE	SPECIALIZED TRAINING/CERTIFICATIONS	SIGNATURE/ DATE
AECOM Project Manager (PM)	Matt Narus, Professional Engineer (PE)	Providing direction to the project team to ensure project objectives are met, project budget is tracked, and project is on schedule.	Matt has over 15 years of experience working on a variety of environmental restoration and compliance projects. He has led numerous projects involving a variety of professional teams spanning offices across the country. Matt has a Master of Science (MS) in Environmental Engineering from the University of Wisconsin-Madison, a Master of Business Administration (MBA) from the University of Washington, and a Bachelor of Science (BS) in Chemistry from the University of Alaska-Fairbanks.	• Registered Professional Environmental Engineer in State of Alaska • Master of Science in Environmental Engineering • 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) • 8-Hour refresher per 29 Code of Federal Regulations (CFR) 1910.120(e)	

TABLE 4-1 PRIME CONTRACTOR PERSONNEL QUALIFICATIONS (CONTINUED)

NAME	PROJECT TITLE	RESPONSIBILITIES/ ROLE	EDUCATION/EXPERIENCE	SPECIALIZED TRAINING/CERTIFICATIONS	SIGNATURE/ DATE
Brice Technical Lead	Kimi Lloyd, PE	Implementing, overseeing, and coordinating safety aspects and objectives of this project. Managing the sampling elements.	Kimi Lloyd has more than 7 years of experience in environmental fieldwork management, field sample collection, laboratory and field analytical testing, air emissions modeling, report writing, and data validation and qualification. She holds a BS in Civil Engineering from the university of Alaska Anchorage and a PE license in Alaska (Civil).	• Registered PE in the State of Alaska • 40-Hour HAZWOPER • 8-Hour refresher per 29 CFR 1910.120(e) • 30-Hour Occupational Safety and Health Administration Construction • Alaska Certified Erosion Sediment Control Lead • USACE Construction Quality Management for Contractors Certification • First-aid certification • Adult cardiopulmonary resuscitation/automated external defibrillator (CPR/AED) certification • Hazardous material shipping • ADEC Qualified Environmental Professional	
Brice Project Chemist	Kelly Carson	Coordinating with the analytical laboratory, review the data, and ensure that the DQOs are met.	Kelly Carson has over 14 years of technical and professional experience executing remedial investigation projects throughout Alaska, with specific experience managing laboratory subcontracts and reviewing and validating analytical data. She holds a MS in Environmental Quality Science from the University of Alaska-Anchorage and a BS in Environmental Studies from Utah State University.	• 40-Hour HAZWOPER • 8-hour refresher per 29 CFR 1910.120(e) • 8-Hour Managers and Supervisors Course per 29 CFR 1910.120€ • Hazardous material shipping • ADEC Qualified Environmental Professional	

TABLE 4-1 PRIME CONTRACTOR PERSONNEL QUALIFICATIONS (CONTINUED)

NAME	PROJECT TITLE	RESPONSIBILITIES/ ROLE	EDUCATION/EXPERIENCE	SPECIALIZED TRAINING/CERTIFICATIONS	SIGNATURE/ DATE
Brice Field Sampler	Mikayla Daigle	Assisting the Brice Technical Lead in collecting, managing, packaging, and shipping analytical samples. Assisting in the overall execution of the project objectives in a safe and efficient manner.	Mikayla Daigle is an Engineer in Training with a year of experience in environmental fieldwork, land surveying, and report writing. She holds a BS in Geological Engineering as well as majors in Geology and Environmental Studies from the University of Wisconsin-Madison.	• Engineer in Training • 40-Hour HAZWOPER • 8-hour refresher per 29 CFR 1910.120(e) • First-aid certification • Adult CPR/AED certification • Bloodborne Pathogens training • Wildlife Awareness and Defense	
Geosyntec Technical Lead	Olga Stewart, PE, PMP	Assisting the Brice Technical Lead in the execution of field activities to meet project objectives in a safe and efficient manner.	Olga has more than 11 years of experience in environmental fieldwork management and field sample collection, including groundwater sampling. She holds a BS in Materials Science Engineering from Lehigh University and a PE license in Alaska (Environmental).	• Registered Professional Engineer in the State of Alaska • 40-Hour HAZWOPER • 8-Hour refresher per 29 CFR 1910.120(e) • First-aid certification • Adult CPR/AED certification • ADEC Qualified Environmental Professional	

Notes: Refer to Acronyms and Abbreviations section for definitions.

This page intentionally blank

WORKSHEET #6 – COMMUNICATION PATHWAYS

Table 6-1 presents communication pathways, which defines the procedures for soliciting and/or obtaining approval between project personnel, contractors, and laboratory staff. These procedures should be followed when an approved project activity requires real-time modifications to achieve project goals, or a UFP-QAPP amendment must be obtained. Procedures for stopping work and responsible entities are also identified.

Table 6-1 describes the communication pathways and modes of communication that will be used during the project after the UFP-QAPP has been approved. The communication pathways presented below define the procedures for soliciting and/or obtaining approval between project personnel, between contractors, and between samplers and laboratory staff. These procedures should be followed when an approved project activity requires real-time modifications to achieve project goals. Procedures for stopping work and responsible entities are also identified.

TABLE 6-1 COMMUNICATION PATHWAYS

COMMUNICATION DRIVERS	RESPONSIBLE ENTITY	NAME	PHONE NUMBER	PROCEDURE (TIMING, PATHWAYS, ETC.)
Point of contact with ADEC / EPA during project execution	USCG PM	Kate von Rekowski	(907) 463-2427	Technical, quality assurance (QA), and decision-making matters concerning the execution of the project (verbal, written, or electronic).
Site access	Base Kodiak Environmental Division Chief	Jennifer Nutt	(907) 487-5320 ext. 6698	Site access will be coordinated with Jennifer Nutt/USCG Base Kodiak.
	AECOM PM	Matt Narus	(907) 261-6786	
	Brice Technical Lead	Kimi Lloyd	(907) 275-2906	
	Geosyntec Technical Lead	Olga Stewart	(907) 754-9678	
Amendments to the UFPP-QAPP	USCG PM	Kate von Rekowski	(907) 463-2427	Coordination of UFP-QAPP amendment dialogue. ADEC and EPA will be notified of significant corrective actions by phone, email, or fax within one week.
Contracting issues requiring coordination between the USCG PM and AECOM / Brice	USCG PM	Kate von Rekowski	(907) 463-2427	USCG will maintain project oversight for the overall project action.
Technical review and oversight of scope, activities, and process	USCG PM	Kate von Rekowski	(907) 463-2427	USCG will maintain project oversight for the overall project action.
Planning and preparatory communication and meetings	AECOM PM	Matt Narus	(907) 261-6786	Facilitates review and status meetings and other meetings as necessary with client and stakeholders as appropriate.
	Brice Technical Lead	Kimi Lloyd	(907) 275-2906	

TABLE 6-1 COMMUNICATION PATHWAYS (CONTINUED)

COMMUNICATION DRIVERS	RESPONSIBLE ENTITY	NAME	PHONE NUMBER	PROCEDURE (TIMING, PATHWAYS, ETC.)
Change in field conditions	Brice Technical Lead	Kimi Lloyd	(907) 275-2906	Notify AECOM PM of change in conditions by the next business day.
	AECOM PM	Matt Narus	(907) 261-6786	Coordination with USCG, ADEC, and EPA to adjust approach if necessary. Contact will be initiated by the end of the day.
Change to fieldwork	Brice Technical Lead	Kimi Lloyd	(907) 275-2906	Notify AECOM PM of fieldwork issue by close of business the next business day.
	AECOM PM	Matt Narus	(907) 261-6786	Notifies USCG PM by the end of the next business day.
	USCG PM	Kate von Rekowski	(907) 463-2427	Evaluates the situation based on information from AECOM PM and selects the recommended solution or an alternate solution. If a significant change to fieldwork will occur based on a recommended solution, ADEC and EPA will be notified prior to fieldwork change implementation.
Analytical data results and data quality issues	Brice Project Chemist	Kelly Carson	(907) 277-7297	Identifies any data quality issues and works with laboratory PM to resolve issues, notifies Brice Technical Lead of the issue and resolution. If there is a significant data quality issue, the project chemist may immediately notify the Brice Technical Lead and the Field Team.
	SGS PM	Justin Nelson	(907) 550-3205	Identifies data quality issues and provides solutions for the project chemist to resolve the issue.
	Brice Technical Lead	Kimi Lloyd	(907) 275-2906	Notifies AECOM PM of data quality issues and initiates a resolution within one week.
	AECOM PM	Matt Narus	(907) 261-6786	Notifies USCG PM of data quality issues and initiates a resolution within one week.
	USCG PM	Kate von Rekowski	(907) 463-2427	Notifies ADEC and EPA of data quality issues.
	ADEC PM	Curtis Dunkin	(907) 269-3053	Evaluates whether actions to resolve data quality issues are adequate, with input from USCG PM, and AECOM PM if necessary.
	EPA PM	Jan Palumbo	(206) 553-6702	
	USCG PM	Kate von Rekowski	(907) 463-2427	

TABLE 6-1 COMMUNICATION PATHWAYS (CONTINUED)

COMMUNICATION DRIVERS	RESPONSIBLE ENTITY	NAME	PHONE NUMBER	PROCEDURE (TIMING, PATHWAYS, ETC.)
Accident or unplanned health and safety incident	Brice Technical Lead	Kimi Lloyd	(907) 275-2906	Notifies AECOM PM within one hour.
	AECOM PM	Matt Narus	(907) 261-6786	Notifies USCG by phone within 24 hours.
	USCG PM	Kate von Rekowski	(907) 463-2427	Notifies ADEC and EPA within 24 after notification from AECOM PM.
Stop work/initiate corrective action	Brice Technical Lead	Kimi Lloyd	(907) 275-2906	Stops work and notifies AECOM PM within one hour.
	AECOM PM	Matt Narus	(907) 261-6786	Stops work and notifies USCG PM by the end of the next business day. Recommends corrective action.
	USCG PM	Kate von Rekowski	(907) 463-2427	The USCG PM is the first point of contact for contract issues. The USCG PM will advise the AECOM PM to stop work based on information provided.

Notes:
Refer to Acronyms and Abbreviations sections for definitions.

This page intentionally blank

WORKSHEET #9 – PROJECT PLANNING SESSION SUMMARY

This Worksheet documents scoping sessions held for the project and identifies team members responsible for planning the project.

TABLE 9-1 PROJECT PLANNING SESSION PARTICIPANTS

Project Name: Kodiak RCRA Schedule of Compliance
Contract HSCG50-14-D-PSL008, Order 70Z08718FPXA70400
Site Location: Kodiak, Alaska
Date of Planning Session: 1 October 2018
Brice PM: Jamie Oakley
Purpose: Walk through the scope of work and answer any questions related to the approach.

NAME	TITLE/ROLE	LOCATION	ORGANIZATION	EMAIL
Kate von Rekowski	USCG PM	Kodiak, In Person	USCG	Kate.E.VonRekowski@uscg.mil
Jennifer Nutt	Base Kodiak Coordination / Environmental Manager	Kodiak, In Person	USCG	Jennifer.N.Nutt@uscg.mil
Matt Narus	AECOM PM	Kodiak, In Person	AECOM	Matthew.Narus@aecom.com
Jamie Oakley	Brice PM	Kodiak, In Person	Brice	Jamie.Oakley@BriceEnvironmental.com
Kimi Lloyd	Brice Technical Lead / Civil Engineer	Kodiak, In Person	Brice	KLloyd@BriceEng.com
Mikayla Daigle	Geological Engineer	Kodiak, In Person	Brice	MDaigle@BriceEng.com
Olga Stewart	Groundwater Sampling Lead	Kodiak, In Person	Geosyntec	OStewart@Geosyntec.com
Brandie Hofmeister	Geologist, CPG	Kodiak, In Person	Borealis	bhofmeister@borealisenvironmental.com

The following notes were recorded and subsequently delivered to the project team following the meeting conducted on 1 October 2018. The notes below only include those relevant to the activities for Site 10/11.

Meeting Agenda/Notes:

1) OBJECTIVE: Walk through the scope of work and answer any questions related to the approach.

Summary of Communication:

1) **Discussion of Project Scope of Work by Task:**
    a. **Task 1: Project Management**
        i. Perform bi-weekly meetings.
        ii. "Juneau" Meeting may take place in Anchorage to simplify travel for regulators.
        iii. Issue one base-wide Health and Safety Plan instead of separate project specific health and safety plans. AECOM and Brice will provide this by 9 November 2018.
        iv. Both ADEC and EPA will review all documents, except Pre-Drafts.
        v. Geosyntec is responsible for receiving and updating the RCRA Database from Ahtna.
    b. **Task 2: Site 10/11**
        i. Work plan will be in full UFP-QAPP style. Work Plan will recognize the numerous damaged/missing wells due to tarmac re-pavement and C130 Nose Dock Facility construction. Information on the construction can be obtained from USCG Construction Manager, Jarrod England. Work Plan will acknowledge EPA concerns regarding stormwater control offsite and the stormwater general permit. Geosyntec will obtain monitoring well inventory map package from Ahtna. A new outfall is present in the area. USCG will provide a copy of Site 3 UFP-QAPP Work Plan as a template but note that it was never finalized.
        ii. Work Plan should review the myriad of files/activities that have been performed to-date for this site. USCG will provide scans of recent files/reports completed by HDR. Recent quarterly product level monitoring data is available. USCG will provide the letter from the EPA requesting work to be done. The proposed full suite of analyses will be ordered for all wells at Site 10/11, regardless of source differences.
        iii. Health and safety for the activities in this area will account for on-going airfield operations.
        iv. Work is scheduled to occur simultaneous to Building 28 activities. Pre-Draft Work Plan is led by Brice and will be submitted to USCG.
2) **Site Walk**
    a. **Photographs of each site in order of visits**:
        i. Potential sample/well locations areas for Building 28
        ii. Wells for Site 10/11
3) **Files and drawings collected.**
    a. **Files shared with team members via Google Drive and USB drive.**

WORKSHEET #10 – CONCEPTUAL SITE MODEL

The conceptual site model for Site 10/11 is presented in Section 2.0 and Appendix D of the CMI Work Plan.

This page intentionally blank

WORKSHEET #11 – PROJECT/DATA QUALITY OBJECTIVES

Project DQOs define the type, quantity, and quality of data that are needed to answer specific environmental questions and support environmental decisions. DQOs are pre-established goals that help monitor and assess project progress. Table 11-1 below presents the project DQOs and the process by which they will be met.

TABLE 11-1 SITE 10/11 GROUNDWATER AND SEEP MONITORING DATA QUALITY OBJECTIVES

Step 1 – Problem Statement/Objective	**Ensure the selected remedy is protective of human health and the environment by measuring non-aqueous phase liquid (NAPL) thickness, groundwater concentration, and seep concentration data to:** **1) Determine if contaminants are migrating into Inner Womens Bay, and** **2) Establish that the plume is stable or shrinking.**					
Step 2 – Principal Study Questions	***Data Quality Objectives***	**DQO 1** **Install monitoring wells to fill data gaps and act as sentry wells for NAPL and groundwater monitoring**	**DQO 2** **Determine the presence/absence and thickness of NAPL and remove it, as necessary**	**DQO 3** **Characterize the current contaminant concentrations in groundwater**	**DQO 4** **Measure soil contaminant concentrations in the smear zone at proposed new well locations**	**DQO 5** **Determine if contaminants are migrating into Inner Womens Bay**
	Goals	Re-establish an adequate monitoring network for determining baseline product thickness and contaminant concentrations in groundwater.	Define the presence, thickness, and limits of NAPL currently present at the Site. Remove recoverable NAPL. Evaluate stability of the NAPL plume.	Establish a new baseline of contaminant concentrations in groundwater. Evaluate stability of the dissolved-phase groundwater plume. Supplement existing groundwater dataset with data representative of current site conditions for a potential future risk assessment.	Determine if soil concentrations just above the groundwater interface represent a continuing source of contamination to groundwater. Supplement existing soil dataset with data representative of current site conditions for a potential future risk assessment.	Identify any contaminants that may be migrating from the Site into Inner Womens Bay that could impact surface water, sediment, or ecological receptors. Supplement existing surface water/seep dataset with data representative of current site conditions for a potential future risk assessment.

TABLE 11-1 SITE 10/11 GROUNDWATER AND SEEP MONITORING DATA QUALITY OBJECTIVES (CONTINUED)

Step 3 – Inputs to the Decision	***Needed Information***	Existing monitoring well condition and construction information Site conceptual site model, including understanding of historical analytical data and hydraulic gradient/flow direction Ultraviolet optical screening tool (UVOST) field screening results Photoionization detector (PID) readings Borehole lithology, water level information, and other field observations collected during well installation	New and historical measurements of NAPL in existing and new wells.	New and historical analytical groundwater data Groundwater project action levels (PALs) as described in Worksheet #15	New analytical soil sample results UVOST field screening results PID readings Borehole lithology, water level information, and other field observations collected during well installation Migration to groundwater cleanup levels (Worksheet #15)	New and historical analytical seep water sample results Surface water PALs (Worksheet #15)
	Source of Needed Information or Data	Historical boring and well construction logs UVOST data, PID readings, and field observations from upcoming field effort Utility information Historical groundwater elevation measurements, tidal studies, water quality measurements, and other hydrogeological information Historical reports from prior investigations with groundwater and analytical data Professional expertise on hydrogeologic chemical migration UVOST data from upcoming field effort	Field measurements will be collected using an oil-water interface probe. Historical reports and maps Publicly available trend analysis tools (e.g., Mann-Kendall)	Analytical groundwater samples from upcoming monitoring events, including analytical results for diesel-range organics (DRO) and residual-range organics (RRO), volatile organic compounds (VOCs), and polycyclic aromatic hydrocarbons (PAHs). Historical reports, maps, and databases Publicly available trend analysis tools (e.g., Mann-Kendall) Worksheet #15 (PALs)	Analytical soil samples from upcoming field effort. Samples will be analyzed for DRO/RRO, VOCs, and PAHs. UVOST data, PID readings, and field observations from upcoming field effort Worksheet #15 (PALs)	Analytical seep water samples from upcoming field effort as well as future monitoring events. Samples will be analyzed for DRO/RRO, VOCs, and PAHs. Historical reports, maps, and databases Worksheet #15 (PALs)

TABLE 11-1 SITE 10/11 GROUNDWATER AND SEEP MONITORING DATA QUALITY OBJECTIVES (CONTINUED)

	Action Levels – How the data will be used	Eight preliminary proposed monitoring well locations have been selected (17-1) based on the information described above. At four of the eight locations (17-1), UVOST will be used as a screening tool before installing the well to provide greater confidence that the well is a sentry /boundary well and not located with the NAPL plume.	The oil-water interface probe can detect thin layers of product present on the surface of the water but can only measure NAPL present at 0.1 feet thick or more. Product thickness trends will be performed using available data	Data will be compared to groundwater PALs (Worksheet #15).	Data will be compared to the soil PALs (Worksheet #15).	Data will be compared to ADEC surface water quality criteria for total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH).
Step 4 – Study Boundaries		***Target Population***				
		NAPL/Groundwater	NAPL	Groundwater	Soil	Seep Water
		Spatial Boundaries				
		Site 10/11 on USCG Base Kodiak (Figure 5 of the CMI Work Plan)				
		Temporal Boundaries				
		New monitoring wells will be installed as part of the 2019 Baseline Monitoring Event.	NAPL measurements will be collected from all viable wells onsite during the 2019 Baseline Monitoring Event and the 2020 and 2021 Annual Long-Term Monitoring events. Historical NAPL measurements will be used for trend analysis	2019 Baseline Monitoring: All viable wells onsite (up to 27) will be sampled. Monitoring wells will not be sampled if an existing well has been destroyed or damaged to the extent that it is not sampleable, or if measurable free product is observed at a well during the NAPL survey. 2020 and 2021 Annual Long-Term Monitoring: Up to eight sentry wells will be sampled during each annual event. Wells will not be sampled if measurable free product is observed at a well during the NAPL survey. Historical groundwater data will be used for trend analysis	Smear zone soil samples will be collected during the 2019 Baseline Monitoring Event.	Seep samples will be collected from four locations during the 2019 Baseline Monitoring Event and the 2020 and 2021 Annual Long-Term Monitoring events.

TABLE 11-1 SITE 10/11 GROUNDWATER AND SEEP MONITORING DATA QUALITY OBJECTIVES (CONTINUED)

	Potential Practical Constraints				
	UVOST Constraints: Prior to well installation, UVOST will be used as a screening tool before installing the well to provide greater confidence that the well is a sentry /boundary well and not located with the NAPL plume. If UVOST determines that a location is within the NAPL plume, a step-out process will be used to find a location out of the plume. At four of the proposed well locations (Figure 5 of the CMI Work Plan), the ones along Inner Womens Bay, stepping-out is not possible. As such, UVOST will only be used at the other four locations. Utility Constraints: Another factor potentially affecting the locations of the proposed wells is existing underground utilities. Wells may need to be moved based on results of the utility clearance process.	Wells previously reported as having product present may have been damaged during recent construction activities and may not be available for monitoring (Table 17-1).	Wells previously reported as having product present may have been damaged during recent construction activities and may not be available for monitoring (Table 17-1).	No practical constraints for collecting soil samples.	Seeps may not be present at the time of the planned field efforts. Additional visits may be necessary during periods of high precipitation to collect seep water samples from the intertidal zone.

TABLE 11-1 SITE 10/11 GROUNDWATER AND SEEP MONITORING DATA QUALITY OBJECTIVES (CONTINUED)

<u>Step 5</u> – Decision Rules	For the four proposed well locations where UVOST will be used (Figure 5 CMI Work Plan): 1) If UVOST results indicate that a proposed well is within the NAPL plume, a step-out process will be performed to select a new location outside of the NAPL plume. 2) If the step-out distance to select a new location is greater than 50 feet, the decision to step out, field notes, boring log, UVOST log, and new step-out locations will be reported to ADEC and EPA prior to installing the well. 3) If UVOST screening within 50 feet of the proposed well location indicates there are no petroleum constituents present, a groundwater monitoring well will be installed for use as a sentry well. 4) The maximum step-out distance is 200 feet. If, after stepping-out 200 feet, UVOST indicates that location is still within contamination, the well will be installed.		1) All historical well locations listed in Table 17-1 will be investigated to determine if the well is still present and suitable for sampling. 2) If the oil water interface indicates product is present in a well during surveying activities, an analytical groundwater sample will not be collected during that event. 3) If a well is suitable for sampling, it will be sampled in accordance with SOP BE-SOP-09 *Groundwater Sampling*.	Analytical soil samples will be collected from just above the groundwater interface while installing each of the eight new wells	1) Investigate the area and determine if seeps are present in the intertidal zone. Up to four seep water samples will be collected. The following seep location criteria will be used (listed in descending order of importance): • Select two seep locations northwest of Outfall IA-1 and two seep locations southeast of Outfall IA-1 (Figure 5 of the CMI Work Plan) • Select seep locations that are separated by at least 300 feet and are at least 100 feet from Outfall IA-1 • Select seep locations that have the highest apparent flow rates. 2) Seep water samples will be collected during the beginning of the incoming tide to ensure seep water is representative of formation water and not of salt water that may have intruded during the previous high tide event. 3) If seeps are not present during the planned field events, additional attempts will be made to collect seep water samples from the intertidal zone, likely during high precipitation events.
<u>Step 6</u> – Performance or Acceptance Criteria			Measurement performance criteria are presented in Worksheet #12. Analytical chemical data will meet quality expectations for precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) as defined by this UFP-QAPP and in accordance with the DoD QSM v 5.1 (2017).	Measurement performance criteria are presented in Worksheet #12. Analytical chemical data will meet quality expectations for PARCCS as defined by this UFP-QAPP and in accordance with the DoD QSM v 5.1 (2017).	Measurement performance criteria are presented in Worksheet #12. Analytical chemical data will meet quality expectations for PARCCS as defined by this UFP-QAPP and in accordance with the DoD QSM v 5.1 (2017).

TABLE 11-1 SITE 10/11 GROUNDWATER AND SEEP MONITORING DATA QUALITY OBJECTIVES (CONTINUED)

Step 7 – Plan for Obtaining Data	UVOST screening will be conducted at the four select well locations presented in Figure 5 of the CMI Work Plan to provide greater confidence the placement is outside of the contaminant plume. If necessary, well placement will be adjusted to ensure that they are placed outside of the contaminant plume. Obtain historical reports/data from the Administrative Record	All existing/accessible/viable wells will be surveyed. The presence/absence and thickness (if appropriate) of product will be recorded as well as the total depth to water and the total depth of the well. This survey will be completed in one day. Obtain historical reports/data from the Administrative Record	2019 Baseline Monitoring: All viable wells onsite (up to 27) will be sampled for DRO/RRO, VOCs and PAHs. Monitoring wells will not be sampled if an existing well has been destroyed or damaged to the extent that it is not sampleable, or if measurable free product is observed at a well during the NAPL survey. 2020 and 2021 Annual Long-Term Monitoring: Up to eight sentry wells will be sampled during each annual event for DRO/RRO, VOCs, and PAHs. Wells will not be sampled if measurable free product is observed at a well during the NAPL survey. Obtain historical reports/data from the Administrative Record	Soil samples will be collected from just above the groundwater interface during the installation of new wells as part of the Baseline Monitoring event. Analytical soil samples will be analyzed for DRO/RRO, VOCs, and PAHs Obtain historical reports/data from the Administrative Record	Four seep water samples will be collected from the intertidal zone along Inner Womens Bay. Seep water samples will be collected at the beginning of the incoming tide to ensure that seep water is representative of formation water and not of salt water that may have intruded the formation during the previous high tide. If seeps are not observed during the upcoming field effort, additional visits will be made in 2019 to obtain these samples. Analytical seep water samples will be analyzed for DRO/RRO, VOCs, and PAHs. Obtain historical reports/data from the Administrative Record

WORKSHEET #12 – MEASUREMENT PERFORMANCE CRITERIA

The tables for this Worksheet summarize the measurement performance criteria (MPC) for each matrix and analytical group. The tables identify the data quality indicators (DQI), MPC, and quality control (QC) sampling and/or activity that will be used to assess the measurement performance for both the sampling and analytical measurement systems. The MPC follow those defined in *United States Department of Defense* (*DoD) Quality Systems Manual (QSM) v.5.1* (DoD 2017) and the analytical methods.

12.1 DATA QUALITY INDICATORS

The quality of the data collected for this project will be verified through appropriate MPC established for both sampling procedures and analytical methods. The criteria also relate to DQIs consisting of precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters. The quality of the sampling procedures and laboratory results will be evaluated for compliance with project DQOs through a review of overall PARCCS, in accordance with procedures described in Worksheet #36.

DQIs are defined in the following subsections.

I) PRECISION

Precision will be evaluated by comparing the following:

- Laboratory control sample (LCS) and LCS duplicate (LCSD) (if prepared and analyzed) to determine the precision of the laboratory procedures and verify matrix interference,
- Matrix spike (MS) and MS duplicate (MSD) samples to determine the effect of the sample matrix on the precision of the results generated using the selected analytical method, and
- Primary and field duplicate sample results.

The required level of precision for field duplicates is a relative percent difference (RPD) of 50 percent (%) for soils and 30% for waters. Field duplicate precision is evaluated by calculating RPD using the following formula:

$$RPD = \frac{2[(D_1 - D_2)]}{D_1 + D_2} x\,100$$

Where: D_1 = first sample value
D_2 = second sample value (replicate)
RPD = relative percent difference

II) ACCURACY

Accuracy will be evaluated by reviewing the following:

- Calibrations – initial and continuing, acceptance, and frequency (deviations are assumed to be noted in case narratives)
- Surrogates – recovery and frequency
- LCS and LCSD recoveries

- MS and MSD recoveries
- Method blanks (MB) (detections in the MB may indicate potential high bias in associated samples)
- Relative response factors (RF) (appropriate calibration procedures improve accuracy of measurement results; deviations are assumed to be noted in case narratives)
- Gas chromatography (GC) second-column confirmation (if required)
- Tuning criteria GC/mass spectroscopy (GC/MS) – acceptability and frequency (to ensure accuracy of mass and ion abundance measurements; deviations are assumed to be noted in laboratory case narratives)
- Internal standards (ISs) (GC and GC/MS) – acceptability and frequency (deviations are assumed to be noted in laboratory case narratives)

Percent recovery (%R) for surrogates, LCS, and MS is calculated using the following formula:

$$\%\ Recovery = \frac{(S - U)}{C_{sa}}\ x\ 100$$

Where: S = measured concentration in spiked aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added

III) REPRESENTATIVENESS

Representativeness shall be achieved through use of the standard field, sampling, and analytical procedures. Representativeness will be evaluated by reviewing the following:

- Sampling design, including sample quantities and locations
- Sampling procedures and equipment
- Sample chain-of-custody (CoC) forms and field logbooks
- Holding times and preservation

IV) COMPLETENESS

Completeness is a measure of the amount of valid data obtained compared with the amount that was expected to be obtained under correct, normal conditions. Completeness will be evaluated for each analyte for a particular sampling event or other defined set of samples (such as by site) with respect to each DQO or end data use. Completeness will be calculated and evaluated for each method, matrix and analyte combination using the following formula:

$$\%\ Completeness = 100\ x\ (\frac{V}{n})$$

Where: V = number of measurements determined to be valid
n = total number of measurements

Valid data are considered usable in the context of project DQOs and/or end data use(s). The completeness goal is considered met when 95% of the sample data are considered valid and usable in the context of project goals.

V) COMPARABILITY

Comparability is a qualitative indicator of the confidence with which one data set can be compared to another. To ensure data set comparability, the following steps will be taken:

- Using standard methods for sampling and analysis.
- Reporting data in standard units.
- Operating instruments within their calibrated range according to established procedures that are based on approved methodology.
- Using only standards supplied by the field test kit manufacturer for field screening analysis.
- Using standard and comprehensive reporting formats.

VI) SENSITIVITY

Sensitivity is the ability of a method or instrument to detect the target analytes at the level of interest. The capability of analytical laboratory methods and instrumentation to provide data with the sensitivity to meet the DQOs is evaluated during the planning phase. The laboratory reference limits, including detection limits (DL), limits of detection (LOD), and limits of quantitation (LOQ), which are evaluated against project action levels (PAL) to determine whether the analytical methods and/or laboratory can meet the project DQOs. Laboratory reference limits for planned fields of testing are included in Worksheet #15.

If a result is greater than the DL and less than the LOQ, the result will be reported as a detected concentration and flagged "J." If no detected concentration is determined down to the DL, the result will be reported to the LOD concentration (with the added variables of sample dilution, final volume, and sample mass included), reported as a non-detect result, and U-flagged. A detected result greater than or equal to the LOQ will be reported without a qualifying flag unless otherwise required by QC exceedance. Non-detect results will be reported to the LOD, and detections between the DL and the LOQ will be reported with a J-flag.

Sample dilution due to target and/or non-target compound concentrations or matrix interference could prevent achievement of DLs. Samples must be analyzed initially while undiluted, when reasonable. If dilution is necessary, the laboratory must report both the original and the diluted results. Samples that are not analyzed undiluted must be supported by matrix interference documentation, such as sample viscosity, color, odor, or results from other analyses of the same sample, to show that undiluted analysis is not possible. Appropriate cleanup procedures must be followed to minimize matrix effects on the DL, LOD, and LOQ.

12.2 MEASUREMENT PERFORMANCE CRITERIA WORKSHEETS

Table 12-1 through 12-3 summarize the MPC for each matrix and analytical group.

12.3 UVOST MEASUREMENT PERFORMANCE CRITERIA

UVOST will be used to assist with the placement of the four of the eight proposed new wells at the site (Figure 5 of the CMI Work Plan). UVOST will be performed prior to installing wells at the four select locations

to provide greater confidence that the well is a sentry /boundary well and not located within the NAPL plume. UVOST borings will be advanced to the water table. If UVOST determines that a location is within the NAPL plume, a step-out process with additional UVOST borings will be used to locate the appropriate placement of a sentry well outside of the contamination plume. If the step-out distance to select a new location is greater than 50 feet, the decision to step out, field notes and boring log, UVOST log, and new step-out locations will be reported to ADEC and EPA prior to installing the well. The maximum step-out distance is 200 feet. If, after stepping-out 200 feet, UVOST indicates that location is still within contamination, the well will be installed. At the four proposed well locations along Inner Womens Bay (Figure 5 of the CMI Work Plan), stepping-out will not be possible, so UVOST will not be used as a preliminary screening step.

A calibration check will be performed on the UVOST prior to each logging event to verify that the instrument is operating properly. Further detail regarding UVOST screening is provided in Worksheet #17 and Worksheet #22. BE-SOP-17 *UVOST Operations* provides additional information regarding calibration limits and frequency.

TABLE 12-1 MEASUREMENT PERFORMANCE CRITERIA FOR METHOD AK102/AK103

Matrix: Soil/Groundwater/Seep Water
Analytical Group or Method: DRO/RRO
Concentration Level: Low-High

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field duplicate	RPD <50% for soils[1] RPD <30% for waters[1]
Accuracy/Bias/Contamination	Blanks (MB)	No analytes detected >1/2 LOQ and >1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected >LOQ and >1/10 the amount measured in any sample.[2] Sample results will be qualified if contamination is detected above the DL in the associated MB.
Accuracy	LCS/LCSD Recoveries MS/MSD Recoveries	DRO (Carbon range C10-C25): 75 to 125% Recovery[3] RRO (Carbon range C25-C36): 60 to 120% Recovery[3]
Precision	LCS/LCSD Recoveries MS/MSD Recoveries	DRO (Carbon range C10-C25): RPD ≤20%[3] RRO (Carbon range C25-C36): RPD ≤20%[3]
Accuracy	Surrogate Recoveries for MB/LCS/LCSD	DRO: o-Terphenyl (or equivalent) Recovery 60 to 120%[3] RRO: n-Triacontane-d62 (or equivalent) Recovery 60 to 120%[3]
Accuracy	Surrogate Recoveries for Field Samples including MS/MSD	DRO: o-Terphenyl (or equivalent) Recovery 50 to 150%[3] RRO: n-Triacontane-d62 (or equivalent) Recovery 50 to 150%[3]
Accuracy/Bias	Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV)	≤25% difference[3]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Samples must be extracted and analyzed within holding times (14 days to extraction, 40 days to analysis)
Representativeness/Usability	Cooler Temperature and Temperature Blank	Temperature 0 to 6 degrees Celsius (°C)[1]
Sensitivity	Evaluate laboratory LODs and LOQs against project DQOs	LOD for non-detect results less than the PAL
Completeness	Completeness of samples collected; completeness of analytical requirements per the UFP-QAPP	95% for all matrices

Notes:
[1] *Field Sampling Guidance* (ADEC 2017a)
[2] *DoD QSM v.5.1* (DoD 2017)
[3] *Underground Storage Tanks Procedures Manual* (ADEC 2017c)

TABLE 12-2 MEASUREMENT PERFORMANCE CRITERIA FOR METHOD SW8260C

Matrix: WORKSHEET #1 Soil/Groundwater/Seep Water
Analytical Group or Method: VOC
Concentration Level: SW8260C (medium-high level, methanol preserved)

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field duplicate	RPD <50% for soils[1] RPD <30% for waters[1]
Accuracy/Bias/Contamination	Blanks (MB, Test Blank [TB])	No analytes detected > LOQ and >1/10 the amount found in any sample. Sample results will be qualified if contamination is detected above the LOQ in the associated MB.
Accuracy	LCS and MS/MSD Recoveries	Soil: *DoD QSM v.5.1*, Table 23 of Appendix C[2] Water: *DoD QSM v.5.1*, Table 24 of Appendix C[2]
Precision	MS/MSD Recoveries (and LCS/LCSD, if performed)	RPD ≤20%[2]
Accuracy	Surrogate Recoveries	Soil: *DoD QSM v.5.1*, Table 23 of Appendix C[2] Water: *DoD QSM v.5.1*, Table 24 of Appendix C[2]
Accuracy/Bias	ICV and CCV	≤20% difference (≤50% for end of analytical batch CCV)[2]
Sensitivity	Internal Standards	Retention time ±10 seconds from retention time of the internal standard (IS) of the calibration midpoint and extracted ion current profile area within -50% to +100% of area from IS calibration midpoint standard
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Samples must be extracted and analyzed within holding times (Soil and Water: 14 days to analysis)
Representativeness/Usability	Cooler Temperature and Temperature Blank	Temperature 0 to 6 °C[1]
Sensitivity	Evaluate laboratory LODs and LOQs against project DQOs	LOD for non-detect results less than the PAL
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	95% for all matrices

Notes:
[1] *Field Sampling Guidance* (ADEC 2017a)
[2] *DoD QSM v.5.1* (DoD 2017). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

TABLE 12-3 MEASUREMENT PERFORMANCE CRITERIA FOR METHOD SW8270D SIM

Matrix: Soil/Groundwater/Seep Water
Analytical Group or Method: PAH
Concentration Level: Low-High

DQI	QC SAMPLE OR MEASUREMENT PERFORMANCE ACTIVITY	MEASUREMENT PERFORMANCE CRITERIA
Precision	Field duplicate	RPD <50% for soils[1] RPD <30% for waters[1]
Accuracy/Bias/Contamination	Blanks (MB)	No analytes detected > LOQ and >1/10 the amount found in any sample. Sample results will be qualified if contamination is detected above the LOQ in the associated MB.
Accuracy	LCS and MS/MSD Recoveries	*Soil: DoD QSM v.5.1*, Table 27 (soil), Table 28 (water) of Appendix C[2] Water: *DoD QSM v.5.1*, Table 27 (soil), Table 28 (water) of Appendix C[2]
Precision	MS/MSD Recoveries (and LCS/LCSD, if performed)	RPD ≤40%[2]
Accuracy	Surrogate Recoveries	Soil: *DoD QSM v.5.1*, Table 25 (soil) and Table 26 (water) of Appendix C[2] Water: *DoD QSM v.5.1*, Table 27 (soil) and Table 28 (water) of Appendix C[2]
Accuracy/Bias	ICV and CCV	≤20% difference (≤50% for end of analytical batch CCV)[2]
Accuracy	Tune Criteria	Check of mass tuning
Sensitivity	Internal Standards	Retention time ±10 seconds from retention time of the IS of the calibration midpoint and extracted ion current profile area within -50% to +100% of area from IS calibration midpoint standard[2]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Samples must be extracted and analyzed within holding times (Soil: 14 days to extraction, 40 days to analysis; Water: 7 days to extraction, 40 days to analysis)
Representativeness/Usability	Cooler Temperature and Temperature Blank	Temperature 0 to 6°C[1]
Sensitivity	Evaluate laboratory LODs and LOQs against project DQOs	LOD for non-detect results less than the PAL
Completeness	Completeness of samples collected; completeness of analytical requirements per the QAPP	95% for all matrices

Notes:
[1] *Field Sampling Guidance* (ADEC 2017a)
[2] *DoD QSM v.5.1* (DoD 2017). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

This page intentionally blank

WORKSHEET #13 – SECONDARY DATA USES AND LIMITATIONS

Secondary data was used to increase the understanding of current site conditions and develop the CMI Work Plan and associated appendices. Figures were prepared using secondary data with some feature locations estimated based on scaled drawings. The usability of secondary data was evaluated to ensure data is of the type and quality necessary to guide preparation of the CMI Work Plan and associated appendices.

Table 13-1 identifies data and information that was used for the CMI Work Plan and their originating sources; it also summarizes the intended use and limitations of the data. The numbers listed in the Data Source column of Table 13-1 correspond to the documents listed by Source Number in Table 13-2.

TABLE 13-1 SECONDARY DATA SUMMARY

SECONDARY DATA	DATA SOURCE	DATA USES RELATIVE TO CURRENT PROJECT	FACTORS AFFECTING THE RELIABILITY OF DATA AND LIMITATIONS ON DATA USE
Analytical Data	2-8, 9, 10, 12-21, 23, 26	These data sources, particularly source numbers 5-7, 12-13, 17-18, and 22, were used to study the nature and extent of historical contamination in soil and groundwater at Site 10/11, to evaluate plume stability, to identify data gaps, and to assist in development of the CMI Work Plan based on site conditions.	Changes in site conditions (i.e., construction, contaminant migration, and attenuation), potential data gaps, age of the data, and changing regulations and analytical methods were considered when reviewing the available data for usability.
Well Data and Groundwater Level Information	6, 19-21, 24, 25	Data were used to assess conditions of the wells, including assessment of damage, reviewing historical product measurements, and analyzing groundwater flow patterns that may impact the current contaminant extent.	The age of secondary data available as well as changing site conditions (i.e., construction, damaged wells) were considered when reviewing the data as conditions may be different than described.
Geologic Setting and Site Conditions	1-7, 19, 24	Data were used to understand historical contamination and identify current data gaps. Additionally, it was used to assess the geologic conditions of the site and surrounding area.	The historical data sources present various investigations with slightly different approaches; the available data was reviewed for applicability and relevancy to this site.

TABLE 13-1 SECOND DATA SUMMARY (CONTINUED)

SECONDARY DATA	DATA SOURCE	DATA USES RELATIVE TO CURRENT PROJECT	FACTORS AFFECTING THE RELIABILITY OF DATA AND LIMITATIONS ON DATA USE
Spatial Data	4-6,19, 23, 25	Data were used to prepare site figures using well, soil boring, and feature locations provided; additionally, secondary spatial data was used to determine historical contamination extent.	Secondary spatial data sources do not provide coordinates; review was required prior to implementing data for planning purposes. A survey will be conducted during field activities to accurately locate existing and new monitoring wells, site features, and sample locations for future use.
Regulatory Correspondence and Determinations	10, 11, 22	Data were used to prepare a CSM, to assess decisions previously determined for the site, and to comply with requirements while conducting fieldwork and preparing reports.	None.

TABLE 13-2 SECONDARY DATA SOURCES

SOURCE NUMBER	DOCUMENT TITLE	AUTHOR	DATE
1	Geologic and Geotechnical Investigation Phases 1 and 2A	CH2M Hill	December 1980
2	Hazardous Materials Survey and Environmental Site Assessment New Cold Storage Building US Coast Guard Support Center Kodak, Alaska	Shannon & Wilson, Inc	May 1992
3	Hazardous Material Survey and Environmental Site Assessment Cutter Storage Building, Building No. 22, and Parking Lots A and B at Hangar No. 2 US Coast Guard Support Center Kodiak, Alaska	Shannon & Wilson, Inc	May 1992
4	Final FRI/CMS Report Volume 5, Site - 10 Air Station	Science Applications International Corporation	February 1995
5	Final FRI/CMS Report, Volume 6, Site 11 - Paint Storage Building	Science Applications International Corporation	February 1995
6	Summary Data Report Sites 10/11 Air Station/Paint Storage Area	Shannon & Wilson, Inc	May 1997

TABLE 13-2 SECONDARY DATA SOURCES (CONTINUED)

SOURCE NUMBER	DOCUMENT TITLE	AUTHOR	DATE
7	Revised Draft CMS Sites 10/11	Shannon & Wilson, Inc	June 1999
8	1999 Summary Report, Airport Staging Area Site Investigation and Removal Action, F10AK100702_01.09_0500_a	Jacobs Engineering Group, Inc	April 2000
9	Final Corrective Measures Study (Shannon & Wilson, 1989)	Shannon & Wilson	September 2001
10	Groundwater Use Determination Air Station Site (Site 10) and Paint Storage Area (Site 11)	Hart Crowser, Inc	May 2002
11	ADEC Division of Spill Prevention and Response Contaminated Sites Remediation Program Air Station and Paint Storage Area, Determination	ADEC	June 2002
12	Draft Quarterly Report for Flow Monitoring, Environmental Sampling and Product Recovery Results, Site 10/11	Hart Crowser, Inc	September 2003
13	2004 Summary Report for Environmental Sampling and Analysis and Product Recovery Results, Site 10/11	Hart Crowser, Inc	February 2005
14	October 2005 to March 2006 Site Data for Groundwater Monitoring and Product Recovery, Site 10/11	Clarus Technologies, LLC	April 2006
15	March 2006 to June 29, 2006 Site Data for Groundwater Monitoring and Product Recovery, Site 10/11	Clarus Technologies, LLC	October 2006
16	January 2007 through June 2007 Site Data for Groundwater Monitoring and Product Recovery, Site 10/11	Clarus Technologies, LLC	September 2007
17	November 2007 Groundwater Sampling and Analysis Report, Site 10/11	Clarus Technologies, LLC	September 2008
18	June 2008 Groundwater Sampling and Analysis Report, Site 10/11	Clarus Technologies, LLC	December 2008
19	April through September 2009, Free Product Monitoring and Recovery Biannual Report and Evaluation for Site 6B and Site 10/11 and Well Decommissioning and Repair	Clarus Technologies, LLC	January 2010
20	Free Product Monitoring and Recovery Quarterly Report - Sites 6B and 10/11 July 2011 - Sept 2011	Windward Environmental, LLC and Clarus Technologies, LLC	January 2012

TABLE 13-2 SECONDARY DATA SOURCES (CONTINUED)

SOURCE NUMBER	DOCUMENT TITLE	AUTHOR	DATE
21	Free Product Monitoring and Recovery Quarterly Report Phase 2 Quarterly Report - Sites 6B and 10/11 Oct 2011 - Dec 2011	Windward Environmental, LLC and Clarus Technologies, LLC	February 2012
22	RCRA Final Permit Reissuance United States Coast Guard, BSU Kodiak EPA ID No. AK9 69033 0742	EPA	August 2014
23	Final Soil Sampling to Support Utility Repairs Building N1, Base Industrial Area, and Petroleum, Oil, and Lubricants Pipeline Field Data Report	Ahtna Environmental, Inc	July 2016
24	Final Site Compliance Report Site 10/11 Air Station/Paint Storage	Ahtna Environmental, Inc	April 2017
25	Final Environmental Management Plan USCG AIRSTA Kodiak C130J Facility Upgrades Phase 1 (Shannon & Wilson, Inc.)	Shannon & Wilson, Inc	June 2017
26	Final Monitoring Well Inventory Technical Memorandum	Ahtna Environmental, Inc	March 2018
27	Environmental Analytical Data Report, Secondary Containment Improvements for Tanks N-10/N-12, N-19/N-20 and N-60	North Wind Services	October 2018

WORKSHEET #14 / 16 – PROJECT TASKS & SCHEDULE

Table 14-1 presents the preliminary project schedule with the specific tasks and the approximate due date or end date of each task. Note that the 2020 and 2021 Annual Long-Term Monitoring events and reports are not included in this schedule since that work has yet to be contracted.

TABLE 14-1 PROJECT SCHEDULE – CMI WORK PLAN THROUGH CMI REPORT

PROJECT ACTIVITY	SCHEDULE (APPROXIMATE)
Submit Draft CMI Work Plan	7 March 2019
Agency Review, Draft CMI Work Plan	8 through 29 March 2019
Submit Draft Final CMI Work Plan	5 April 2019
Agency Review, Draft Final CMI Work Plan	8 through 19 April 2019
Submit Final CMI Work Plan	26 April 2019
Fieldwork –Mobilization	29 April 2019
Fieldwork – Demobilization	24 May 2019
Submit Draft CMI Report	30 August 2019
Agency Review, Draft CMI Report	2 September through 4 October 2019
Submit Draft Final CMI Report	18 October 2019
Agency Review, Draft Final CMI Report	21 October through 8 November 2019
Submit Final CMI Report	15 November 2019

This page intentionally blank

WORKSHEET #15 – PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

This Worksheet and associated tables provide target analyte lists, analytical methods, PALs, and laboratory-specific reference limits (DL, LOD, and LOQ). The purpose of this Worksheet and associated tables is to demonstrate that the selected analytical laboratory and analytical methods can provide accurate data (i.e., quantitative results with known precision and bias) at the PAL(s). To meet MPC for sensitivity, the LODs for non-detections and the LOQs for detections shall be less than the PALs.

15.1 SOIL AND GROUNDWATER PROJECT ACTION LEVELS

Groundwater beneath Site 10/11 is not presently being used for drinking water and is not expected to be of suitable quality for use as drinking water because of the potential for salt water intrusion and the existing industrial land use. In June 2002, ADEC issued approval for development of alternative cleanup levels at the Air Station area (including Site 10/11) under 18 AAC 75.350. At that time, alternative cleanup values were set for groundwater and soil migration to groundwater cleanup levels at 10 times the Table C groundwater and Tables B1/B2 cleanup levels, respectively (ADEC 2002). These alternative cleanup levels are the basis for the selected remedy at Site 10/11.

Through this determination, the Site 10/11 site-specific project action limits (PALs) for groundwater and soil (Worksheet #15) are as follows:

- **Soil** – PALs are the most conservative of the Human Health cleanup level or 10 times the migration to groundwater soil cleanup levels from Tables B1 and B2 over 40-inch zone of 18 AAC 75.341 (ADEC 2018a).
- **Groundwater** – PALs are 10 times the groundwater cleanup levels from 18 AAC 75.345 Table C and 18 AAC 75.350 (ADEC 2018a).

The applicability of the 350 determination at Site 10/11 and the resulting PALs described above will be reviewed following the 2019 Baseline Monitoring Event (Section 17.1.1).

15.2 SURFACE WATER PROJECT ACTION LEVELS

Alaska water quality criteria (18 AAC 70, ADEC 2018b), including the numeric criteria specified in the *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances* (ADEC 2008), apply to this site. Based on the known contaminants at the site (Section 2.6), total aqueous hydrocarbons (TAqH), as represented by the sum of benzene, toluene, ethylbenzene, and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs), and total aromatic hydrocarbons (TAH), as represented by the sum of BTEX compounds, are the primary constituents of interest in surface water. TAqH must be less than 15 micrograms per liter (µg/L), and TAH must be less than 10 µg/L. Other analytes in surface water will also be compared to applicable numeric criteria (ADEC 2008).

15.3 ANALYTICAL METHODS

All samples, soil and water, will be analyzed for DRO/RRO (AK102/AK103), volatile organic compounds (VOCs) (SW8260C), and PAHs (SW8270D SIM). SGS Labs in Anchorage, Alaska will be the analytical laboratory for the project. The laboratory LOQs, LODs, and DLs presented in Tables 15-1 and 15-2 represent the achievable limits for analytes in a laboratory matrix. In Table 15-2, lab limits are compared to Project Screening Levels (PSLs), which are the most stringent applicable groundwater cleanup levels,

instead of PALs described in Section 15.1. Note that, in general, these numbers are 10 times less than the PALs.

For analytes with laboratory LODs that do not meet the cleanup levels due to limitations in the sensitivity of the method, the sample LOD will be evaluated against the laboratory LOD. Additionally, the analysis of field samples may result in sample dilutions that cause laboratory reporting limits to be elevated above PALs. Non-detect results will be reported to the LOD; if the LOD is above the PAL, then it cannot be definitively said that the analyte is not present at or below the PAL. Non-detect sample results with LOQs and LODs that exceed the PALs will be evaluated for potential effects on the usability of these data with regard to project DQOs.

TABLE 15-1 PROJECT ACTION LIMITS AND LABORATORY SPECIFIC REPORTING LIMITS FOR SOIL

ANALYLE	METHOD	CASRN	UNITS	ADEC HUMAN HEALTH[1]	ADEC MIGRATION TO GROUNWDATER[1]	PAL[2]	LABORATORY LMITS[3]		
							DL	LOD	LOQ
Diesel-range organics (DRO)	AK102	NS	mg/kg	8,250	230	2300	6.2	10	20
Residual-range organics (RRO)	AK103	NS	mg/kg	8,300	9,700	8,300	6.2	10	20
1,1,1,2-Tetrachloroethane	SW8260C	630-20-6	mg/kg	15	0.022	0.22	0.0062	0.01	0.02
1,1,1-Trichloroethane	SW8260C	71-55-6	mg/kg	360	32	320	0.0078	0.0125	0.025
1,1,2,2-Tetrachloroethane	SW8260C	79-34-5	mg/kg	4.4	0.003	0.03	0.0039	0.00625	0.0125
1,1,2-Trichloroethane	SW8260C	79-00-5	mg/kg	1.1	0.0014	0.014	0.0031	0.005	0.01
1,1,2-Trichloro-1,2,2-trifluoroethane	SW8260C	76-13-1	mg/kg	740	310	740	0.031	0.05	0.1
1,1-Dichloroethane	SW8260C	75-34-3	mg/kg	33	0.092	0.92	0.0078	0.0125	0.025
1,1-Dichloroethene	SW8260C	75-35-4	mg/kg	240	1.2	12	0.0078	0.0125	0.025
1,1-Dichloropropene	SW8260C	563-58-6	mg/kg	NS	NS	NS	0.0078	0.0125	0.025
1,2,3-Trichlorobenzene	SW8260C	87-61-6	mg/kg	66	0.15	1.5	0.015	0.025	0.05
1,2,3-Trichloropropane	SW8260C	96-18-4	mg/kg	0.054	0.000031	0.00031	**0.0078**	**0.0125**	**0.025**
1,2,4-Trichlorobenzene	SW8260C	120-82-1	mg/kg	32	0.082	0.82	0.0078	0.0125	0.025
1,2,4-Trimethylbenzene	SW8260C	95-63-6	mg/kg	43	0.61	6.1	0.015	0.025	0.05
1,2-Dibromo-3-chloropropane[4]	SW8260C	96-12-8	mg/kg	NA	NA	0.053	0.031	0.05	**0.1**
1,2-Dibromoethane	SW8260C	106-93-4	mg/kg	0.31	0.00024	0.0024	**0.0031**	**0.005**	**0.01**
1,2-Dichlorobenzene	SW8260C	95-50-1	mg/kg	78	2.4	24	0.0078	0.0125	0.025
1,2-Dichloroethane	SW8260C	107-06-2	mg/kg	3.9	0.0055	0.055	0.0031	0.005	**0.01**
1,2-Dichloropropane	SW8260C	78-87-5	mg/kg	12	0.030	0.30	0.0031	0.005	0.01
1,3,5-Trimethylbenzene	SW8260C	108-67-8	mg/kg	37	0.66	6.6	0.0078	0.0125	0.025
1,3-Dichlorobenzene	SW8260C	541-73-1	mg/kg	62	2.3	23	0.0078	0.0125	0.025
1,3-Dichloropropane[4]	SW8260C	142-28-9	mg/kg	NS	NS	16,000	0.0031	0.005	0.01
1,4-Dichlorobenzene	SW8260C	106-46-7	mg/kg	15	0.037	0.37	0.0078	0.0125	0.025
2,2-Dichloropropane[5]	SW8260C	594-20-7	mg/kg	12	0.030	0.30	0.0078	0.0125	0.025
2-Butanone	SW8260C	78-93-3	mg/kg	23,000	15	150	0.078	0.125	0.25

TABLE 15-1 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC REPORTING LIMITS FOR SOIL (CONTINUED)

ANALYLE	METHOD	CASRN	UNITS	ADEC HUMAN HEALTH[1]	ADEC MIGRATION TO GROUNWDATER[1]	PAL[2]	LABORATORY LMITS[3]		
							DL	LOD	LOQ
2-Chlorotoluene[4]	SW8260C	95-49-8	mg/kg	NS	NS	16,000	0.0078	0.0125	0.025
2-Hexanone	SW8260C	591-78-6	mg/kg	210	0.11	1.1	0.031	0.05	0.1
4-Chlorotoluene[4]	SW8260C	106-43-4	mg/kg	NS	NS	16,000	0.0078	0.0125	0.025
4-Isopropyltoluene	SW8260C	99-87-6	mg/kg	NS	NS	NS	0.0078	0.0125	0.025
4-Methyl-2-pentanone (MIBK)	SW8260C	108-10-1	mg/kg	2,200	18	180	0.078	0.125	0.25
Benzene	SW8260C	71-43-2	mg/kg	8.1	0.022	0.22	0.0039	0.00625	0.0125
Bromobenzene	SW8260C	108-86-1	mg/kg	160	0.36	3.6	0.0078	0.0125	0.025
Bromochloromethane[4]	SW8260C	74-97-5	mg/kg	NS	NS	1,500	0.0078	0.0125	0.025
Bromodichloromethane	SW8260C	75-27-4	mg/kg	2.6	0.0043	0.043	0.0078	0.0125	0.025
Bromoform	SW8260C	75-25-2	mg/kg	170	0.1	1	0.0078	0.0125	0.025
Bromomethane	SW8260C	74-83-9	mg/kg	7.4	0.024	0.24	0.062	0.1	0.2
Carbon disulfide	SW8260C	75-15-0	mg/kg	500	2.9	29	0.031	0.05	0.1
Carbon tetrachloride	SW8260C	56-23-5	mg/kg	6.6	0.021	0.21	0.0039	0.00625	0.0125
Chlorobenzene	SW8260C	108-90-7	mg/kg	180	0.46	4.6	0.0078	0.0125	0.025
Chloroethane	SW8260C	75-00-3	mg/kg	1,400	72	720	0.062	0.1	0.2
Chloroform	SW8260C	67-66-3	mg/kg	2.9	0.0071	0.071	0.0078	0.0125	0.025
Chloromethane	SW8260C	74-87-3	mg/kg	120	0.61	6.1	0.0078	0.0125	0.025
cis-1,2-Dichloroethene	SW8260C	156-59-2	mg/kg	170	0.12	1.2	0.0078	0.0125	0.025
cis-1,3-Dichloropropene	SW8260C	10061-02-6	mg/kg	15	0.018	0.18	0.0039	0.00625	0.0125
Dibromochloromethane	SW8260C	124-48-1	mg/kg	88	0.0027	0.027	0.0078	0.0125	0.025
Dibromomethane	SW8260C	74-95-3	mg/kg	22	0.025	0.25	0.0078	0.0125	0.025
Dichlorodifluoromethane	SW8260C	75-71-8	mg/kg	110	3.9	39	0.015	0.025	0.05
Ethylbenzene	SW8260C	100-41-4	mg/kg	35	0.13	1.3	0.0078	0.0125	0.025
Hexachlorobutadiene	SW8260C	87-68-3	mg/kg	3.3	0.02	0.2	0.0062	0.01	0.02
Isopropylbenzene	SW8260C	98-82-8	mg/kg	54	5.6	54	0.0078	0.0125	0.025

TABLE 15-1 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC REPORTING LIMITS FOR SOIL (CONTINUED)

ANALYLE	METHOD	CASRN	UNITS	ADEC HUMAN HEALTH[1]	ADEC MIGRATION TO GROUNWDATER[1]	PAL[2]	LABORATORY LMITS[3]		
							DL	LOD	LOQ
Methyl tert-butyl ether	SW8260C	2165-09-26	mg/kg	480	0.4	4	0.031	0.05	0.1
Methylene Chloride	SW8260C	75-09-2	mg/kg	360	0.33	3.3	0.031	0.05	0.1
Naphthalene	SW8260C	91-20-3	mg/kg	20	0.038	0.38	0.0078	0.0125	0.025
n-Butylbenzene	SW8260C	104-51-8	mg/kg	20	23	20	0.0078	0.0125	0.025
N-Propylbenzene	SW8260C	103-65-1	mg/kg	52	9.1	52	0.0078	0.0125	0.025
o-Xylene	SW8260C	95-47-6	mg/kg	57	1.5	15	0.0078	0.0125	0.025
P & M-Xylene	SW8260C	179601-23-1	mg/kg	57	1.5	15	0.015	0.025	0.05
sec-Butylbenzene	SW8260C	135-98-8	mg/kg	28	42	28	0.0078	0.0125	0.025
Styrene	SW8260C	100-42-5	mg/kg	180	10	100	0.0078	0.0125	0.025
tert-Butylbenzene	SW8260C	98-06-6	mg/kg	35	11	35	0.0078	0.0125	0.025
Tetrachloroethene	SW8260C	127-18-4	mg/kg	68	0.19	1.9	0.0039	0.00625	0.0125
Toluene	SW8260C	108-88-3	mg/kg	200	6.7	67	0.0078	0.0125	0.025
trans-1,2-Dichloroethene	SW8260C	156-60-5	mg/kg	960	1.3	13	0.0078	0.0125	0.025
trans-1,3-Dichloropropene	SW8260C	10061-01-5	mg/kg	15	0.018	0.18	0.0039	0.00625	0.0125
Trichloroethene	SW8260C	79-01-6	mg/kg	3.5	0.011	0.11	0.0031	0.005	0.01
Trichlorofluoromethane	SW8260C	75-69-4	mg/kg	980	41	410	0.015	0.025	0.05
Vinyl acetate	SW8260C	108-05-04	mg/kg	1,000	1.1	11	0.031	0.05	0.1
Vinyl chloride	SW8260C	75-01-4	mg/kg	0.61	0.0008	0.008	0.0031	0.005	0.01
Xylenes (total)	SW8260C	1330-20-7	mg/kg	57	1.5	15	0.0228	0.0375	0.075
1-Methylnaphthalene	SW8270D SIM	90-12-0	mg/kg	68	0.41	4.1	0.00625	0.0125	0.025
2-Methylnaphthalene	SW8270D SIM	91-57-6	mg/kg	250	1.3	13	0.00625	0.0125	0.025
Acenaphthene	SW8270D SIM	83-32-9	mg/kg	3,800	37	370	0.00625	0.0125	0.025
Acenaphthylene	SW8270D SIM	208-96-8	mg/kg	1,900	18	180	0.00625	0.0125	0.025
Anthracene	SW8270D SIM	120-12-7	mg/kg	19,000	390	3,900	0.00625	0.0125	0.025
Benzo[a]anthracene	SW8270D SIM	56-55-3	mg/kg	12	0.70	7	0.00625	0.0125	0.025

TABLE 15-1 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC REPORTING LIMITS FOR SOIL (CONTINUED)

ANALYLE	METHOD	CASRN	UNITS	ADEC HUMAN HEALTH[1]	ADEC MIGRATION TO GROUNWDATER[1]	PAL[2]	LABORATORY LMITS[3]		
							DL	LOD	LOQ
Benzo[a]pyrene	SW8270D SIM	50-32-8	mg/kg	1.2	1.9	1.2	0.00625	0.0125	0.025
Benzo[b]fluoranthene	SW8270D SIM	205-99-2	mg/kg	12	20	12	0.00625	0.0125	0.025
Benzo[g,h,i]perylene	SW8270D SIM	191-24-2	mg/kg	1,900	15,000	1,900	0.00625	0.0125	0.025
Benzo[k]fluoranthene	SW8270D SIM	207-08-9	mg/kg	120	190	120	0.00625	0.0125	0.025
Chrysene	SW8270D SIM	218-01-9	mg/kg	1,200	600	1,200	0.00625	0.0125	0.025
Dibenz(a,h)anthracene	SW8270D SIM	53-70-3	mg/kg	1.2	6.3	1.2	0.00625	0.0125	0.025
Fluoranthene	SW8270D SIM	206-44-0	mg/kg	2,500	590	2,500	0.00625	0.0125	0.025
Fluorene	SW8270D SIM	86-73-7	mg/kg	2,500	36	360	0.00625	0.0125	0.025
Indeno[1,2,3-cd]pyrene	SW8270D SIM	193-39-5	mg/kg	12	65	12	0.00625	0.0125	0.025
Naphthalene	SW8270D SIM	91-20-3	mg/kg	20	0.038	0.38	0.005	0.010	0.020
Phenanthrene	SW8270D SIM	85-01-8	mg/kg	1,900	39	390	0.00625	0.0125	0.025
Pyrene	SW8270D SIM	129-00-0	mg/kg	1,900	87	870	0.00625	0.0125	0.025

Notes:

[1] 18 AAC 75, Method Two, Tables B1 and B2, over 40-inch zone cleanup levels (ADEC 2018a).

[2] Project action limits are the most conservative of the Human Health and ten times the Migration to Groundwater cleanup levels for the over 40-inch zone in 18 AAC 75 (ADEC 2018a). For analytes that do not have ADEC cleanup levels, the EPA Regional Screening Level for residential soil (cancer risk 1E-06 and HQ = 1.0) are presented (EPA 2017).

[3] Laboratory limits for all methods from SGS Anchorage.

[4] For analytes that do not have ADEC cleanup levels, the EPA Regional Screening Levels for residential soil are presented (EPA 2017).

[5] The ADEC cleanup level for 1,2-dichloropropane is presented as surrogate value for 2,2-dichloropropane.

Bold indicates that the laboratory DL, LOD, or LOQ exceeds the PAL.

DL = detection limit
HQ = hazard quotient
LOD = limit of detection
LOQ = limit of quantitation
mg/kg = milligram(s) per kilogram
NS = not specified

TABLE 15-2 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC REPORTING LIMITS FOR GROUNDWATER AND SEEP WATER

ANALYTE	METHOD	CASRN	UNITS	PSL[1]	LABORATORY LIMITS[2]		
					DL	LOD	LOQ
Diesel-range organics (DRO)	AK102	NS	µg/L	1,500	180	300	600
Residual-range organics (RRO)	AK103	NS	µg/L	1,100	150	250	500
1,1,1,2-Tetrachloroethane	SW8260C	630-20-6	µg/L	5.7	0.15	0.25	0.5
1,1,1-Trichloroethane	SW8260C	71-55-6	µg/L	8,000	0.31	0.5	1
1,1,2,2-Tetrachloroethane	SW8260C	79-34-5	µg/L	0.76	0.15	0.25	0.5
1,1,2-Trichloroethane	SW8260C	79-00-5	µg/L	0.41	0.12	0.2	0.4
1,1-Dichloroethane	SW8260C	75-34-3	µg/L	28	0.31	0.5	1
1,1-Dichloroethene	SW8260C	75-35-4	µg/L	280	0.31	0.5	1
1,1-Dichloropropene	SW8260C	563-58-6	µg/L	NS	0.31	0.5	1
1,2,3-Trichlorobenzene	SW8260C	87-61-6	µg/L	7	0.31	0.5	1
1,2,3-Trichloropropane	SW8260C	96-18-4	µg/L	0.0075	**0.31**	**0.5**	**1**
1,2,4-Trichlorobenzene	SW8260C	120-82-1	µg/L	4.0	0.31	0.5	1
1,2,4-Trimethylbenzene	SW8260C	95-63-6	µg/L	56	0.31	0.5	1
1,2-Dibromo-3-chloropropane[4]	SW8260C	96-12-8	µg/L	0.00033	**3.1**	**5**	**10**
1,2-Dibromoethane	SW8260C	106-93-4	µg/L	0.075	**0.31**	**0.5**	**1**
1,2-Dichlorobenzene	SW8260C	95-50-1	µg/L	300	0.31	0.5	1
1,2-Dichloroethane	SW8260C	107-06-2	µg/L	1.7	0.15	0.25	0.5
1,2-Dichloropropane	SW8260C	78-87-5	µg/L	8.2	0.31	0.5	1
1,3,5-Trimethylbenzene	SW8260C	108-67-8	µg/L	60	0.31	0.5	1
1,3-Dichlorobenzene	SW8260C	541-73-1	µg/L	300	0.31	0.5	1
1,3-Dichloropropane[4]	SW8260C	142-28-9	µg/L	370	0.15	0.25	0.5
1,4-Dichlorobenzene	SW8260C	106-46-7	µg/L	4.8	0.15	0.25	0.5
2,2-Dichloropropane[4]	SW8260C	594-20-7	µg/L	8.2	0.31	0.5	1
2-Butanone	SW8260C	78-93-3	µg/L	5,600	3.1	5	10
2-Chlorotoluene[4]	SW8260C	95-49-8	µg/L	240	0.31	0.5	1
2-Hexanone	SW8260C	591-78-6	µg/L	38	3.1	5	10
4-Chlorotoluene	SW8260C	106-43-4	µg/L	250	0.31	0.5	1
4-Isopropyltoluene	SW8260C	99-87-6	µg/L	NS	0.31	0.5	1
4-Methyl-2-pentanone (MIBK)	SW8260C	108-10-1	µg/L	6,300	3.1	5	10
Benzene	SW8260C	71-43-2	µg/L	4.6	0.12	0.2	0.4
Bromobenzene	SW8260C	108-86-1	µg/L	62	0.31	0.5	1
Bromochloromethane[4]	SW8260C	74-97-5	µg/L	83	0.31	0.5	1
Bromodichloromethane	SW8260C	75-27-4	µg/L	1.3	0.15	0.25	0.5
Bromoform	SW8260C	75-25-2	µg/L	33	0.31	0.5	1
Bromomethane	SW8260C	74-83-9	µg/L	7.5	1.5	2.5	5

TABLE 15-2 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC REPORTING LIMITS FOR GROUNDWATER AND SEEP WATER (CONTINUED)

ANALYTE	METHOD	CASRN	UNITS	PSL[1]	LABORATORY LIMITS[2]		
					DL	LOD	LOQ
Carbon disulfide	SW8260C	75-15-0	µg/L	810	3.1	5	10
Carbon tetrachloride	SW8260C	56-23-5	µg/L	4.6	0.31	0.5	1
Chlorobenzene	SW8260C	108-90-7	µg/L	78	0.15	0.25	0.5
Chloroethane	SW8260C	75-00-3	µg/L	21,000	0.31	0.5	1
Chloroform	SW8260C	67-66-3	µg/L	2.2	0.31	0.5	1
Chloromethane	SW8260C	74-87-3	µg/L	190	0.31	0.5	1
cis-1,2-Dichloroethene	SW8260C	156-59-2	µg/L	36	0.31	0.5	1
cis-1,3-Dichloropropene	SW8260C	10061-01-5	µg/L	4.7	0.15	0.25	0.5
Dibromochloromethane	SW8260C	124-48-1	µg/L	8.7	0.15	0.25	0.5
Dibromomethane	SW8260C	74-95-3	µg/L	8.3	0.31	0.5	1
Dichlorodifluoromethane	SW8260C	75-71-8	µg/L	200	0.31	0.5	1
Ethylbenzene	SW8260C	100-41-4	µg/L	15	0.31	0.5	1
Hexachlorobutadiene	SW8260C	87-68-3	µg/L	1.4	0.31	0.5	1
Isopropylbenzene	SW8260C	98-82-8	µg/L	450	0.31	0.5	1
Methyl tert-butyl ether	SW8260C	1634-04-4	µg/L	140	3.1	5	10
Methylene Chloride	SW8260C	75-09-2	µg/L	110	1	2.5	5
Naphthalene	SW8260C	91-20-3	µg/L	1.7	0.31	0.5	1
n-Butylbenzene	SW8260C	104-51-8	µg/L	1,000	0.31	0.5	1
N-Propylbenzene	SW8260C	103-65-1	µg/L	660	0.31	0.5	1
o-Xylene	SW8260C	95-47-6	µg/L	190	0.31	0.5	1
P & M-Xylene	SW8260C	179601-23-1	µg/L	190	0.62	1	2
sec-Butylbenzene	SW8260C	135-98-8	µg/L	2,000	0.31	0.5	1
Styrene	SW8260C	100-42-5	µg/L	1,200	0.31	0.5	1
tert-Butylbenzene	SW8260C	98-06-6	µg/L	690	0.31	0.5	1
Tetrachloroethene	SW8260C	127-18-4	µg/L	41	0.31	0.5	1
Toluene	SW8260C	108-88-3	µg/L	1,100	0.31	0.5	1
trans-1,2-Dichloroethene	SW8260C	156-60-5	µg/L	360	0.31	0.5	1
trans-1,3-Dichloropropene	SW8260C	10061-02-6	µg/L	4.7	0.31	0.5	1
Trichloroethene	SW8260C	79-01-6	µg/L	2.8	0.31	0.5	1
Trichlorofluoromethane	SW8260C	75-69-4	µg/L	5,200	0.31	0.5	1
Vinyl acetate	SW8260C	108-05-04	µg/L	410	3.1	5	10
Vinyl chloride	SW8260C	75-01-4	µg/L	0.19	0.05	0.075	0.15
Xylenes (total)	SW8260C	1330-20-7	µg/L	190	1	1.5	3
1-Methylnaphthalene	SW8270D SIM	90-12-0	µg/L	11	0.015	0.025	0.05
2-Methylnaphthalene	SW8270D SIM	91-57-6	µg/L	36	0.015	0.025	0.05

TABLE 15-2 PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC REPORTING LIMITS FOR GROUNDWATER AND SEEP WATER (CONTINUED)

ANALYTE	METHOD	CASRN	UNITS	PSL[1]	LABORATORY LIMITS[2]		
					DL	LOD	LOQ
Acenaphthene	SW8270D SIM	83-32-9	µg/L	530	0.015	0.025	0.05
Acenaphthylene	SW8270D SIM	208-96-8	µg/L	260	0.015	0.025	0.05
Anthracene	SW8270D SIM	120-12-7	µg/L	43	0.015	0.025	0.05
Benzo[a]anthracene	SW8270D SIM	56-55-3	µg/L	0.3	0.015	0.025	0.05
Benzo[a]pyrene	SW8270D SIM	50-32-8	µg/L	0.25	0.0062	0.01	0.02
Benzo[b]fluoranthene	SW8270D SIM	205-99-2	µg/L	2.5	0.015	0.025	0.05
Benzo[g,h,i]perylene	SW8270D SIM	191-24-2	µg/L	0.26	0.015	0.025	0.05
Benzo[k]fluoranthene	SW8270D SIM	207-08-9	µg/L	0.8	0.015	0.025	0.05
Chrysene	SW8270D SIM	218-01-9	µg/L	2	0.015	0.025	0.05
Dibenz(a,h)anthracene	SW8270D SIM	53-70-3	µg/L	0.25	0.0062	0.01	0.02
Fluoranthene	SW8270D SIM	206-44-0	µg/L	260	0.015	0.025	0.05
Fluorene	SW8270D SIM	86-73-7	µg/L	290	0.015	0.025	0.05
Indeno[1,2,3-cd]pyrene	SW8270D SIM	193-39-5	µg/L	0.19	0.015	0.025	0.05
Naphthalene	SW8270D SIM	91-20-3	µg/L	1.7	0.031	0.05	0.1
Phenanthrene	SW8270D SIM	85-01-8	µg/L	170	0.015	0.025	0.05
Pyrene	SW8270D SIM	129-00-0	µg/L	120	0.015	0.025	0.05
TAH[3]	SW8270DSIM	NA	µg/L	10	NA	NA	NA
TAqH[3]	SW8270DSIM and SW8260C	NA	µg/L	15	NA	NA	NA

Notes:

[1] PSLs are the Table C groundwater cleanup levels in 18 AAC 75 (ADEC 2018a). For analytes that do not have ADEC cleanup levels, the EPA Regional Screening Level for tapwater is used – see Note 4.

[2] Laboratory limits for all methods from SGS Anchorage.

[3] Alaska Water Quality Standards, 18 AAC 70 (ADEC 2018b). TAH concentrations are calculated by summing the BTEX compounds. TAqH concentrations are calculated by summing TAH (BTEX compounds) plus the 16 PAH compounds: acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,hi,)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene. TAH and TAqH criteria are shown for the individual BTEX and PAH compounds, respectively.

[4] EPA Regional Screening Level for tapwater (cancer risk 1E-06 and HQ = 1.0) (EPA 2017).

[5] The ADEC cleanup level for 1,2-dichloropropane is presented as surrogate value for 2,2-dichloropropane.

Bold indicates that the laboratory DL, LOD, or LOQ exceeds the PAL.

µg/L = microgram(s) per liter
DL = detection limit
HQ = hazard quotient
LOD = limit of detection
LOQ = limit of quantitation
NA = not applicable
NS = not specified
PSL = Project Screening Level
TAH = total aromatic hydrocarbons
TAqH = total aqueous hydrocarbons

This page intentionally blank

WORKSHEET #17 – SAMPLING DESIGN AND RATIONALE

The overall project objective is to ensure the selected remedy is protective of human health and the environment by measuring NAPL thickness, groundwater concentration, and seep concentration data to:

- Determine if contaminants are migrating into Inner Womens Bay
- Establish that the plume is stable or shrinking.

The selected remedy requires product monitoring in all wells. The presence or absence of product will be documented. The selected remedy also requires groundwater monitoring in sentry wells and seep sampling in the intertidal zone to ensure that there is no release of contaminants above ADEC ambient water quality standards into Inner Womens Bay.

The plan for groundwater and seep monitoring at Site 10/11 is summarized below and detailed in the following subsections. This monitoring will assess the remaining impacts and progress towards complying with PALs.

17.1 MONITORING PLAN SUMMARY

VII) 2019 BASELINE MONITORING EVENT

A baseline monitoring event will be performed in 2019. The objectives of the baseline monitoring event are as follows:

1. **Monitoring Well Installation** – Re-establish the monitoring well network by installing eight new wells to replace destroyed/damaged wells and fill previous data gaps
2. **NAPL Survey** – Determine if free product exists in any of the Site 10/11 monitoring well and the findings will be documented
3. **Groundwater Sampling** – Characterize the current nature and extent of groundwater contamination at the site above PALs
4. **Seep Sampling** – Determine if seep samples exceed surface water cleanup standards

Upon completion of the baseline NAPL survey, seep sampling, and groundwater sampling event, a CMI Report will be prepared. The CMI Report will summarize the fieldwork and lab results, identify necessary revisions to the current selected remedy, and develop the specific scope for the long-term monitoring and management of the site. We anticipate that at least two additional annual monitoring events will be performed in 2020 and 2021. While the specifics of the additional monitoring events will be defined in the CMI Report, it is likely that the additional monitoring events will include a NAPL survey (and potential removal), sentry well groundwater sampling, and seep sampling.

17.2 BASELINE MONITORING EVENT

VIII) MONITORING WELL INSTALLATION

Numerous monitoring wells at the site have been destroyed or damaged during recent construction/repaving activities that have occurred onsite. Table 17-1 provides a summary of the wells that have been destroyed/damaged. As a first step during the baseline sampling event, a new site

reconnaissance/well inventory will be performed to determine the actual number of existing and viable wells onsite.

Eight new wells will be installed in key locations to provide a network of sentry wells for on-going groundwater monitoring or otherwise fill a data gap at Site 10/11. Figure 5 of the CMI Work Plan shows the locations of the proposed monitoring wells and Table 17-2 provides the rationale for the location of each new well.

TABLE 17-1 WELL STATUS

WELL ID	MONUMENT TYPE[1]	DIAMETER (inches)[1]	TD (feet btoc)[1]	DTW (feet btoc)[1]	2011 PRODUCT PRESENT[2]	2017 AND 2018 OBSERVATIONS / CONDITION[1, 3]	NEW PROPOSED WELL TO REPLACE DAMAGED/REMOVED WELL	MONITORING PLAN OVERVIEW[4,7]
MW-10-003	Flush Mount	4	13.46	5.57	No	2017: Good 2018: Found	-	NAPL survey Baseline sampling
MW-10-018	Flush Mount	Unknown	NM	NM	No	2017: Found, but damaged 2018: Found	MW-10-046 (Figure 5 of the CMI Work Plan)	NAPL survey Baseline sampling
MW-10-019	Flush Mount	4	NM	NM	Yes	2017: Found, but damaged 2018: Removed during construction 2019: Replaced by construction contractor	-	NAPL Survey Baseline sampling
MW-10-020	Stickup	2	9.42	15.77	No	2017: Found, but damaged 2018: Gone, in construction area 2019: Replaced by construction contractor	-	NAPL Survey Baseline sampling
MW-10-021	Flush Mount	2	14.15	3.96	No	2017: No compression cap 2018: Gone, in construction area 2019: Replaced by construction contractor	-	NAPL Survey Baseline sampling
MW-10-022	Flush Mount	2	14.58	4.58	Yes	2017: Product at 4.56, product absorbing pad/ good 2018: No observations provided	-	NAPL survey Baseline sampling
MW-10-023	-	-	-	-	No	No observations provided (likely gone)	MW-10-045 (Figure 5 of the CMI Work Plan)	NAPL survey Baseline sampling
MW-10-024	Flush Mount	2	15.88	7.7	No	2017: Didn't have screws 2018: Found	-	NAPL survey Baseline sampling

TABLE 17-1 WELL STATUS (CONTINUED)

WELL ID	MONUMENT TYPE[1]	DIAMETER (inches)[1]	TD (feet btoc)[1]	DTW (feet btoc)[1]	2011 PRODUCT PRESENT[2]	2017 AND 2018 OBSERVATIONS / CONDITION[1, 3]	NEW PROPOSED WELL TO REPLACE DAMAGED/REMOVED WELL	MONITORING PLAN OVERVIEW[4,7]
MW-10-025	Flush Mount	2	15.92	7.1	Yes	2017: No screws, product absorbing pad/good 2018: Found	-	NAPL survey Baseline sampling
MW-10-026	Flush Mount	2	15.79	7.81	Yes	2017: Damaged monument 2018: Found	-	NAPL survey Baseline sampling
MW-10-030/-027[6]	Flush Mount	2	NM	6.84	No	No observations provided	-	NAPL survey Baseline sampling
MW-10-031	Flush Mount	Unknown	NM	NM	No	2017: Could not open monument 2018: No observations provided	MW-10-047 (Figure5 of the CMI Work Plan)	NAPL survey Baseline sampling
MW-10-032	Flush Mount	Unknown	NM	NM	No	2017: Did not open well, annulus filled with sludge 2018: No observations provided	MW-10-042 (Figure 5 of the CMI Work Plan)	NAPL survey Baseline sampling
MW-10-033	Flush Mount	2	16.83	10.11	Yes	2017: Good 2018: No observations provided	-	NAPL survey Baseline sampling
MW-10-034	Flush Mount	Unknown	NM	NM	No	2017: Could not open monument 2018: No observations provided	MW-10-043 (Figure 5 of the CMI Work Plan)	NAPL survey Baseline sampling
MW-10-035	Flush Mount	Unknown	NM	NM	No	No observations provided	-	NAPL survey Baseline sampling
MW-10-036	Flush Mount	Unknown	NM	NM	Yes	2017: Could not open monument 2018: Found	-	NAPL survey Baseline sampling
MW-10-037	Flush Mount	Unknown	NM	NM	Yes	2017: Could not open monument 2018: Found, new lid	-	NAPL survey Baseline sampling

TABLE 17-1 WELL STATUS (CONTINUED)

WELL ID	MONUMENT TYPE[1]	DIAMETER (inches)[1]	TD (feet btoc)[1]	DTW (feet btoc)[1]	2011 PRODUCT PRESENT[2]	2017 AND 2018 OBSERVATIONS / CONDITION[1, 3]	NEW PROPOSED WELL TO REPLACE DAMAGED/REMOVED WELL	MONITORING PLAN OVERVIEW[4,7]
MW-10-038	Flush Mount	Unknown	NM	NM	Yes	2017: No observations provided 2018: Likely gone, not found	-	NAPL survey Baseline sampling
MW-10-039	Flush Mount	NM	12.37[5]	5.5[5]	Yes	2017: Product absorbing pad 2018: Found	-	NAPL survey Baseline sampling
MW-10-OR1	Flush Mount	4	20.82	9.89	No	2017: Good 2018: Found	-	NAPL survey Baseline sampling
MW-10-OR2	Flush Mount	4	21.7	10.7	No	2017: Non-bolted lid/good 2018: Found	-	NAPL survey Baseline sampling
MW-11-010	Stickup	2	17.91	14.5	No	2017: Good 2018: No observations provided	-	NAPL survey Baseline sampling

Notes:

1 Information retrieved from *Final Monitoring Well Inventory Technical Memorandum, United States Coast Guard Base, Kodiak, Alaska* (Ahtna 2018).

2 Information retrieved from *Free Product Monitoring and Recovery Quarterly Report-Site 6B and 10/11 Oct 2011-Dec 2011* (Windward 2012).

3 Observations were made during a client and contractor site visit on 1 October 2018.

4 If measurable product is found during the NAPL survey, analytical laboratory samples will not be collected during the baseline or sentry well groundwater sampling.

5 The TD and DTW numbers are reversed from how they were originally reported in the *Final Monitoring Well Inventory Technical Memorandum, United State Coast Guard Base, Kodiak, Alaska* (Ahtna 2018).

6 MW-10-027, northwest of Hangar 1, is believed to have been destroyed prior to 2003 and replaced by MW-10-030 at the same location in 2003. The *Final Monitoring Well Inventory Technical Memorandum* (Ahtna 2018) states that MW-10-027 was located and described, and that MW-10-030 is destroyed. However, it is likely that the well found and documented was MW-10-030 and the older counterpart, MW-10-027, is no longer there.

7 If no product is found during the NAPL survey, analytical laboratory samples will be collected from the well.

btoc = below top of casing
DTW = depth to water
ID = identification number
NAPL = non-aqueous phase liquid
NM = not measured
TD = total depth
- = No data/not visited

TABLE 17-2 NEW WELL RATIONALE

NEW WELL ID	ESTIMATED DEPTH TO GROUNDWATER (feet bgs)	ACTICIPATED SCREEN INTERVAL (feet bgs)[1]	RATIONALE FOR PROPOSED NEW WELL LOCATIONS[2]
MW-10-040	5	4 to 14	New well to act as a sentry well on the southeast edge of the assumed contaminant plume.
MW-10-041	10	8 to 18	New well to detect potential contamination from sources upgradient of the historical spills at Site 10 and potential contamination crossgradient of Site 11.
MW-10-042	10	8 to 18	New well to act as a sentry well on the northwestern edge of the assumed contaminant plume. Also can be used to replace MW-10-032.
MW-10-043	9	7 to 17	New well to act as a sentry well on the western edge of the assumed contaminant plume. Also can be used to replace MW-10-034.
MW-10-044	6	4 to 14	New well to act as a sentry well on the southwestern edge of the assumed contaminant plume and to detect potential contaminant migration to Inner Womens Bay.
MW-10-045	6	4 to 14	New well to act as a sentry well and create a sentinel line of wells to detect potential contaminant migration to Inner Womens Bay. Provides a representative replacement for MW-10-023.
MW-10-046	6	4 to 14	New well to act as a sentry well and create a sentinel line of wells to detect potential contaminant migration to Inner Womens Bay. Provides a representative replacement for MW-10-018 and MW-10-021.
MW-10-047	10	8 to 18	New well to act as a sentry well on the eastern edge of the plume.

Notes:

[1] Well screens will be 10 feet in length at all wells. Depending on the depth of groundwater, the placement of the top of each screen will be up to 2 feet above the water table to accommodate the anticipated fluctuations in the groundwater table. If groundwater is encountered at 5 feet bgs or less, the screen will be placed 1 foot above encountered groundwater so that a proper bentonite seal can be set.

[2] While the objective is to install the specified wells as sentry wells, it is possible that this may not be achieved based on conditions observed and spatial limitations.

bgs = below ground surface
ID = identification number

UVOST Screening

Prior to well installation, UVOST will be used to assist with the placement of the four of the eight proposed new wells at the site to provide greater confidence the well is a sentry /boundary well and not located with the NAPL plume – Figure 5 of the CMI Work Plan shows those locations and the potential step-out directions. At the four proposed well locations along Inner Womens Bay (Figure 5), stepping-out will not be possible, so UVOST will not be used as a preliminary screening step.

The UVOST will be advanced through the subsurface in accordance with BE-SOP-17 *UVOST Operations* provides using a Geoprobe 6620 direct-push drill unit. If UVOST determines that a location is within the NAPL plume, a step-out process with additional UVOST borings will be used to locate the appropriate placement of a sentry well outside of the contamination plume. If UVOST screening indicates it is necessary to place a well more than 50 feet from the originally proposed location in order to characterize a "clean" boundary, the agencies will be conferred prior to well placement – the decision to step out, field notes, the boring log, UVOST log, and new step-out locations will be provided to ADEC and EPA via email prior to installing the well. Each boring location will be marked with wooden lathe, survey whiskers or spray paint, and a unique location identification to aid in surveying activities. The maximum step-out distance is 200 feet. If, after stepping-out 200 feet, UVOST indicates that location is still within contamination, the well will be installed.

The UVOST uses laser-induced fluorescence technology to delineate known or suspected contamination in the NAPL form. Each UVOST probe provides continuous, real-time data on petroleum contamination at a maximum rate of one data reading per every two centimeters (cm) of downward push. Signal intensities are calibrated to a known standard reference solution before each probe point. During the probe, the height and area under the waveform represents the signal intensity of each individual wavelength relative to that standard (i.e., % fluorescence is a percentage of the standard reference solution). The concentration of a contaminant in the soil matrix is directly related to the signal intensity and %-fluorescence. These %-fluorescence readings are delivered instantly to the system field control, typically a laptop computer, at a rate of one per second. By regulating the direct-push rate of the drill machine to two cm per second, the log in turn records a %-fluorescence every two cm. By field standards, this is considered to be high density continuous logging. Analytical soil samples will be used in conjunction with the UVOST to identify the type of petroleum, oil, lubricant present and correlate the signal strength to analytical concentrations.

Monitoring Well Installation and Development

The eight groundwater monitoring wells will be installed and developed in accordance with ADEC Monitoring Well Guidance (ADEC 2013), EPA guidance (EPA 1990), and BE-SOP-22 *Monitoring Well Installation, Development, and Decommissioning* (Attachment C-2). Wells will consist of 2-inch diameter, schedule 40 polyvinyl chloride (PVC) risers with 0.010-inch prepacked well screens. Well screens will be 10 feet in length at all wells. Depending on the depth of groundwater, the placement of the top of each screen will be up to 2 feet above the water table to accommodate the anticipated fluctuations in the groundwater table. If groundwater is encountered at 5 feet below ground surface (bgs) or less, the screen

will be placed 1 foot above encountered groundwater so that a proper bentonite seal can be set. A 20-40 silica sand filter pack will extend above the well screen by 0.5-2.0 feet, again depending on the depth at which groundwater is encountered (i.e., more sand will be used if groundwater is deeper). A bentonite seal will be installed at least 2 feet thick on the top of the filter pack. The annular space above the bentonite seal will be filled with a bentonite slurry or coarse bentonite chips to two feet bgs. If chips are used, they will be hydrated in 5-foot lifts. 20-40 silica sand will be placed in the remaining length if the annulus. Each well will have a flush-mounted completion to prevent interference with site traffic.

Monitoring wells will be developed no sooner than 24 hours after well installation. The wells will be developed using a surge block and a peristaltic or submersible pump to cyclically remove sediment from the bottom of the well and well screen. Once the turbidity decreases and the water is visually clear, water quality parameters will be monitored for stabilization. Development procedures are detailed in BE-SOP-22 *Monitoring Well Installation and Development* (Attachment C-2).

Soil Sample Collection

During installation of each proposed well, one soil sample will be collected from the unsaturated zone in each location and submitted to the laboratory for the analysis of DRO/RRO, VOCs, and PAHs. Discrete soil samples will be collected from the drilling cores. The soil sample will be collected from the interval with most visible staining/odor or the interval with the highest photoionization detector (PID) response. If no staining/odor is observed or if there is no elevated PID response, the sample will be collected from the interval 6 inches above the water table. These samples will assist in the further delineation of soil impacts, the migration of these impacts, and the connection (if any) between soil and groundwater impacts. Soil samples will also further assist in the understanding and monitoring of natural attenuation occurring at Site 10/11.

Drilling and soil sampling will be conducted in accordance with the ADEC *Field Sampling Guidance* (ADEC 2017a), EPA guidance (EPA 1990), BE-SOP-05 *Drilling and Core Logging*, and BE-SOP-06 *Soil Sampling* (Attachment C-2).

IX) NAPL SURVEY

Table 17-3 lists the wells in the existing network that have been confirmed as still existing based on a 2017 well inventory (Ahtna 2018) and an informal site visit completed in 2018. Importantly, as noted in inventory/reconnaissance observations (Table 17-1), many of the wells listed in Table 17-3, while not missing or destroyed, have been damaged. Therefore, as a first step during the baseline sampling event, a new site reconnaissance/well inventory will be performed to determine the actual number of existing and viable wells onsite.

After new wells are installed, the entire viable well network (i.e., the wells listed in Table 17-3, as possible) will be monitored for the presence of floating product/ sheen, and static water levels will be measured. The monitoring well inventory (Table 17-1, Appendix C) will be updated, and damaged wells will be assessed and repaired, if possible. An electronic oil-water interface probe capable of distinguishing between water and petroleum product, and sensitive to ± 0.01 foot, will be used for the measurements

and decontaminated prior to use in each well. Along with the product measurement and static water level, the total depth of well casing will also be recorded during these survey activities. Additionally, the condition of the well and viability for sample collection will be noted for use in future field decisions.

If more than 1 inch of product is observed in a well, a baildown test will be performed to assess NAPL mobility. This test will consist of removing the product using a bailer and monitoring how quickly the product returns. This information will be used to determine if the recommended remedy that will be provided in the CMI Report should include product recovery.

TABLE 17-3 POTENTIAL BASELINE GROUNDWATER MONITORING LOCATIONS

EXISTING WELLS	
MW-10-003	MW-10-032*
MW-10-018*	MW-10-033
MW-10-019	MW-10-034*
MW-10-020	MW-10-035
MW-10-021	MW-10-036*
MW-10-022	MW-10-037
MW-10-024	MW-10-038*
MW-10-025	MW-10-039
MW-10-026*	MW-10-OR1
MW-10-030	MW-10-OR2
MW-10-031*	MW-11-010
PROPOSED NEW WELLS	
MW-10-040	MW-10-044
MW-10-041	MW-10-045
MW-10-042	MW-10-046
MW-10-043	MW-10-047

*Well is likely damaged/destroyed, but will be sampled if present/viable

X) GROUNDWATER SAMPLING

After new wells are installed and developed and the NAPL survey is completed, up to 30 monitoring wells, as listed in Table 17-3, will be sampled. Monitoring wells will not be sampled if:

1. The well has been destroyed or damaged to the extent that it is not sampleable.
2. Measurable free product is observed during the NAPL survey

Groundwater samples will be collected using low-flow sampling procedures based on the United States EPA (EPA) and ADEC guidelines (EPA 2002 and 2017, ADEC 2017a) and in accordance with BE-SOP-09 *Groundwater Sampling* (Attachment C-2). Wells will be sampled using a submersible bladder pump (or similar). The pump intake will be set at the approximate midpoint of the submerged portion of the screened interval. All groundwater samples will be submitted to the laboratory for the analysis of

DRO/RRO, VOCs, and PAHs. Prior to sample collection, each well will be gauged using a water level meter (Attachment C-2, BE-SOP-21 *Groundwater and LNAPL Measurements*).

If a well is purged dry, it will be allowed to recharge for 24 hours. If the well has recharged to 80% or more, the well will be sampled without further purging. When sufficient yield is available, monitoring well parameters will be stabilized prior to sample collection. A YSI 556 water quality meter with a flow-through cell and turbidity meter will be used to monitor field parameters for stabilization (Attachment C-2, BE-SOP-20 *Water Quality Measurements*). In addition to parameter stabilization, drawdown during purging will not exceed 0.3 feet (at a minimum flow rate of approximately 50 to 100 milliliters per minute [mL/min]), where possible. After stabilization, volatile samples will be collected followed by non-volatile constituents (Attachment C-2, BE-SOP-09 *Groundwater Sampling*).

XI) SEEP SAMPLING

Four seeps will be sampled in accordance with BE-SOP-76 *Water Seep Sampling* (Attachment C-2), using decontaminated or disposable sample collection devices. Samples will be analyzed for DRO/RRO, VOCs, and PAHs. BTEX and PAH analytical results for seep water samples will be totaled and compared to ADEC TAH and TAqH water quality standards (ADEC 2018b).

The locations of the seeps are not precisely defined. Figure 2 of the CMI Work Plan shows the locations where seeps were present and sampled in 2004 (Hart Crowser 2005). To select the four seep locations for this baseline monitoring event, a reconnaissance survey will first be conducted to identify locations where seeps are present along the shoreline in the vicinity of Site 10/11. All seep locations will be documented, and their locations will be surveyed. After reconnaissance, the following criteria will be used to select the four sampling locations (listed in descending order of importance):

- Select seep locations immediately downgradient from existing monitoring wells with known historical contamination (e.g., MW-10-039, MW-10-022, MW-10-038).
- Select seep locations where a sheen or odor is present.
- Select seep locations that are separated by at least 200 feet and are at least 100 feet from Outfall IA-1.
- Select at least one seep location northwest of Outfall IA-1.
- Select seep locations that have the highest apparent flow rates.

Collection of the seep samples will be coordinated with the beginning of an incoming tide to ensure that samples collected from the intertidal zone are most representative of site groundwater as opposed to outflowing salt water that may have intruded the subsurface during the previous high tide event. If springs are not observed along the intertidal zone, additional attempts will be made to collect these samples during subsequent site visits.

XII) CMI REPORT

Upon completion of the baseline NAPL survey, seep sampling, and groundwater sampling event, a CMI Report will be prepared. The CMI Report will summarize the fieldwork and lab results, identify necessary revisions to the current selected remedy, and develop the specific scope for long-term monitoring and management of the site.

17.3 LONG-TERM MANAGEMENT APPROACH

Following the 2019 Baseline Monitoring Event, at least two additional annual monitoring events will be performed in 2020 and 2021. While the specifics of the additional monitoring events will be defined in the CMI Report, we anticipate the additional monitoring events will include a NAPL survey (and potential removal), sentry well groundwater sampling, and seep sampling.

The following outlines the decision points for the Site 10/11 long-term management approach beyond the proposed baseline (2019) and two annual monitoring events (2020 and 2021):

1) If, during the baseline monitoring and the two subsequent annual monitoring events, sitewide surface water and groundwater concentrations are below their respective cleanup standards (Worksheet #15) and no measurable/recoverable free product is detected, then a "Corrective Action Complete" determination will be requested and the RCRA permit will be modified in accordance with 40 CFR 270.42
2) If, during the baseline monitoring event and the two subsequent annual monitoring events, contaminants are detected in groundwater above their respective cleanup levels (Worksheet #15), measurable/recoverable free product is detected, and:
    a. If (1) dissolved-phase concentration trend analyses indicate that the plume is stable or decreasing, (2) contaminant concentrations in points-of-compliance (i.e., surface water or designated sentry wells) are <u>below</u> media cleanup standards (Worksheet #15), and (3) no significant free product is measured in the site monitoring wells, then a "Corrective Action Complete with Controls" determination will be requested; and the RCRA permit will be modified in accordance with 40 CFR 270.42.
    b. If (1) trend analyses indicate that the plume is not stable, (2) contaminant concentrations in points-of-compliance are <u>above</u> media cleanup standards (Worksheet #15), or (3) significant free product is measured in the site monitoring wells, then additional annual monitoring events will be proposed and/or a revised remedy will be considered.

XIII) ANNUAL MONITORING REPORTS

The CMI Report will be prepared following the 2019 Baseline Monitoring Event. Following the subsequent annual monitoring events (which, at a minimum, will occur in 2020 and 2021), the results will be reported along with the RCRA quarterly monitoring results from the same period. The content of these reports will include the following:

- A narrative describing activities conducted, including a description of any deviations from the approved CMI Work Plan/UFP-QAPP
- A summary of the findings, analytical results, analytical data tables, an interpretation of the analytical data, trend analyses, and a summary of the data quality and usability
- A discussion of data plus, if possible, using the recently acquired groundwater/seep results to assess the effectiveness of the corrective measures
- Tables and figures supporting the narrative report
- Conclusions and recommendations
- Appendices containing copies of all chemical data generated and field documentation (field notes, forms, copies of the CoC, a sample summary, cooler receipt forms, and any variance requests, site photographs, Chemical Quality Data Review, ADEC checklists, etc.).

17.4 COMMON PROCEDURES

XIV) DECONTAMINATION

Down-hole drilling equipment will be decontaminated between borings and sites using a water and Alconox mixture. Decontaminated water will be collected in a tub or 55-gallon drum. Smaller items including hand tools, soil sampling equipment, and non-dedicated water sampling equipment will be decontaminated between sample locations and/or samples to prevent cross-contamination. Decontamination of these smaller items will consist of washing the equipment with a mixture of potable water and Alconox, followed by a deionized or distilled water rinse. The water generated during decontamination activities will be collected in a tub or 55-gallon drum or in 5-gallon buckets with screw-top lids. Decontamination water will be filtered using a granular activated carbon (GAC) filter and stored in appropriately labeled 55-gallon drums. The filtered water will be analyzed to confirm acceptably low contaminant concentrations prior to discharge. Compliant filtered water will be discharged onsite in a vegetated area 100 feet or more from surface water bodies and in a manner to prevent erosion. Decontamination procedures are detailed in BE-SOP-14 *Equipment Decontamination* (Attachment C-2).

XV) SURVEY

The locations of UVOST borings, monitoring wells, and any pertinent site features will be surveyed using global navigation satellite system (GNSS) real-time kinematic (RTK) techniques. In environments where RTK is not suitable, post processed GNSS static techniques may also be used. A Trimble R10 base/rover kit will be utilized for GNSS surveying activities. A Nikon AE-7C automatic level will be used to precisely measure and establish monitoring well elevations. In general, the closest survey monument to each site will be used, and no new survey monuments are anticipated to be established. Horizontal control will be referenced to the North American Datum of 1983 (2011), Vertical control will be referenced to the North American Vertical Datum of 1988 (NAVD88). If a control point is not accessible or within a required usability range, one will be established to tie survey data into the National Spatial Reference System, and a minimum of two hours of static global positioning system (GPS) data will be collected for Online Positioning User Service (OPUS) post-processing. Survey field procedures will utilize US Army Corps of Engineers Engineering and Design Manual EM 1110-1-1005 (“Control and Topographic Surveying”) for guidance and best practices. The resulting geospatial data will be projected in the Alaska State Plane Coordinate System 1983, Zone 4, US Survey Feet.

XVI) WASTE MANAGEMENT

All wastes generated during field effort will be managed appropriately in compliance with federal and state regulations. The IDW streams anticipated during the project include non-hazardous soil, groundwater purge water and decontamination water, and solid wastes (e.g., personal protective equipment [PPE] and core sleeves).

Soil cuttings will be field screened with a PID, and if results are below 20 parts per million (ppm), the cuttings generated during field activities will be managed in accordance with the procedures described in the following subsections. ADEC approval will be required prior to transport and disposal of investigative-derived waste (IDW).

Liquid Waste

Liquid IDW, including purge water from groundwater sampling and development activities and decontamination water, will be generated during field activities. Water will be collected in Department of Transportation (DOT)-approved 5-gallon buckets with screw-top lids or in 55-gallon drums and passed through a portable GAC unit. The filtered water will be stored in labeled 55-gallon drums pending analytical analysis to confirm appropriateness to discharge to site. The drums will be appropriately labeled with a non-hazardous solid waste label containing at a minimum the generator, waste type, container number, project number, PM and contact number, generation date, and estimated weight or volume. Approved filtered water will be discharged to a vegetated area onsite greater than 100 feet from surface water bodies. At the end of the field event, the spent GAC material will be placed in a DOT-approved, 55-gallon drum with the soil cuttings for offsite disposal.

Soil Cuttings

Soil cuttings generated from soil borings will be placed back in the borehole of origin. Soil cuttings generated during monitoring well installation will be placed in DOT-approved 55-gallon open-top steel drums and staged on wooden pallets. The drums will be appropriately labeled with a non-hazardous solid waste label containing at a minimum the generator, waste type, container number, project number, PM and contact number, generation date, and estimated weight or volume. Container markings will be applied to containers with permanent marker of contrasting color on the upper side (not top) of the container.

A composite waste characterization sample will be collected from the drums to characterize the waste prior to disposal. The waste will be transported to an approved disposal facility in accordance with state and federal regulations. Copies of the waste profile documentation, waste manifests, and Certificate of Disposal will be included as an appendix to the final report.

Solid Waste

Solid wastes generated during the field effort may include PPE (nitrile gloves, hearing protection, etc.), dedicated sampling equipment (tubing, etc.), empty sample bottles, and miscellaneous refuse (plastic bags, cardboard, paper towels, plastic sheeting, etc.). Wastes will be stored in plastic trash bags and transported to the Kodiak Landfill for disposal as non-regulated waste.

Waste Tracking

The waste tracking process requires the following:

- Approximate location of removal
- Receipt by treatment or disposal facility
- Certificate of disposal

A waste accumulation spreadsheet will be maintained. The spreadsheet will be updated daily while onsite, and as needed while the waste materials are in transit, storage, and disposal facility/recycler.

WORKSHEET #18 – SAMPLING LOCATIONS AND METHODS

This Worksheet provides summarizes the samples to be collected as part of this project, as described in detail Worksheet #17. Figure 5 of the CMI Work Plan shows the sample locations. Field SOPs are provided in Attachment C-2 of the CMI Work Plan.

18.1 SAMPLE IDENTIFICATION PROCEDURES

Samples will be given a unique identifier reflecting the sample location, sample medium or type, and sample year. Sample containers will be labeled to match the CoC records. At the time of sampling, appropriate sample numbers will be recorded in the field logbook. This section describes what the sample identification, location identification, and matrix may be for each type of sample. All samples collected for this project will be numbered with unique identifiers as described below:

Year-Site Location:

- Two-digit code for the sampling year ("19" for 2019)
- Eight-digit code for the project site ("SWMU1011" for SWMU 10/11)

Sample Type and Sample Location

Soil, groundwater, and seep samples will be collected. To distinguish between the sample types, the following codes will be used:

- SB for soil boring
- MW for groundwater well
- SW for seep water

Sample Location

Each sample location will be differentiated with sequential numbering. The samples from existing wells at the Site and the new groundwater monitoring wells will follow historical naming conventions. Previously installed groundwater wells at the site have been labeled MW-10-XX for those wells at Site 10 and MW-11-XX for those wells at Site 11. Groundwater monitoring wells installed during the 2019 field season will have similar identifiers beginning with -040 (i.e., MW-10-040). This nomenclature will also be used to identify groundwater samples with the Year-Site location identifier on the front end (i.e., 19SWMU1011-MW10040).

Soil samples collected from the Site will be associated with their boring location, starting with boring SB-10-040 (i.e., 19SWMU1011-SB10040-X-X).

Sample Depth

The ending depth of the soil sample will also be included in the sample identification as the final two digits of the sample identifier:

- 0-2 for 0.0 to 2.0 ft bgs
- 4-6 for 4.0 to 6.0 ft bgs

Duplicate Marker (if applicable)

The duplicate sample for groundwater samples will be assigned a 9 at the end of the primary sample identification number (i.e., 19SMWU1011-MW100409). Duplicate soil samples will be identified with a 9 after the soil boring identifier and before the depth indicators (i.e., 19SWMU1011-SB10040-2-4 and 19SWMU1011-SB100409-2-4).

General Format for a Sample Identification Number (Sample ID):

TABLE 18-1 SAMPLE IDENTIFICATION

SAMPLE DESCRIPTION	LOCATION ID	SAMPLE TYPE	SAMPLE ID
Primary groundwater sample from MW-10-040	MW-10-040	Primary	19SWMU1011-MW10040
Duplicate groundwater sample from MW-10-040	MW-10-040	Duplicate	19SWMU1011-MW10409
Primary soil sample from soil boring SB-10-040 at a depth of 6 to 8 feet bgs	SB-10-040	Primary	19SWMU1011-SB10040-6-8
Duplicate soil sample from soil boring SB-10-040 at a depth of 6 to 8 feet bgs	SB-10-101	Duplicate	19SWMU1011-SB100409-6-8
Seep sample from location SW-10-SH4	SW-10-SH4	Primary	19SWMU1011-SW10SH4
Duplicate Seep sample from location SW-10-SH4	SW-10-SH4	Duplicate	19SWMU1011-SW10SH49

18.1 Sample Location and Methods

The following samples will be collected during this project:

- 2019 Baseline Monitoring:
  - Soil: 8 samples collected during new groundwater monitoring well installation.
  - Groundwater: Up to 30 samples from (viable) existing and new wells (Table 17-3)
  - Seeps: 4 samples
- 2020 and 2021 Annual Long-Term Monitoring:
  - Groundwater: Up to 8 samples from designated sentry wells during low/incoming tide; potential wells listed in Table 17-4 will be designated in the CMI Report (Section 17.2.5)
  - Seeps: 4 samples

Tables 18-2 and 18-3 provide additional details for the samples to be collected as part of this project.

TABLE 18-2 BASELINE MONITORING EVENT SAMPLING LOCATIONS AND METHODS

MATRIX	EXAMPLE SAMPLE ID	SAMPLE TYPE	SAMPLE LOCATIONS	SAMPLE DEPTH	SOP REFERENCE	PARAMETER (METHOD)
Baseline Monitoring Event						
Soil	19SWMU1011-SB10040-6-8	Discrete	8 new well locations – see Figure 5 of the CMI Work Plan	Location Dependent: Soil/Groundwater Interface	BE-SOP-05 BE-SOP-06	VOCs (SW8260C) PAHs (SW8270D SIM) DRO/RRO (AK102/AK103)
Groundwater	19SWMU1011-MW10040	Low-flow	Up to 30 wells – see Table 17-3 and Figure 5 of the CMI Work Plan	Location Dependent: Approximately 5 to 20 feet bgs	BE-SOP-09 BE-SOP-20 BE-SOP-21	VOCs (SW8260C) PAHs (SW8270D SIM) DRO/RRO (AK102/AK103)
Seep	19SWMU1011-SW10SH4	Grab	4 locations – see Section 17.2.4 and Figure 5 of the CMI Work Plan	Surface	BE-SOP-76	VOCs (SW8260C) PAHs (SW8270D SIM) DRO/RRO (AK102/AK103)

Notes:
For definition, refer to Acronyms and Abbreviations sections.

TABLE 18-3 ANNUAL LONG-TERM MONITORING EVENT SAMPLING LOCATIONS AND METHODS

MATRIX	EXAMPLE SAMPLE ID	SAMPLE TYPE	SAMPLE LOCATIONS	SAMPLE DEPTH	SOP REFERENCE	PARAMETER (METHOD)
Annual Long-Term Monitoring Events						
Groundwater	19SWMU1011-MW10044	Low-flow	Up to 8 sentry wells – see Table 17-4 and Figure 5 of the CMI Work Plan for potential locations	Location Dependent: Approximately 5 to 10 feet bgs	BE-SOP-09 BE-SOP-20 BE-SOP-21	VOCs (SW8260C) PAHs (SW8270D SIM) DRO/RRO (AK102/AK103)
Seep	19SWMU1011-SW10SH1	Grab	4 locations – see Section 17.2.4 and Figure 5 of the CMI Work Plan	Surface	BE-SOP-76	VOCs (SW8260C) PAHs (SW8270D SIM) DRO/RRO (AK102/AK103)

Notes:
For definition, refer to Acronyms and Abbreviations sections

WORKSHEET #19 / 30 – SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

Table 19-1 provides analytical and preparation method/SOP and associated sample volume, container specifications, preservation requirements, and maximum holding times for each matrix, analytical group, and concentration level. Analytical SOPs are provided in Attachment C-3.

Laboratory: SGS Anchorage
200 W Potter Drive
Anchorage, AK 99518
(907) 550-3205
PM: Justin Nelson

Certification: ADEC CS Laboratory Approval (Exp. 12/31/2019)
DoD Environmental Laboratory Accreditation Program (ELAP) Certification (Expires 12/31/2019)
Backup Lab: SGS network laboratories
Shipment: Alaska Airlines GoldStreak or Ravn

TABLE 19-1 SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES (SGS ANCHORAGE)

MATRIX	ANALYTE/ANALYTE GROUP	METHOD/SOP	CONTAINER(S) (NUMBER, SIZE, AND TYPE PER SAMPLE)[1]	PRESERVATION	PREPARATION HOLDING TIME	ANALYTICAL HOLDING TIME	TURNAROUND TIME
Groundwater and Seep Water	VOC	SW5030B/SW8260C 764r12/783r03	(3) 40 milliliter (mL) volatile organic analysis (VOA) vials w/ Teflon-lined septa (TLS)	Cool to 0 to 6°C, HCl to pH<2	14 days		30 days
	PAH Low Volume	SW3520C/SW8270D SIM 759r16/727r10	(2) 250 mL amber glass jars w/ Teflon-lined caps (TLC)	Cool to 0 to 6°C	7 days	40 days	30 days
	DRO/RRO Low Volume	SW3520C/AK102/AK103 759r16/712r16	(2) 250 mL amber glass jars w/TLC	Cool to 0 to 6°C, HCl to pH<2	14 days	40 days	30 days
Soil	VOC	SW5035A/SW8260C 767r10/783r03	(1) 4-ounce (oz.) pre-tared amber glass jar w/TLS	Cool to 0 to 6°C MeOH	14 days		30 days
	PAH	SW3550C/SW8270D SIM 761r20/727r10	(1) 4-oz. amber glass jar w/TLC	Cool to 0 to 6°C	14 days		30 days
	DRO/RRO	SW3550C/AK102/AK103 761r20/712r16	(1) 4-oz. amber glass jar w/TLC	Cool to 0 to 6°C	14 days	40 days	30 days

Notes:
[1] Sample containers may vary but must meet analytical method requirements. A larger container may be substituted to provide adequate sample volume for multiple analyses with the same preservation requirements.

This page intentionally blank

WORKSHEET #20 – FIELD QUALITY CONTROL SUMMARY

This Worksheet summarizes the type and frequencies of field primary and QC samples that will be collected and submitted to the laboratory for each matrix, analytical group, and concentration level. QC samples will be collected and/or submitted as follows:

- At minimum, one field duplicate sample will be collected per every 10 primary samples for each matrix sampled and for each target analyte. A minimum of one field duplicate will be collected each day, if 10 or more samples are collected. Field duplicates will be collected from locations of suspected contamination at the same time and location as the primary sample and will be submitted to the laboratory blind with unique sample identification numbers (IDs) and sample collection times.
- MS/MSD samples will be collected and submitted at a frequency of one set for every 20 or fewer primary samples (5%) or one per sample delivery group (SDG)/analytical batch, whichever is more frequent. Each cooler shipment will include one MS/MSD.
- One test blank (TB) will accompany each cooler that contains gasoline-range organics and/or VOC samples.
- Equipment blanks will be collected from the submersible pumps used for groundwater sampling. Equipment blanks will be collected at a frequency of 5% of the groundwater samples using reagent grade water provided by the analytical laboratory.

Field and QC sample quantities will be based on actual quantities and determined in the field. Analytical methods and estimated sample quantities are included in Table 20-1.

TABLE 20-1 FIELD QC SUMMARY

SAMPLE TYPE	ANALYTE / ANALYTICAL GROUP	ANALYTICAL METHOD	FIELD SAMPLES	FD	MS/ MSD	TRIP BLANK	EQUIPMENT BLANK	TOTAL # SAMPLES
Groundwater	DRO/RRO	AK102/103	25	3	2/2	NA	2	34
	VOC	SW8260	25	3	2/2	2	2	36
	PAH	SW8270SIM	25	3	2/2	NA	2	34
Seep Water	DRO/RRO	AK102/103	4	1	1/1	NA	NA	7
	VOC	SW8260	4	1	1/1	1	NA	8
	PAH	SW8720SIM	4	1	1/1	NA	NA	7
Soil	DRO/RRO	AK102/103	8	1	1/1	NA	NA	11
	VOC	SW8260	8	1	1/1	1	NA	12
	PAH	SW8270SIM	8	1	1/1	NA	NA	11

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
The number of field samples is estimated. Field and QC sample numbers will be based on actual quantities and determined in the field.
Total number of analyses includes field samples, field duplicates, MS/MSD, and TBs.

This page intentionally blank

WORKSHEET #21 – FIELD STANDARD OPERATING PROCEDURES

The SOPs that are applicable to this project are presented in Table 21-1. Field SOPs are provided in Attachment C-2.

TABLE 21-1 FIELD STANDARD OPERATING PROCEDURES

REFERENCE NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	EQUIPMENT TYPE	MODIFIED FOR PROJECT WORK
BE-SOP-01	*Logbook Documentation and Field Notes*	Logbook, camera, permanent ink pen	No
BE-SOP-02	*Sample Chain-of-Custody*	Field documents	No
BE-SOP-03	*Labeling, Packaging and Shipping Samples*	Samples, field documents	No
BE-SOP-04	*Quality Control Samples*	Samples	No
BE-SOP-05	*Drilling and Core Logging*	Geoprobe, tooling, PPE	No
BE-SOP-06	*Soil Sampling*	Sampling containers, coolers, disposable spoons, PPE	No
BE-SOP-09	*Groundwater Sampling*	Oil/Water interface, probe, peristaltic pump, tubing, sampling containers, PPE	No
BE-SOP-14	*Equipment Decontamination*	Scrub brushes, Super Sacks, 55-gallon drums, PPE	No
BE-SOP-15	*Field Screening with PID*	PID, isobutylene calibration gas, PPE	No
BE-SOP-17	*Field Screening with a UVOST*	Dakota Technologies, Inc. (DTI) UVOST system	No
BE-SOP-20	*Water Quality Measurements*	YSI instrument, turbidity meter, calibration standards	No
BE-SOP-21	*Groundwater and Non-Aqueous Phase Liquid (NAPL) Measurements*	Water level indicator, interface probe, PPE	No
BE-SOP-22	*Monitoring Well Installation and Development*	Geoprobe, monitoring well, surge block, submersible pump	No
BE-SOP-25	*Underground Utility Locates*	Magnetic locator	No
BE-SOP-29	*GeoXH GPS Location Survey*	Trimble GeoXH GPS unit	No
BE-SOP-51	*Material Handling/Manual Lifting*	PPE	No
BE-SOP-52	*Driving Motor Vehicles*	Trucks	No
BE-SOP-59	*Site Traffic*	PPE, temporary fencing, signage	No
BE-SOP-61	*Working around Drill Rigs*	Drill rigs	No
BE-SOP-64	*Working with Hand Tools*	PPE and hand tools	No
BE-SOP-66	*Breathing Zone Air Monitoring*	PPE, PID, isobutylene calibration gas	No
BE-SOP-75	*Managing Fatigue at Work*		No
BE-SOP-76	*Water Seep Sampling*	PPE	No

This page intentionally blank

WORKSHEET #22 – FIELD INSTRUMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

The calibration of field equipment will be checked each day before the start of work, or more frequently, as needed. Any instrument "drift" from prior calibration will be recorded in a field notebook. If necessary, recalibration of the instruments will occur. Calibration will be conducted in accordance with the procedures in Table 22-1. Table 22-1 identifies all field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection and provides the SOP number for each type of equipment. In addition, this table documents the frequency, acceptance criteria, and corrective action requirements for calibrating each type of equipment. Field SOPs are provided in Attachment C-2 of the Work Plan.

Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means. A label with the identification number and the date when the next calibration is due will be physically attached to the equipment. If this is not possible, records traceable to the equipment (showing the equipment identification) will be readily available for reference. In addition, the results of calibrations and records of repairs will be recorded in a logbook. Scheduled periodic calibration of testing equipment does not relieve field personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, the device shall be removed from service, tagged so that it is not inadvertently used, and the appropriate personnel notified so that a recalibration can be performed, or a substitute piece of equipment can be obtained.

Equipment that fails calibration or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate it is out of calibration. Such equipment will be repaired and satisfactorily recalibrated. Equipment that cannot be repaired will be replaced.

TABLE 22-1 FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

FIELD EQUIPMENT	ACTIVITY	SOP REFERENCE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
UVOST	Calibrations using Reference Emitter (RE)	BE-SOP-17	Calibrate daily prior to use, and as needed	5,000 to 12,000 photovolts	Recalibrate as necessary. If acceptable calibration cannot be obtained, return equipment to vendor for repair or replacement.
PID	Calibration using isobutylene gas	BE-SOP-15	Calibrate daily prior to use	±5%	Re-calibrate as necessary. If acceptable calibration cannot be obtained, return equipment to vendor for repair or replacement.
Water Quality Meter (YSI)	Calibration using applicable pH, ORP, and conductivity solutions	BE-SOP-20	Calibrate daily prior to use	See Attachments 1 and 2 in BE-SOP-20	Re-calibrate as necessary. If acceptable calibration cannot be obtained, return equipment to vendor for repair or replacement.
Turbidity Meter	Calibration using applicable standards	BE-SOP-20	Calibrate daily prior to use	See Attachments 1 and 2 in BE-SOP-20	Refer to troubleshooting sections in BE-SOP-20.

Notes:
For definitions, see Acronyms and Abbreviations sections

This page intentionally blank

WORKSHEET #23 – ANALYTICAL STANDARD OPERATING PROCEDURES

The following table lists all SOPs for the specific sample preparation and analytical procedures that will be used for project samples. Analytical SOPs are provided in Attachment C-3.

TABLE 23-1 ANALYTICAL STANDARD OPERATING PROCEDURE REFERENCES

SOP NUMBER	TITLE AND DATE	DEFINITIVE OR SCREENING DATA	MATRIX/ ANALYTICAL GROUP	SOP OPTION OR EQUIPMENT TYPE	MODIFIED FOR PROJECT WORK? (Y/N)
712r16	Diesel-Range Organics and Residual-Range Organics by Methods AK102, AK103, 8015c (Revision 13, Effective 3/2014)	Definitive	Soil and water; DRO/RRO	GC-FID	N
727r10	PAHs by GCMS-SIM by Methods 8270D-SIM, 625M-SIM (Revision 8, Effective 12/2016)	Definitive	Soil and water; PAHs	GS/MS	N
764r12	Purge and Trap Aqueous SW846 8000B & 5030B (revision 11, Effective 11/2014)	Definitive	Water; VOCs	Purge and trap extraction	N
767r10	Purge and Trap Extraction, Nonaqueous by SW846 5035A (Revision 9, Effective 8/2014)	Definitive	Soil; VOCs	Purge and trap extraction	N

This page intentionally blank

WORKSHEET #24 – ANALYTICAL INSTRUMENT CALIBRATION

To ensure that the analytical methods and the selected instrumentation meet the project requirements, each analytical instrument shall be calibrated following the procedures and frequency specified by the approved laboratory quality assurance plan, analytical method, and in accordance with *DoD QSM v.5.1* (DoD 2017). Specific analytical method SOP references are provided in Worksheet #23 (Table 23-1) and the laboratory SOPs are included in Attachment C-3.

This Worksheet is intended to provide information regarding laboratory calibration procedures for the requested methods for the project. Instrument calibration procedures, acceptance criteria, and corrective actions for the analytical methods are included in the laboratory SOPs, referenced in Table 24-1.

24.1 INSTRUMENT CALIBRATION REQUIREMENTS

The calibrations and quality assurance (QA)/QC shall meet the acceptance criteria specified in Table 24-1. For calibrations, the following standards must be met:

- All results reported shall be within the calibration range. Results outside the calibration range are unsuitable for quantitative work and show only an estimate of the true concentration.
- Results shall be within the working range determined by the daily initial calibration (ICAL).
- Samples shall be diluted, if necessary, to bring analyte responses within the calibration range. Data that exceed the calibration range must be reported by the laboratory with the dilution results.
- Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in the calibration and quantitation of sample results.
- Calibration standards shall be traceable to standard materials.

Instrument calibration shall be achieved by beginning with the simplest approach (the linear model through the origin) and shall then progress through other options (nonlinear) until the acceptance criteria are met. When an analyte has more than one acceptable calibration model, results shall be reported from the simplest calibration model.

The ICAL must be verified by a second source standard. Multipoint calibrations shall contain the minimum number of calibration points specified in the applicable tables, with all points used for the calibration being contiguous. If more than the minimum number of standards is analyzed for the ICAL, all standards analyzed shall be included in the ICAL. The only exception is that a standard at either end of the calibration curve can be dropped from the calibration if the requirement for the minimum number of standards is met and the low point of the calibration curve is at or below the LOQ for each analyte. Analyte concentrations are determined with either calibration curves or RFs. Nonlinear calibration should be considered only when a linear approach cannot be applied. It is not acceptable to use an alternative calibration procedure when a compound fails to perform in the usual manner. When multipoint calibration is specified, the concentrations of the calibration standards shall bracket those expected in the samples.

For GC and GC/MS methods, when using RFs to determine analyte concentrations, the average RF from the ICAL shall be used. The continuing calibration shall not be used to update the RFs from the ICAL.

24.2 CONTINUING CALIBRATION VERIFICATION

The continuing calibration verification (CCV) cannot be used as the LCS. A CCV is to be performed daily before sample analysis (unless an ICAL and second source standard verification are performed immediately before sample analysis) and as required by the applicable method. In addition, *DoD QSM v.5.1* (DoD 2017) requires that the concentration used for the CCV sample shall be between the low calibration standard and the midpoint of the calibration range. Finally, the lowest standard used must be the lowest concentration for which quantitative data are to be reported.

24.3 ANALYTICAL INSTRUMENT CALIBRATION PROCEDURES

Laboratory calibration procedures and corrective actions for the analytical methods planned for this project are included in the analytical laboratory SOPs included in Attachment C-3. In accordance with the UFP-QAPP Optimized Worksheets guidance, Table 24-1 references the laboratory SOPs and identifies the responsible person(s).

TABLE 24-1 ANALYTICAL INSTRUMENT CALIBRATION

ANALYTICAL METHOD	INSTRUMENT	TITLE/POSITION RESPONSIBLE FOR CORRECTIVE ACTION	SOP REFERENCE
AK102/AK103	GC/FID	Laboratory Analyst Laboratory QA Manager	712r16
SW8260C SW8270D SIM	GC/MS	Laboratory Analyst Laboratory QA Manager	764r16&767r10 727r10

WORKSHEET #25 – ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION

The selected laboratory for the project, SGS, operates under a quality system that conforms to International Organization for Standardization (ISO) 17025:2005 (ISO 2010). The analytical instrument calibration, maintenance, testing, and inspection activities to be included in this Worksheet are documented in the laboratory quality assurance manuals (QAMs) and SOPs. The laboratory QAMs, certifications, and analytical SOPS are included in Attachment C-3 for reference.

This page intentionally blank

WORKSHEET #26 / 27 – SAMPLE HANDLING, CUSTODY, AND DISPOSAL

The following table identifies components of the sample handling system specific to this project. Table 26-1 lists personnel and their organizational affiliations that are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection, to laboratory delivery, to final sample disposal.

This table also describes the procedures and forms that will be used to maintain sample custody and integrity including CoC forms, sample identification, custody seals, laboratory sample receipt forms, and laboratory sample transfer forms.

Laboratory Contractor: SGS Anchorage

Method of Sample Delivery: Air Cargo

Number of Days from Reporting until Sample Disposal: 30 days after final report is issued

TABLE 26-1 SAMPLE MANAGEMENT

ACTIVITY	ORGANIZATION AND TITLE OF PERSON RESPONSIBLE FOR ACTIVITY	REFERENCE
Sample documentation and labeling	Contractor Lead Sampler	Worksheet 26/27 BE-SOP-01 BE-SOP-03
Sampling identification	Contractor Lead Sampler	Worksheet 26/27
Packaging and shipping coordination	Contractor Lead Sampler	Worksheet 26/27 BE-SOP-03
CoC form completion	Contractor Lead Sampler	BE-SOP-02
Sample receipt, inspection, and log-in	Contractor Lead Sampler or Project Chemist Laboratory Project Manager	Worksheet 26/27 Worksheet 23
Sample custody and storage	Contractor Lead Sampler or Project Chemist Laboratory Project Manager	Worksheet 26/27 Worksheet 23
Sample disposal	Laboratory Project Manager	Worksheet 26/27

Sample Documentation and Labeling

Accurate and comprehensive recordkeeping is critical to documenting sample custody and includes CoC records. The field logbook and field forms will be the primary tools for capturing information collected during the field effort. Field logbooks will be completed in accordance with SOP BE-SOP-01 *Logbook Documentation and Field Notes* (Attachment C-2). Several supplemental data collection forms are included in the task specific SOPs identified in Worksheet #21.

Enough information will be recorded throughout collection, transport, and analysis of samples to support creation of a sample summary sheet. This document will identify all the samples collected during the

sampling event (and track the samples to the coolers that they were shipped to the laboratory in) and provided the following minimum data:

- Location ID
- Sample depth
- Sample ID
- Date/Time sample collected
- Analytical methods
- Matrix
- Container type/volume
- QC (TB, QC, MS/MSD, etc.)
- Laboratory
- SDG number
- Field preservation
- Cooler name
- Sampler initials
- Turnaround time

Chain-of-Custody

The CoC form tracks sample possession and handling from the time of collection through analysis and final disposition. Collected samples will remain in the custody of the field team that collected the samples until shipment to the analytical laboratory. Each CoC form will be completed in accordance with SOP BE-SOP-02 *Sample Chain-of-Custody* (Attachment C-2) and will contain the information listed below:

- Unique identification number (i.e., 2019SWMU1011-01)
- The first four digits define the sampling year (2019)
- The next characters define the project Site SWMU 10-11 (SWMU1011)
- The next two digits represent the sequential CoC number (-01, -02, -03, etc.)
- The cooler will be given a unique identification name or number, which will be recorded on the CoC form.
- The CoC form will include the sample ID, location ID, sample date/time, sampler initials, container (quantity, type, and volume), preservation method, matrix, analytical group, QC (MS/MSD, if applicable), turnaround time, and any notes associated with the sample. This information will be entered for each sample collected for laboratory analysis.
- The CoC form will be signed by the person transferring custody at any stage of shipment.
- A separate CoC form will be completed for each cooler.

The CoC form will be placed in a plastic bag and taped to the inside lid of the cooler.

Packaging Procedures

Samples will be labeled, packaged, and shipped in accordance with SOP BE-SOP-03 *Labeling, Packaging, and Shipping Samples* (Attachment C-2). In preparation of sample shipment, the following steps will be followed:

- Store primary samples, QC samples, temperature blanks, and trip blanks together in a cooler or refrigerator until ready for packaging.
- Check that all lids are on tight.
- Match printed labels to information on jar lids, wipe off condensation, apply labels, and secure. Labels should contain the following at a minimum: project name or number, sample date and time, sample ID, analyses, and preservation (if applicable).

Sample coolers will be shipped overnight via air cargo to SGS Anchorage. If transfer of samples to another laboratory is required, SGS will store, package, and ship samples following established CoC procedures. Once samples are received, the laboratory will follow Sample Custody and Storage Procedures (Section 26.5.1) and their SOPs.

Sample Receipt, Inspection, and Log-in Procedures

A sample custodian at the laboratory will accept custody of the shipped samples, and check them for discrepancies, proper preservation, integrity, etc. The laboratory will complete a cooler receipt form when samples are received. Cooler receipt information, including signed CoC, custody seals, and completed cooler receipt form will be provided to the Contractor project chemist within 24 hours of cooler receipt. Discrepancies or other data quality issues identified by the laboratory will be forwarded to the laboratory manager and/or the Contractor project chemist for corrective action.

Sample Custody and Storage Procedures

The sample custodian will relinquish custody to the appropriate department for analysis. Disposal of the samples will occur only after analyses and QA/QC checks are completed, and the final data report has been submitted.

Following completion of chemical analysis on samples, the samples will continue to be maintained according to preservation methods indicated on Worksheet #19/30 for at least two weeks after expiration of the appropriate holding time.

After the two weeks have expired, the samples may be moved to an un-refrigerated storage location but shall be kept for a minimum of 60 days after the Contractor has received the final deliverables unless other arrangements have been authorized by the Contractor.

Sample Disposal

After expiration of the storage time identified above, or other arrangements authorized by the Contractor, samples will be disposed of in accordance with Federal, State, and Local requirements.

This page intentionally blank

WORKSHEET #28 – ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

The purpose of the laboratory QC sample activities is to produce data of known quality that satisfy the project-specific DQOs. This Worksheet provides details regarding analytical QC requirements that laboratories follow to produce definitive data, and it is used to verify that the selected analytical methods can meet the MPC included in Worksheet 12. Tables 28-1 and 28-2 provide analytical QC samples, acceptance criteria, corrective actions, and laboratory flagging criteria for each analytical method.

28.1 ANALYTICAL QUALITY CONTROL SAMPLES

The following sections describe the analytical QC samples that will be prepared and analyzed by the laboratory for this project.

XVII) METHOD BLANK

A MB is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The MB is carried through the complete sample preparation and analytical procedure and is used to assess possible contamination resulting from the analytical process.

A MB shall be included in every analytical batch. The presence of analytes in a MB above the DL indicates the need for further assessment of the data. The source of contamination should be investigated; and measures must be taken to correct, minimize, or eliminate the problem if the concentration exceeds one-half the LOQ. For common laboratory contaminants (e.g., methylene chloride, acetone, or phthalates), the MB concentration must not exceed the LOQ (or if greater than the LOQ, less than one-tenth of the higher of the amount measured in any sample or the regulatory limit). No analytical data shall be corrected for the presence of analytes in blanks.

If an analyte is detected in the MB and at similar concentrations in the associated samples, and corrective actions are not performed or are ineffective, an appropriate flag shall be applied to the sample results.

XVIII) LABORATORY CONTROL SAMPLE

An LCS is a sample of known composition that is spiked with all target analytes. The LCS is used with each analytical batch to determine whether the method is in control. Each analyte in the LCS shall be spiked at a level less than or equal to the midpoint of the calibration curve, which is defined as the median point of the curve instead of the middle of the range. The LCS shall be carried through the complete sample preparation and analysis procedure. The LCS cannot be used as the CCV.

At least one LCS shall be included in every analytical batch. If more than one LCS is analyzed in an analytical batch, results from all LCSs shall be reported. A failure of an analyte in any of the LCSs shall require appropriate corrective action, including qualification of the failed analyte in all the samples, as required.

The LCS limits specified in the *DoD QSM v.5.1* Appendix C (DoD 2017) tables shall be used unless the analytes are not listed in these tables (in which case laboratory historical control limits [CLs] will be used). The performance of the LCS is evaluated against the QC acceptance limits. Whenever an analyte in the LCS is outside the acceptance limit, corrective action shall be performed. If an analyte in the LCS exceeds

the upper or lower CL and no corrective action is performed or the corrective action is ineffective, an appropriate flag shall be applied to all affected results.

XIX) MATRIX SPIKE/MATRIX SPIKE DUPLICATE

An MS or MSD is an aliquot of sample collected in the field and spiked with known concentrations of all target analytes. The spiking occurs before sample preparation and analysis. Each analyte in the MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve for that analyte. The MS/MSD is used to document potential matrix effects associated with a site and will not be used to control the analytical process. The MS/MSD results and any associated flags will not be related to other samples that are collected from the same site where the MS/MSD set was collected, aside from the primary sample and field duplicate (if collected at the same location). Additional volume will be collected for samples selected for MS/MSDs, and the laboratory will use those samples to prepare the appropriate MS/MSDs.

The performance of the MS and MSD is evaluated against the QC acceptance limits outlined in the *DoD QSM v.5.1 (*DoD 2017). In general, criteria for the MS and MSD are the same acceptance criteria used for LCS limits. If either the MS or the MSD is outside the QC acceptance limits, the data shall be evaluated to determine whether there is a matrix effect or analytical error, and an appropriate flag will be applied to the affected analytes.

If the sample concentration exceeds the spike concentration, the data shall be reported unflagged. The laboratory should communicate potential matrix difficulties to the Contractor Project Chemist so that an evaluation can be made with respect to project DQOs.

XX) SURROGATES

Surrogates are compounds similar to the target analytes in chemical composition and behavior but not normally found in environmental samples. Surrogates are used to evaluate accuracy, method performance, and extraction efficiency. Surrogates shall be added to environmental samples, controls, and blanks in accordance with the method requirements.

Surrogate recovery limits are listed in the *DoD QSM v. 5.1* Appendix C tables (DoD 2017). If these criteria are not available, the laboratory shall use its in-house statistically derived limits. If a surrogate recovery is outside the acceptance limit, corrective action must be performed. After the system problems have been resolved and system control has been reestablished, the sample should be re-prepared and reanalyzed. If corrective actions are not performed or are ineffective, an appropriate flag shall be applied to the sample results.

XXI) INTERNAL STANDARDS

Internal standards are known amounts of standards that are added to a portion of a sample or sample extract and carried through the entire determination procedure. These standards are used as a reference for calibration and for controlling the precision and bias of the analytical method. Internal standards shall be added to environmental samples, controls, and blanks, in accordance with the method requirements.

If the internal standard results are outside of the acceptance limits, corrective actions shall be performed. After the system problems have been resolved and system control has been reestablished, all samples analyzed while the system was malfunctioning shall be reanalyzed. If corrective actions are not performed or are ineffective, an appropriate flag shall be applied to the sample results.

XXII) RETENTION TIME WINDOWS

Retention Time (RT) windows are used in GC, ion chromatography, and high-performance liquid chromatography analysis for qualitative identification of analytes. RT windows are calculated from replicate analyses of a standard on multiple days. The procedure and calculation method are given in SW-846, Method 8000C. The center of the RT window is established for each analyte and surrogate using the RT of the midpoint standard of the ICAL. For non-mass spectrometry methods, these are updated daily using the absolute RT in the ICV.

If the RT is outside of the acceptance limits, corrective action shall be performed. This applies to all CCV subsequent to the ICV and to LCSs. If corrective actions are not performed or are ineffective, an appropriate flag shall be applied to the sample results.

28.2 QUALITY CONTROL CHECKS

The following sections describe laboratory QC procedures.

XXIII) PREPARATORY AND ANALYTICAL BATCH REQUIREMENTS

A preparatory batch includes samples that are prepared or extracted together, including several laboratory QC samples that are prepared along with the field samples. A preparatory batch is a group of field samples (not exceeding 20 environmental samples) plus associated laboratory QC samples including MB, LCS, and method-required QC that are similar in composition (matrix); extracted or digested at the same time and with the same lot of reagents; and analyzed together as a group.

An analytical batch includes samples that are analyzed together and extends to cover samples that do not need separate extraction or digestion (e.g., VOC analysis by purge and trap). The analytical batch includes field samples, calibration check, calibration blank, and a closing blank and calibration verification; as well as method-required QC.

The identity of each preparatory and analytical batch shall be unambiguously reported with the analyses so that a reviewer can identify the laboratory QC samples and the associated environmental samples. The type of laboratory QC samples and the frequency of use of these samples are discussed in the following subsections.

XXIV) HOLDING TIME COMPLIANCE

All sample preparation and analysis shall be completed within the method-required holding times. Some methods have more than one holding time requirement (e.g., preparation holding time and analytical holding time). For methods not requiring sample preparation, the holding time is calculated from the time

of sample collection to the time of completion of all analytical runs. For methods requiring sample preparation before analysis:

- Preparation holding time is calculated from the time of sample collection to the time of completion of preparation.
- Analytical holding time is calculated from the time of completion of preparation to the time of completion of all analytical runs.

Holding times are determined based on days, hours, and minutes. If the time of sample collection is not provided, the laboratory must assume the most conservative time of day. If holding times are exceeded and the analyses are performed, the results shall be flagged and identified in the data package case narrative.

XXV) CONFIRMATION

Results at or above the LOQ for samples analyzed by GC require quantitative confirmation. The confirmation shall be completed within the method-required holding times. If holding times are exceeded and the analyses are performed, an appropriate flag shall be applied to the results. For GC methods, a second column will be used for confirmation.

Unless otherwise specified or overlapping peaks are causing erroneously high results, data from the primary column or detector shall be reported as the primary result. The column used for both the primary and confirmation results shall be indicated on the sample reports. The associated calibration and laboratory QC results shall be submitted for both columns so that sample results can be appropriately evaluated.

XXVI) CONTROL CHARTS

Control charts are used to track laboratory performance over time. It is recommended that all analytes spiked into the LCS be tracked via control charts. These charts are useful for identifying trends and problems in an analytical method. The laboratory shall use these charts to establish in-house LCS CLs. Control charts shall be monitored on an ongoing basis (at least quarterly) for shifts in mean recovery, changes in standard deviation, and development of trends. A laboratory must use its in-house statistically established LCS CLs for trend analysis and may use in-house CLs as a component in estimating measurement uncertainty.

XXVII) STANDARD MATERIALS

Standard materials (including second source materials) used in calibration and to prepare samples shall be traceable to a National Institute of Standards and Technology, EPA, American Association of Laboratory Accreditation, or another equivalent approved source, if available.

All standard materials shall be stored in accordance with manufacturer's recommendations. Standard materials shall be tracked, stored, and replaced in accordance with laboratory QA procedures outlined in its QAP and appropriate SOPs.

A second source standard is used to independently confirm the ICAL. The use of a standard from a second lot obtained from the same manufacturer (independently prepared from different source materials) is acceptable for use as a second source standard. The concentration of the second source standard shall be at or near the midpoint of the calibration range.

28.3 TABLES

Table 28-1 and Table 28-2 provide analytical QC samples, acceptance criteria, corrective actions, and laboratory flagging criteria for each analytical method.

This page intentionally blank

TABLE 28-1 SUMMARY OF ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION FOR METHODS AK102 AND AK103

QC SAMPLE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	PERSON RESPONSIBLE FOR CA	MEASUREMENT PERFORMANCE CRITERIA
MB	One per preparatory batch	No analytes detected >½ LOQ and 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Assess data. Correct problem. If necessary, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Laboratory Analyst Laboratory QA Manager	No analytes detected >1/2 LOQ. Sample results will be qualified if contamination is detected above the DL in the associated MB.
LCS/LCSD	One LCS/LCSD pair per preparatory batch	AK101: Recovery 60-120% AK102: Recovery 75-125% AK103: Recovery 60-120% RPD ≤20%	Correct problem, then reanalyze the LCS and all samples in the associated preparatory batch for the failed analytes.	Laboratory Analyst Laboratory QA Manager	LCS/LCSD within method recovery and precision limits.
Surrogate spike	All field and QC samples	QC samples (MB/LCS/LCSD) AK101, AK102, AK103: Recovery 60-120% Field Samples (including MS/MSD) AK101, AK102, AK103: Recovery 50-150%	Correct problem, then re-prepare and reanalyze the sample.	Laboratory Analyst Laboratory QA Manager	Surrogate recoveries within method control limits.
MS/MSD	One pair per preparatory batch	AK101, AK102, AK103: Use LCS Recovery Limits RPD ≤20%	Assess data to determine whether there is a matrix effect or analytical error. Communicate potential matrix effects to project chemist so an evaluation can be made regarding DQOs.	Laboratory Analyst Laboratory QA Manager	MS/MSD recoveries within LCS method control limits. MS/MSD RPD ≤ 20% per DoD QSM.

TABLE 28-2 SUMMARY OF ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION FOR METHODS SW8260C AND SW8270D SIM

QC SAMPLE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	PERSON RESPONSIBLE FOR CORRECTIVE ACTION	MEASUREMENT PERFORMANCE CRITERIA
MB	One per analytical batch	No analytes detected >½ LOQ and 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected >LOQ.	Rule out instrument contamination by re-analyzing the MB. If problem persists, If necessary, correct problem. Re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Laboratory Analyst Laboratory QA Manager	No analytes detected >1/2 LOQ. Sample results will be qualified if contamination is detected above the DL in the associated MB.
LCS	One per analytical batch	Recoveries within *DoD QSM v.5.1* limits. If no DoD QSM limits are available, laboratory statistically derived limits will be used.	Correct problem, then re-prep and reanalyze the LCS and all associated samples.	Laboratory Analyst Laboratory QA Manager	LCS within recovery limits.
Surrogate spike	All field and QC samples	Recoveries within *DoD QSM v.5.1* limits. If no DoD QSM limits are available, laboratory statistically derived limits will be used.	Check if sample was properly spiked. If non-compliant and matrix interference not observed, correct problem and re-prep and/or reanalyze.	Laboratory Analyst Laboratory QA Manager	Surrogates within recovery limits.
MS/MSD	One per 20 project samples per matrix	Recoveries within *DoD QSM v.5.1* LCS limits. RPD ≤20%. (For SW8270D SIM, RPD ≤40%.)	Check if sample was properly spiked. If indicative of matrix interference, discuss in case narrative. Otherwise, re-prep and reanalyze the sample.	Laboratory Analyst Laboratory QA Manager	MS/MSD within recovery and precision limits.

TABLE 28-2 SUMMARY OF ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION FOR METHODS SW8260C AND SW8270D SIM (CONTINUED)

QC SAMPLE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	PERSON RESPONSIBLE FOR CORRECTIVE ACTION	MEASUREMENT PERFORMANCE CRITERIA
IS	Each sample, standard, and QC sample.	RT ±30 seconds from RT of the IS in the ICAL midpoint standard. Extracted ion current profile area within -50 to +100% of area from IS in ICAL midpoint standard.		Laboratory Analyst Laboratory QA Manager	IS recoveries within limits.

This page intentionally blank

WORKSHEET #29 – PROJECT DOCUMENTS AND RECORDS

Table 29-1 identifies the documents and records that will be generated for all aspects of the project including, but not limited to, sample collection and field measurement, onsite and offsite analysis, and data assessment. All files will be stored electronically in the project file location on Brice's server.

TABLE 29-1 PROJECT DOCUMENTS AND RECORDS

RECORD	GENERATION	VERIFICATION	STORAGE LOCATION/ ARCHIVAL
Sample Collection and Field Records			
Completed Field Logbook Pages	Lead Sampler	Project Manager	Project Files
Completed Sampling Field Forms	Lead Sampler	Project Manager	Project Files
CoC Forms	Lead Sampler	Project Manager	Project Files
Deviations and Corrective Actions	Lead Sampler	Project Manager	Project Files
Daily Site Safety Meeting Forms	Lead Sampler	Project Manager	Project Files
Waste Manifests	Lead Sampler	Project Manager	Project Files
Project Assessment			
Field Audit Checklists	Field Manager	Project Chemist	Project Files
Data Verification Checklists	Project Chemist	Project Team	Project Files
Chemical Data Quality Report	Project Chemist	Project Team	Project Files
Data Usability Assessment Report	Project Chemist	Project Team	Project Files
Laboratory Records			
Electronic Data Deliverables (EDDs)	SGS Anchorage	Project Chemist	Project Files

This page intentionally blank

WORKSHEET #31 , 32, & 33 – ASSESSMENTS AND CORRECTIVE ACTION

Table 31-1 identifies the type and frequency of assessment activities that will be performed for the project. Table 31-2 describes corrective actions, and Table 31-3 lists reporting requirements.

TABLE 31-1 ASSESSMENTS

ASSESSMENT TYPE	FREQUENCY	INTERNAL OR EXTERNAL	ORGANIZATION PERFORMING ASSESSMENT	PERSON(S) RESPONSIBLE FOR PERFORMING ASSESSMENT	PERSON(S) RESPONSIBLE FOR RESPONDING TO ASSESSMENT FINDINGS	PERSON(S) RESPONSIBLE FOR IDENTIFYING AND IMPLEMENTING CORRECTIVE ACTION	PERSON(S) RESPONSIBLE FOR MONITORING EFFECTIVENESS OF CORRECTIVE ACTION
Laboratory technical evaluation	Once, prior to subcontract award and before sampling begins	Internal	Brice	Brice Project Chemist	Analytical Laboratory PM	Analytical Laboratory PM	Brice Project Chemist
Field sampling technical evaluation	Initial and ongoing	Internal	Brice	Technical Lead	Technical Lead and Project Manager	Technical Lead and Project Manager	Technical Lead and Project Manager
Analytical data review	After receipt of analytical results	Internal	Brice	Brice Project Chemist	Analytical Laboratory PM	Brice Project Chemist	Project Manager
Field inspection/audit	As determined by ADEC	External	ADEC	ADEC	USCG	USCG	USCG

TABLE 31-2 ASSESSMENT RESPONSE AND CORRECTIVE ACTION

ASSESSMENT TYPE	NATURE OF DEFICIENCIES DOCUMENTATION	INDIVIDUAL(S) NOTIFIED OF FINDINGS (NAME, TITLE, ORGANIZATION)	TIMEFRAME OF NOTIFICATION	NATURE OF CORRECTIVE ACTION RESPONSE DOCUMENTATION	INDIVIDUAL(S) RECEIVING CORRECTIVE ACTION RESPONSE (NAME, TITLE, ORGANIZATION)	TIMEFRAME FOR RESPONSE
Field sampling technical evaluation	Logbook notes, groundwater sampling forms, core logs	Brice Technical Lead	Within 24 hours	Logbook notes, email correspondence, or documentation in report	Technical Lead	While onsite if possible; otherwise, document deviations in the logbook notes and/or in the report
Analytical data review	Email correspondence, CoC variance request forms, cooler receipt forms	Analytical Laboratory PM	Within 24 hours	Email correspondence, formal corrective action report/letter, case narrative	Brice Project Chemist	Within holding times, if possible; otherwise, prior to reporting analytical data

TABLE 31-3 REPORTING

TYPE OF REPORT	FREQUENCY (DAILY, WEEKLY MONTHLY, QUARTERLY, ANNUALLY, ETC.)	PROJECTED DELIVERY DATE(S)	PARTY RESPONSIBLE FOR REPORT PREPARATION	REPORT RECIPIENT(S)
Site Activities Report	Draft, Draft-Final, and Final version, after completion of fieldwork and receipt of the final analytical data reports	See Worksheet #14/16	Brice	USCG, ADEC, EPA
Data quality review and assessment, including the *ADEC Laboratory Data Review Checklist* (ADEC 2017b)	Once, after completion of fieldwork and receipt of the final analytical data reports	See Worksheet #14/16	Brice	USCG, ADEC, EPA

WORKSHEET #34 – ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

Table 34-1 lists the inputs that will be used during data verification and quality review. Inputs include planning documents, field records, and laboratory records. Data verification is a check that all specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records are available to proceed to data quality review.

Data quality review and assessment includes an evaluation of conformance to stated requirements, including those in the contract, methods, SOPs, and UFP-QAPP.

TABLE 34-1 DATA VERIFICATION AND VALIDATION INPUTS

DESCRIPTION	VERIFICATION (COMPLETENESS)	VALIDATION (CONFORMANCE TO SPECIFICATIONS)
Approved UFP-QAPP	X	
Contract	X	
Field SOPs	X	
Laboratory certifications, SOPs, and reporting limits	X	X
Statement(s) of work	X	
Field logbook(s)	X	X
Field instrument calibration logs	X	X
CoC and cooler receipt form	X	X
Sampling diagrams/surveys	X	X
Daily quantity reports	X	X
Waste manifests and/or disposal records	X	X
Correspondence	X	X
Change orders/deviations	X	X
Field audit reports	X	X
Field CA reports	X	X
Case narrative	X	X
Internal laboratory CoC form(s)	X	X
Cooler receipt form(s) for each cooler of samples	X	X
Sample date/time of receipt, date/time of prep, date/time of analysis	X	X
Initial and continuing calibration	X	X
Field sample and field QC sample results	X	X
Laboratory QC sample results	X	X
DL, LOD, and LOQ reported	X	X
DL, LOD, and LOQ establishment and verification	X	X
Raw data	X	X
Bench sheets/worksheets	X	X
Instrument analytical run logs	X	X
Instrument maintenance and operations logs	X	X
Definition of laboratory qualifiers	X	X
PDF and electronic versions of the laboratory report, searchable and bookmarked	X	X
Communication records	X	X
Documentation of data quality issues and their resolution, including Corrective Actions	X	X

WORKSHEET #35 – DATA VERIFICATION PROCEDURES

Table 35-1 describes data verification procedures, including types of records, required documents, process descriptions, and responsible persons.

TABLE 35-1 DATA VERIFICATION PROCEDURES

RECORDS REVIEWED	REQUIREMENT DOCUMENTS	PROCESS DESCRIPTION	RESPONSIBLE ORGANIZATION
Field documentation including field logbook(s), Global Positioning System (GPS) coordinates, and photographs	UFP-QAPP Field SOPs	Verify accuracy and completeness for each day of field activities. Verify that all planned samples, including field QC samples, were collected and documented in accordance with the Field SOPs and QAPP requirements. Verify that deviations from planned activities were documented. Verify that field monitoring and field measurements were recorded.	Technical Lead
Field SOPs	UFP-QAPP Field SOPs	Verify that the sampling SOPs were followed.	Technical Lead
Analytical SOPs	UFP-QAPP	Verify that the analytical SOPs were followed.	Laboratory QA Manager and Subcontract Laboratory
Sample receipt documentation (CoC forms, cooler receipt forms, laboratory log-in information)	UFP-QAPP Field SOPs	Examine CoC forms against project requirements (correct analytical methods requested, samples identified correctly, complete CoC). Verify CoC (CoC relinquished, samples received). Verify accuracy and completeness. Verify that discrepancies were documented and resolution of any potential data quality issues.	Brice Project Chemist, Technical Lead
Sample summary table(s)	UFP-QAPP	Verify accuracy and completeness of the sample summary by comparing against the planned samples and the CoCs and cooler receipt forms for samples actually submitted to the laboratory.	Technical Lead Brice Project Chemist
Field measurements, including field screening results	UFP-QAPP Field SOPs	Verify that field measurements meet the QA/QC requirements established in the project QAPP. Verify accuracy and completeness.	Technical Lead

TABLE 35-1 DATA VERIFICATION PROCEDURES (CONTINUED)

RECORDS REVIEWED	REQUIREMENT DOCUMENTS	PROCESS DESCRIPTION	RESPONSIBLE ORGANIZATION
Laboratory data packages	UFP-QAPP	Verify accuracy and completeness of the laboratory data packages: • Verify that laboratory procedures used to generate the analytical data were performed in accordance with the DoD QSM. • Verify that data for all samples submitted to the laboratory (based on the sample summary) have been provided. • Verify that the complete copy of the laboratory report includes all relevant laboratory QC data (including raw data) and is provided in searchable PDF format. • Verify that the specified analytical and extraction methods were performed by the laboratories.	Brice Project Chemist
EDDs	UFP-QAPP	Verify that EDDs meet contract requirements. Verify that the EDDs are consistent with the final data package.	Laboratory QA Manager Brice Project Chemist
Analytical results, including DL/LOD/LOQ, and laboratory data qualifiers	UFP-QAPP CoC Forms	Verify that the specified analytical methods were used by the laboratory. Verify that data for all samples submitted to the laboratory have been provided. Verify that reporting limits meet DQOs specified in the QAPP. Verify that method and required QC samples were analyzed, and all relevant data (including chromatograms) have been provided. Verify that soil sample results are dry-weight corrected. Ensure that required lists of analytes were reported as specified.	Laboratory QA Manager and Brice Project Chemist
Field QC sample results	UFP-QAPP	Verify that all QAPP-required QC samples were collected and analyzed.	Technical Lead
Audit reports, CA reports	UFP-QAPP	Verify accuracy and completeness. Verify that Corrective Actions were documented and implemented.	Laboratory QA Manager, Subcontract Laboratory, and Brice Project Chemist

WORKSHEET #36 – DATA VALIDATION PROCEDURES

The chemical data quality review consists of data verification, data review, and data usability assessment. Data verification confirms that the specified requirements have been performed. Data verification and data quality review inputs are included in Worksheet #34, and data verification procedures are included in Worksheet #35.

Data quality review and assessment is the systematic process of evaluating whether the data comply with the predefined requirements of the project, including method, procedural, and contractual requirements and comparing the results with criteria based on the DQOs documented in this UFP-QAPP. This Worksheet documents procedures that will be used to review and assess project data.

The chemical data quality review process is summarized in Table 36-1.

TABLE 36-1 CHEMICAL DATA QUALITY REVIEW PROCEDURES

PROCEDURES	DESCRIPTION
Data reviewer	Brice Project Chemist
Analytical Group/Method	The same level of data quality review applies to all methods analyzed by the analytical laboratory.
Data deliverable requirements	Level IV report in PDF, EDD
Analytical specifications	Worksheet #28, laboratory SOPs
MPC	Worksheet #12
Percent of data packages to be reviewed	100%
Percent of raw data reviewed	Varies: Raw data may be reviewed when matrix interference is suspected, or discrepancies are identified by the laboratory.
Percent of results to be recalculated	0%
Chemical data quality review procedures	Worksheet #36
Data quality review code	S2bVEM[1]

Notes:

[1] Stage 2B Validation Electronic and Manual. Chemical data quality review will be consistent with the Stage 2B electronic procedures outlined *in Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, EPA 540-R-08-005* (EPA 2009).

All types of data, including screening data and definitive data, are relevant to the chemical data review and usability assessment. The following subsections focus on the data review requirements for definitive data only.

36.1 LABORATORY REPORTING REQUIREMENTS

Laboratories used to perform work for this project are required to follow the appropriate program and method requirements to ensure that the data quality is acceptable and can be used to support project decisions. Laboratory certification requirements include the following:

- Current State of Alaska certificate of approval for Contaminated Sites analysis
- DoD ELAP approval for the fields of testing and matrices proposed on the project

36.2 ANALYTICAL DATA PACKAGE REQUIREMENTS

A group of samples submitted to the laboratory at the same time and included on the same CoC will be considered an SDG. The results for an SDG will be reported as one analytical data package. Laboratories must provide Level IV data packages that meet the minimum requirements included in the ADEC *Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling Technical Memorandum* (ADEC 2017d) and *DoD QSM v.5.1* (DoD 2017).

Laboratory analytical reports must meet the following minimum requirements:

- Case narrative must meet ADEC requirements and shall include the project name and USACE NPDL Work Order Number (19-XXX)
- Project name
- Field sample ID number on CoC
- Abbreviated subcontracted laboratory name
- Subcontracted laboratory report number
- Lab ID number for sample
- Date sample collected
- Date sample received at subcontracted laboratory
- Date sample extracted or prepared and date analyzed
- Extraction or preparation procedures, if appropriate
- Analysis procedure including method numbers
- Analyte of parameter
- DL/LOD/LOQ for all results
- Initial and continuing calibration
- Analytical results and units
- Dilution factor
- Chromatograms and raw data for all methods
- Matrix
- Sample description (i.e., multi-phase, non-homogeneous, pebbles, roots, cloudy, viscous, etc.)
- Soil/sludge and solid waste data shall be reported on a dry-weight basis with percent moisture included
- Original CoC record, custody seals, and sample cooler receipt forms, with all forms properly signed and dated

36.3 LABORATORY DATA DELIVERABLES

At minimum, laboratory data deliverables for each SDG will include a searchable and bookmarked electronic Level IV data package in PDF for each SDG consistent with the requirements specified in ADEC Data Quality Objectives, Quality Assurance Requirements for Laboratory Data, and Sample Handling Technical Memorandum (ADEC 2017d) and the DoD QSM (DoD 2017), and an excel or access data deliverable to include sample and quality control sample results.

36.4 LABORATORY RESULT REPORTING REQUIREMENTS

The following result reporting requirements will be met for laboratory data:

- DLs and sample results should be reported to one decimal place more than the corresponding LOQ, unless the appropriate number of significant figures for the measurement dictates otherwise.
- Results for soil and sediment samples will be reported on a dry-weight basis. DLs, LODs, and LOQs will be adjusted for moisture.
- Samples should be analyzed undiluted, if possible. ND results will be reported to the LOD.

All reported data shall reflect any dilutions and/or concentrations. The dilution factor, if applicable, shall be noted on the analytical report. Such changes should also be reflected in the reporting limits with footnotes detailing the reason for the dilution. If dilution is required, data from both runs shall be recorded and reported; however, one result will be selected and reported as the primary result. If samples must be rerun for any reason, the data shall be included in the report. Chemical data results between the DL and the LOQ will be flagged "J."

36.5 LABORATORY DATA REVIEW AND EVALUATION

All analytical data that the laboratory generates shall be verified before submittal to the project team. This internal data review process shall include all aspects of data generation, reduction, and QC assessment.

The calibration, QC, corrective actions, and flagging requirements for definitive data are included in Worksheet #24 and Worksheet #28. The laboratory shall apply data qualifiers as part of its internal validation activities. The allowable data qualifiers for definitive data are Q, J, B, U, and N, and are defined in the *DoD QSM v.5.1* (DoD 2017). Flagging criteria apply when acceptance criteria are not met and when corrective actions are not successful or not performed.

The Contractor Project Chemist or data reviewer will subsequently evaluate the flags that the laboratory applied as part of its internal data review and reporting. The flags may be accepted, modified, or rejected. For all data qualifiers that are changed, clear justification must be provided.

36.6 CHEMICAL DATA QUALITY REVIEW PROCEDURES

All project data will be reviewed on an analytical-batch basis by assessing QC samples and associated field sample results. Data quality review will be performed using the QC criteria defined in this UFP-QAPP; the

most current version of the DoD QSM (DoD 2017); ADEC Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling Technical Memorandum (ADEC 2017a); specific method guidance, such as the ADEC Underground Storage Tanks Procedures Manual, Guidance for Treatment of Petroleum-Contaminated Soil and Standard Sampling Procedures (ADEC 2017b); the SW-846 Third Edition (through Final Update IV 2007) (EPA 2007); General Data Validation Guidelines (DoD 2018); and the laboratory SOP, in that order.

Data quality review and assessment is typically performed by person(s) independent of the activity being evaluated. Data quality review includes completing the ADEC *Laboratory Data Review Checklist (*ADEC 2017b) for each SDG, the review of the analytical data including QC sample results, field and laboratory QA reports, and all data submittals.

The following information will be reviewed during the data quality review and assessment:

- CoC documentation
- Holding time compliance
- QC sample frequencies
- Blanks
- LCS recoveries (and precision, if LCSD performed)
- Surrogate spike recoveries
- MS/MSD recoveries and precision
- Initial and continuing calibration summary information
- Internal standards
- Field duplicate precision
- Case narrative review, laboratory flagging review, and other method-specific criteria

In general, electronic data deliverables (EDDs) will be evaluated for consistency with project and contract requirements. EDDs will be consistent with the Level IV PDF report.

XXVIII) DATA QUALITY REVIEW GUIDELINES

The chemical data quality review will identify results requiring qualification and potential effects on data usability based on the MPC in Worksheet #12 and Worksheet #28. Table 36-2 defines the qualifiers to be applied to the analytical data set, as appropriate. Direction of bias will be indicated wherever possible.

Qualification will not be required in the following circumstances:

- Surrogate or MS recoveries were outside QC limits, and the sample was diluted by a factor of 5 or greater.
- MS recoveries were outside QC limits, and the spiked concentration was less than that of the parent sample.
- An analyte was detected in the MB, but there was no detection in the sample.
- MS/MSD or LCS/LCSD recovery exceeds the upper control limit, and there was no detection in the sample(s).

Data may be rejected on the following grounds:

- ICAL (per compound) criteria not met
- Continuing calibration (per compound) not verified
- All NDs with the continuing calibration recovery less than CLs
- All NDs with the LCS recovery less than CLs
- Any compound with LCS recovery less than 10%
- Missed holding times greater than two times the method-specified holding time
- Surrogate recovery of less than 10% and a dilution factor of 5 or less

TABLE 36-2 CHEMICAL DATA QUALITY REVIEW QUALIFIERS

QUALIFIER	DESCRIPTION
ND (LOD)	Analyte result is less than the LOD.
J	Analyte is considered an estimated value because the level is below the laboratory LOQ and above the DL.
B	Analyte result is considered a high estimated value due to contamination present in the method or trip blank.
QH/QL/QN	Analyte result is considered an estimated value biased (high, low, uncertain) due to a QC failure.
R	Analyte result is rejected – result is not usable. Note that "R" replaces the chemical result (no result shall be reported with an "R" flag).

Note:
Data quality review will indicate when performance criteria are not met. The final rejection of data (qualified "R") and their use must be decided by the project team in the context of project objectives, and not based solely on the assessment performed by the data reviewer.

XXIX) BLANK EVALUATION GUIDANCE

The Contractor project chemist will evaluate MBs, as well as other field blanks, based on the concentration of the analyte in the samples in relation to the concentration in the blank. The Brice project chemist must discuss any blank contamination that may affect data usability in conjunction with project-specific goals. When a data set contains low-level detects in field samples and has associated field or laboratory blanks that have detects at similar concentrations, this suggests that the low-level detects in these field samples may be artifacts because of either field or laboratory practices. MBs will be evaluated to the DL. If an analyte is detected in the MB above the DL, associated sample results that are ≤10 times the amount found in the MB will be flagged "B" at the detected concentration to document the associated blank contamination.

XXX) DUPLICATE EVALUATION GUIDANCE

QC measures for precision include field duplicates, laboratory duplicates, and MSDs. The laboratory will evaluate and qualify these measures according to procedures outlined in Worksheet #28, with the exception of the field duplicates.

To evaluate field duplicate precision, the RPD between duplicate results will be calculated. Duplicate results will be qualified "QN" if the RPD exceeds the recommended 50% for soils or 30% for waters

(Worksheet #12). Duplicate results will be qualified when one result is greater than the LOQ and one result is ND. RPD will not be calculated for duplicate pairs with both results below the LOQ.

Field duplicate results can be used to assess field sampling precision, laboratory precision, and, potentially, the representativeness of the matrix sampled. Poor overall precision may result from one or more of the following:

- Field instrument variation
- Analytical measurement variation
- Poor sampling technique
- Sample transport problems
- Spatial variation (heterogeneous sample matrices)

To identify the cause of imprecision, the project team should evaluate the field sampling design rationale and sampling techniques, as well as review both field and analytical duplicate sample results. If poor precision is indicated in both the field and analytical duplicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate results, then the sampling technique, field instrument variation, sample transport, and/or spatial variability may be the source of error. If data validation reports indicate that analytical imprecision exists for a particular data set or SDG, then the reports must discuss the effect of that imprecision on usability.

36.7 CHEMICAL DATA QUALITY REPORT

A chemical data quality report will be prepared summarizing the findings of the data quality review and discussing their effect on overall data usability. In addition to the overall data quality report, the Contractor Project Chemist or data reviewer will complete the ADEC *Laboratory Data Review Checklist* (ADEC 2017b) for each laboratory data package.

The chemical data quality report will present detailed results of the data quality review and assessment, including, but not limited to, a discussion of all QC parameters evaluated; the acceptance criteria used to evaluate each parameter; the extent of the QC exceedance; identification of samples affected by the QC exceedance; and discussion of any qualifiers applied to the samples results, including potential direction of bias and relationship to screening levels and/or cleanup levels (if possible). Significant trends and biases in the data will be evaluated and identified. A detailed description will be provided for any corrective actions and/or systematic problems that were identified during the data review process. The chemical data quality report will be the overall PARCCS summary, referencing the ADEC *Laboratory Data Review Checklist* (ADEC 2017b) for details.

Analytical results with LOQs greater than laboratory LOQ and/or PSLs will be identified and evaluated for potential effects on usability. Rejected results will be presented in a table with a brief explanation of the reason for rejection.

Analytical data will be tabulated in the completed report. All analytical results, including duplicate results, will be reported with any appropriate qualifiers in accompanying data tables. Chemical data tables will include the following information:

- Location ID
- Field sample ID
- Laboratory ID number
- Matrix
- Analytical method
- Percent moisture
- Concentration units
- Result
- PSLs
- LOQ for each sample ID/method/analyte/matrix
- Data qualifier flags

Laboratory LODs for ND results will be compared to PSLs established for the method/analyte/matrix in Worksheet #15. If the laboratory LOD for the ND result exceeds the PSL, the result will be flagged or otherwise highlighted. Rejected data shall be presented in a table with a brief explanation of the reason(s) for data rejection. Table 36-3 lists general data qualifying conventions.

TABLE 36-3 GENERAL DATA QUALIFYING CONVENTIONS

QC REQUIREMENT	CRITERIA	FLAG	FLAG APPLIED TO
Holding time	Time exceeded for extraction or analysis	QL for positive results and non-detects	All analytes in sample
	Time exceeded for extraction or analysis by a factor of >2	QL for positive results; R for non-detects	
Sample preservation	Improper sample preservation	QL for positive results and non-detects (all results for volatile soil samples not preserved in the field will be rejected)	Sample
	Temperature >6 °C upon receipt	QL for positive results and non-detects	
	Temperature >8 °C upon receipt at laboratory	QL for positive results; R for non-detects	
	Temperature <0 °C upon receipt and not frozen or otherwise adversely affected	No flag required	
Sample integrity	Bubbles in VOA vial > ¼ inch used for analysis	QL for positive results and for non-detects	Sample
Instrument tuning	Ion abundance method-specific criteria not met	R for all results	All associated samples in analytical batch
Initial calibration	All analytes must be within method-specified criteria	R for all results	All associated samples in analytical batch

TABLE 36-3 GENERAL DATA QUALIFYING CONVENTIONS (CONTINUED)

QC REQUIREMENT	CRITERIA	FLAG	FLAG APPLIED TO
Second-source check	All analytes must be within method-specified criteria	R for all results	All associated samples in analytical batch
Continuing calibration	All analytes must be within method-specific criteria Note: closing CCV for GC/MS must be within 50%-150%	QH/QL/QN for positive results and for non-detects	All associated samples in analytical batch
	Criteria exceeded by more than 2x	QH/QL/QN for positive results; R for non-detects	
Low-level calibration check	All analytes must be within 50% of expected value	High bias: QH for positive results Low bias: QL for positive results and for non-detects	All associated samples in analytical batch
	Criteria exceeded by more than 2x	QH/QL/QN for positive results; R for non-detects	
LCS	Percent Recovery (%R) > upper control limit (UCL)	QH for positive results	The specific analyte(s) in all samples in associated analytical batch
	%R <lower control limit (LCL)	QL for positive results and for non-detects	
	%R <LCL and <10%	QL for positive results; R for non-detects	
ISs	Area >UCL	QL for positive results; R for non-detects	Sample
	Area <LCL	QH for positive results	
Surrogate spikes	%R >UCL	QH for positive results	Sample
	%R <LCL and >10%	QL for positive results and non-detects	
	%R <10%	QL for positive results; R for non-detects	
	Dilution >5x	No flagging required for failed surrogates	
Blanks (method, field, or trip)	Analyte(s) detected above the DL (use the blank of the highest concentration)	B for positive sample results $\leq$ 10 times	All samples in preparation, field or analytical batch, whichever applies
Field duplicates (FD)	RPD >CL and FDs >LOQ	QN for positive results	The specific analyte(s) in FD pair
	One FD >LOQ, one ND	QN for positive results and non-detects	
	One FD>LOQ, one FD >LOD but <LOQ	QN for positive results	
	Both results <LOQ	No flagging required for RPDs outside QC limits	
MS/MSD	MS or MSD %R >UCL	QH for positive results	The specific analyte(s) in parent sample
	MS or MSD %R <LCL	QL for positive results and non-detects	
	MS or MSD %R <LCL and <10%	QL for positive results; R for non-detects	
	MS/MSD RPD >CL	QN for positive results	

TABLE 36-3 GENERAL DATA QUALIFYING CONVENTIONS (CONTINUED)

QC REQUIREMENT	CRITERIA	FLAG	FLAG APPLIED TO
	Sample concentration >spike concentration; excessive dilution (dilution >5x)	No flag required	
RT window	Analyte within established window	R for all results if analyte is outside established window	Sample

Notes:
Information in this table reflects flagging criteria from guidance documents, as well as criteria applied based on professional judgment.
For definitions, see Acronyms and Abbreviations sections

This page intentionally blank

WORKSHEET #37 – DATA USABILITY ASSESSMENT

The data usability assessment is an evaluation based on the results of data verification and data quality review in the context of the overall project decisions or objectives. The assessment determines whether the project execution and resulting data meet the project DQOs. The sampling and analytical activities must be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data.

The following subsections summarize (1) the processes used to determine whether the collected data are of the right type, quality, and quantity to support project decision making; (2) how data quality issues will be addressed; and (3) how limitations of the use of the data will be handled.

The Data Usability Assessment Table (Table 37-1, which follows the text discussion) includes specific examples of items that may be evaluated during the usability assessment, as applicable.

37.1 SUMMARY OF USABILITY ASSESSMENT PROCESSES

A usability assessment is performed to determine how well the data collected for a project support the project objectives. Decisions can then be made by the project team (e.g., PM, Project Chemist, etc.).

Data gaps may be present if (1) a sample is not collected, (2) a sample is not analyzed for the requested parameters, or (3) the data are determined to be unusable. The need for further investigation will be determined on a case-by-case basis. This determination will depend on whether data can be extrapolated from adjacent sample locations and whether the data are needed based on the results from adjacent sample locations.

The Project Chemist and the analytical laboratory subcontractor will ensure that the collected data meet the DLs, LODs, LOQs, and laboratory QC limits specified in this UFP-QAPP, as referenced. During the data quality review and assessment, nonconformances will be documented and the Contractor Project Chemist will apply qualifiers in accordance with the procedures in Worksheet #36. Except for rejected data, all data are considered usable as qualified by the Project Chemist. The Project Chemist will then evaluate potential effects on data usability and work with the project team to determine whether the data are usable within the context of project objectives.

37.2 PERSONNEL RESPONSIBLE FOR PERFORMING THE USABILITY ASSESSMENT

The Brice project team's in-house data management team will be responsible for performing the analytical data usability assessment.

The project chemist will also perform a usability assessment of the reviewed data. The Technical Lead, with support from the Brice project chemist, will use the results of the usability assessments to determine whether the data generated during the investigation can be used to answer the principal study questions.

37.3 USABILITY ASSESSMENT PROCEDURES AND DOCUMENTATION

As described in Worksheet #36, the Brice Project Chemist will generate a chemical data quality report to be included with the project report that describes the results of the data verification, validation, and usability assessment. The Brice Project Chemist will work with the AECOM PM, Brice Technical Lead, and other project staff to discuss conclusions drawn and determine any potential limitations on the usability of the project data as a result of the assessment. The data quality assessment will document all data nonconformance and usability determinations, even in cases where it is determined that the usability of the data is not affected.

The usability of the data collected during field activities will be assessed in several ways:

- Any deviations from proposed field activities and sampling and handling procedures will be reviewed and their effect on data usability evaluated.
- Field screening and analytical results for field samples and field and laboratory QC samples will be compared against the project DQOs and evaluated using the MPC in Worksheet #12.
- Analytical results, including ND values, will be compared against the PSLs and cleanup levels in Worksheet #15.
- Data verification and data quality review will be completed following the procedures in Worksheet #31, 32, & 33, Worksheet #34, Worksheet #35, and Worksheet #36.
- Based on the results of data verification and data quality review, the usability of the data will be evaluated in the context of project-specific DQOs following the procedures in Worksheet #37.

Measurement error will be evaluated by reviewing sampling design, sampling locations, and sample collection methods. The Brice Project Chemist or data validator will evaluate laboratory and field QC sample results (field duplicates, blanks, LCSs, surrogate recoveries, and matrix effect, if any) to assess the overall measurement error associated with the project.

XXXI) BIAS CONTAMINATION

The analytical results for blanks (including MBs and TBs) will be checked against the MPC in Worksheet #12 to evaluate possible bias as a result of contamination.

XXXII) PRECISION AND ACCURACY

Laboratory precision is measured by the variability associated with duplicate (two) or replicate (more than two) analyses. One type of sample that can be used to assess laboratory precision is the LCS. Multiple LCS analyses over the duration of the project can be used to evaluate the overall laboratory precision for the project. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch but between LCSs analyzed in multiple batches.

Precision and accuracy will be evaluated using DQIs such as field duplicates, MS/MSDs, LCSs, and surrogates. Precision and accuracy of the data set will be considered acceptable after integration of qualified results (i.e., estimated [J] and ND estimated results).

XXXIII) REPRESENTATIVENESS

All samples for each method and matrix will be evaluated for holding time compliance. Representativeness of the project data is evaluated by reviewing qualified results regarding the use of standard methods and sampling procedures, sampling locations and quantities, and sampling design.

XXXIV) SENSITIVITY

Analytical methods and laboratory instrumentation are selected for use based on the ability of the method to detect target analytes at or below the PSLs. The capability of analytical laboratory methods and instrumentation to provide data with the sensitivity to meet the DQOs in the project sample matrix will be evaluated as part of the usability assessment. The DLs, LODs, and LOQs will be evaluated against the PSLs to determine whether the analytical methods and/or laboratory meet the project DQOs.

XXXV) COMPARABILITY

Data comparability will be evaluated through the collection and analysis of field duplicates and field blanks. The laboratory use of standard analytical methods for their analyses and operation of instruments within their range of calibration will be reviewed. The analytical results will be reported in correct standard units. Holding times, sample preservation, and sample integrity will be evaluated for compliance with QC criteria.

Complete field documentation using standardized data collection forms shall support the assessment of comparability. Historical comparability shall be achieved through consistent use of methods and documentation procedures throughout the project. Assessment of comparability is primarily subjective. Experienced environmental professionals with a clear knowledge of the DQOs and project decisions should interpret the results.

XXXVI) COMPLETENESS

Following the data validation, a completeness check will be performed based on the MPC in Worksheet #12. Valid data are data that are usable in the context of the project goals. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set.

For completeness requirements, valid results are all results not qualified with an R-flag (rejected) after the usability assessment has been performed. Completeness should not be determined based solely on the laboratory data qualifiers.

XXXVII) UNCERTAINTY BASED ON LABORATORY LIMITS OF QUANTITATION

LOQs, LODs, and DLs for sample results will be evaluated against the UFP-QAPP requirements. The LOQs for ND results will be evaluated against the laboratory limits and PALs in Worksheet #15. If the LOQ exceeds the PAL, the LOD will be evaluated.

The laboratory LOQs, LODs, and DLs included in Worksheet #15 represent the achievable limits for analytes in a laboratory matrix. However, analysis of field samples may result in sample dilutions that cause elevation of laboratory reporting limits above PALs.

When the PAL is less than the DL, the sample result cannot be used to verify that the chemical is not of potential concern at the site. A high degree of uncertainty exists when the PAL is greater than the DL and less than the LOD for ND results, and these ND results should be considered potentially greater than the screening level. When the PAL is greater than the LOD and less than the LOQ and the sample result is ND, by definition there is a 1% false negative rate and the result shall be considered below PAL with 99% confidence. For ND results with LODs over the PAL, the potential for the presence of those analytes will be evaluated based on site history, uses of the analyte, and professional judgment in coordination with the regulatory agencies.

TABLE 37-1 DATA USABILITY ASSESSMENT TABLE

ITEM	ASSESSMENT ACTIVITY	RESPONSIBILITY
Laboratory data deliverables and Work Plan	Ensure that all necessary information was provided, including (but not limited to) QC sample results and data validation results.	Brice Project Chemist
Sampling locations, deviation	Determine whether alterations to sampling locations continue to satisfy the project DQOs.	Brice Technical Lead, AECOM PM
CoC, deviation	Establish that any problems with documentation or custody procedures do not prevent the data from being used for the intended purpose.	Brice Project Chemist
Holding times, deviation	Determine the acceptability of data where holding times were exceeded.	Brice Project Chemist
SOPs and methods, deviations	Evaluate the impact of deviations from analytical and field SOPs and specified methods on data quality.	Brice Technical Lead, Brice Project Chemist
QC samples	Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of observed blank contamination.	Brice Project Chemist
Matrix	Evaluate matrix effects (interference or bias).	Brice Project Chemist
Meteorological data and site conditions	Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and site conditions on sample results. Review field reports to identify whether any unusual conditions were present and how the sampling plan was executed.	Brice Technical Lead
Comparability	Ensure that results from different data collection events achieve an acceptable level of agreement.	Brice Project Chemist
Completeness	Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable (completeness as defined in the project DQOs documented in this UFP-QAPP).	AECOM PM, Brice Technical Lead, Brice Project Chemist
Critical samples	Establish that critical samples and critical target analytes, as defined in the UFP-QAPP, were collected and analyzed. Determine whether the results meet criteria specified in the UFP-QAPP.	AECOM PM, Brice Technical Lead, Brice Project Chemist
Data restrictions	Describe the exact process for handling data that do not meet project DQOs (i.e., when MPC are not met). Depending on how those data will be used, specify the restrictions on use of those data for environmental decision making.	AECOM PM, Brice Technical Lead, Brice Project Chemist

TABLE 37-1 DATA USABILITY ASSESSMENT TABLE (CONTINUED)

ITEM	ASSESSMENT ACTIVITY	RESPONSIBILITY
Usability decision	Determine whether the data can be used to make a specific decision considering the implications of all deviations and corrective actions.	AECOM PM, Brice Technical Lead, Brice Project Chemist
Usability report	Discuss and compare overall precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity for each matrix, analytical group, and concentration level. Describe limitations on the use of project data if criteria for DQIs are not met.	Brice Project Chemist

Note: Information in this table reflects general data usability considerations.

REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2018a (July). *18 Alaska Administrative Code (AAC) 75, Oil and Other Hazardous Pollution Control Regulations.*

ADEC. 2018b (February). 18 AAC 70 *Water Quality Standards.*

ADEC. 2017a (August). *Field Sampling Guidance.*

ADEC. 2017b (July). *Laboratory Data Review Checklist.*

ADEC. 2017c (March). *Underground Storage Tanks Procedures Manual, Guidance for Treatment of Petroleum-Contaminated Soil and Standard Sampling Procedures.*

ADEC. 2017d (March). *Data* Qua*lity Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling.* Technical Memorandum.

ADEC. 2013 (September). *Monitoring Well Guidance.*

ADEC. 2008 (December). *Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances.*

ADEC. 2002 (June). *ADEC Division of Spill Prevention and Response Contaminated Sites Remediation Program Air Station and Paint Storage Area. Determination Document. Kodiak, Alaska.* Prepared for USCG.

Ahtna Environmental, Inc (Ahtna). 2018 (March). *Final Monitoring Well Inventory Technical Memorandum. United States Coast Guard Base, Kodiak, Alaska.*

Clarus Technologies, LLC (Clarus). 2008 (December). *June 2008 Groundwater Sampling and Analysis Report USCG ISC Kodiak, Alaska, Site 10/11, Air Station Kodiak. Kodiak, Alaska.* Prepared for USCG.

Clarus. 2008 (September). *November 2007 Groundwater Sampling and Analysis Report USCG ISC Kodiak, Alaska, Site 10/11, Air Station Kodiak, Kodiak, Alaska.* Prepared for USCG.

Clarus. 2007 (September). *USCG ISC Kodiak, Site 10/11, January 2007 through June 2007 Site Data for Groundwater Monitoring and Product Recovery.* Prepared for USCG FD & CC (Pacific).

United States Department of Defense (DoD). 2018 (February). *General Data Validation Guidelines.*

DoD. 2017 (January). *Quality Systems Manual for Environmental Laboratories, Version 5.1.*

Hart Crowser. 2005 (February). *2004 Summary Report for Environmental Sampling and Analysis and Product Recovery Results USCG ISC Kodiak, Site 10/11, Kodiak, Alaska.* Prepared for USCG.

Hart Crowser. 2003 (September). Q*uarterly Report for Flow Monitoring, Environmental Sampling, and Product Recovery Results; USCG ISC Kodiak, Site 10/11, Kodiak, Alaska.*

Hart Crowser. 2002 (October). *Draft Work Plan for Flow Monitoring and Environmental Sampling to Support Stormwater Management USCG ISC Kodiak, Site 10/11, Kodiak, Alaska.*

Intergovernmental Data Quality Task Force (IDQTF). 2012. *Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets.*

IDQTF. 2005a. *Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs, Part 1: UFP-QAPP Manual, Final, Version 1.* EPB505-B-04-900A/DTIC ADA 427785.

IDQTF. 2005b (March). *Uniform Federal Policy for Quality Assurance Project Plans, Part 2B: Quality Assurance /Quality Control (QA/QC) Compendium: Minimum QA/QC Activities, Final, Version 1.* EPA-505-B-04-900B/DTIC ADA 426957.

International Organization for Standardization (ISO). 2010 (reviewed). *General Requirements for the Competence of Testing and Calibration Laboratories.* Standard 17025:2005.

North Wind Services. 2018 (October). *Environmental Analytical Data Report, Secondary Containment Improvements for Tanks N-10/N-12, N-19/N-20 and N-60, United States Coast Guard Base Support Unit Kodiak, Kodiak, Alaska.* Prepared for USCG.

Shannon & Wilson. 1999 (June). *Revised Draft Corrective Measures Study Sites 10/11, Air Station/Paint Storage Area, Integrated Support Command Center Kodiak, Kodiak, Alaska.* Prepared for USCG.

Shannon & Wilson. 1997 (May). *Summary Data Report Sites 10/11 Air Station/Paint Storage Area, Integrated Support Command Kodiak, Kodiak, Alaska.* Prepared for USCG.

Shannon & Wilson. 1997 (May). *Corrective Measures Study: Site 10/11, Air Station/Paint Storage Area, ISC Kodiak, Kodiak, Alaska*. Prepared for USCG.

Shannon & Wilson. 1992 (May). *Hazardous Materials Survey and Environmental Site Assessment Cutter Storage Building, Building No. 22 and Parking Lots A and B at Hangar No. 22 US Coast Guard Support Center, Kodiak, Alaska.* Prepared for USCG.

United States Environmental Protection Agency (EPA). 2017 (September). *Low Stress (low flow) Purging and Sampling Procedures for the Collection of Ground Water Samples from Monitoring Wells, EQASOP-GW4.*

EPA. 2014 (July). *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium, SW-846 Update V, Revision 8.*

EPA. 2009 (January). *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use, EPA 540-R-08-005.*

EPA. 2007 (February). *Status Tables for SW-846, Third Edition, Final Updates, I, II, IIA, IIB, III, IIIA, IIIB AND IV plus other New and Revised SW-846 Methods at the OSW Methods Web Site.*

EPA. 2002 (May). *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers, EPA 542-S-02-001.*

EPA. 1990 (February). *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells, EPA600/4-89/034.*

Western Regional Climate Center (WRCC). 2018. https://wrcc.dri.edu/. Accessed November 5, 2018.

Windward Environmental LLC (Windward). 2012 (February). *Free Product Monitoring and Recovery Quarterly Report – Sites 6B and 10/11 Oct 2011- Dec 2011.*

This page intentionally blank

ATTACHMENT C-1

FIELD FORMS

This page intentionally blank

Brice Engineering

ACTIVITY HAZARDS ANALYSIS

Date _____ Project _____

Activity _____

Activity Location _____

Prepared By _____

Overall Risk Assessment Code (RAC) (Use Highest Code)	

Risk Assessment Code (RAC) Matrix

E = Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
SEVERITY	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Add Identified Hazards

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE	RAC

Add Items

EQUIPMENT	TRAINING	INSPECTION

Involved Personnel

NAME	POSITION

Acceptance Authority Signature/Title _____

This page intentionally blank

SITE SAFETY AND HEALTH PLAN ACCEPTANCE

I have had the opportunity to read and ask questions about the Site Safety and Health Plan (SSHP). My signature certifies that I understand the procedures, equipment, and restrictions of the plan and agree to abide by them.

	Name	Signature	Date	Company
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

This page intentionally blank

DAILY VEHICLE INSPECTION CHECKLIST

Client		Project	
		Date (Weekly)	
Vehicle Type		Rental Agency	
Make/Model		Year	
Mileage (start)		Mileage (end)	

	MON		TUE		WED		THUR		FRI		SAT		SUN	
Body and Interior	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**
Inspection Sticker / Registration Tag														
Door Locks / Handles														
Lighting System														
Body and Interior														
Upholstery														
Seatbelts														
Heater/defroster														
Air Conditioner														
Floorboards/Mats														
Paint														
Other:														
PERFORMANCE:														
Brakes / Parking Brake														
Steering														
Operating Condition														
Oil Leak														
Tire Pressure														
Gauges (Pressure/Elect.)														
Fluids														
Other:														

OPERATOR REMARKS:

INFORM MECHANICS OF REPAIRS NEEDED BEFORE OPERATING

DAILY DRILL RIG INSPECTION CHECKLIST

EQ# _____ INSPECTED BY _____

Description _____ FOR WEEK ENDING _____

	MON		TUE		WED		THUR		FRI		SAT		SUN	
EXTERIOR:	Ok	Fix	Ok	Fix	Ok	Fix	Ok	Fix	Ok	Fix	Ok	Fix	Ok	Fix
STRUCTURE														
TRACKS														
OUTRIGGERS														
FLUIDS (FUEL, HYDRAULIC OIL, ENGINE OIL, COOLANT)														
LEAKS (FUEL,COOLANT, LUBE)														
RADIATOR														
LIGHTS														
BACK UP ALARM														
EMERGENCY SHUTOFF														
FIRE EXT.														
WINCH														
GAUGES/ INDICATOR LIGHTS (PRESSURE/HYDRAULIC OIL/ ENGINE OIL)														
REMOTE CONTROL BOX														

OPERATOR REMARKS:

DAILY SITE SAFETY MEETING

Date	Project	Site Safety and Health Officer

Activities to be Performed	Tools, Equipment, Materials to be Used	Possible Injury, Hazards	Required PPE, Controls, Plan

Name	Signature	Date	Company
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

This page intentionally blank

Hazard Report Card

Employee Name	Project
Brice Company	
Specific Location	
Equipment Involved	Date/Time
Description of Hazard/Unsafe Practice	
Suggested Corrective Action	
Employee Signature	Form Submitted To
Printed Name	(Employee: Submit completed form to your Supervisor)

Response	
Supervisor	Date Received
Supervisor's Remarks	
Corrective Action Taken	
Other	
Supervisor Signature	Completion Date
Printed Name	(Supervisor: Complete and submit to Safety Officer)

This page intentionally blank

Incident / Event Report

This form is to be completed for ALL incidents/injuries including Record Only, First Aid, and Equipment or Property Damage. Submit to the Safety Department immediately, and no later than within 24-hours.

Employee (Name/Title) Making Report	Brice Company

Check all that apply:
☐ Internal Record Only ☐ First Aid ☐ Medical Treatment ☐ Property Damage ☐ Equipment Damage ☐ Environmental

Date	Time	Start of Shift	Crew	Supervisor

Employees and Witnesses Involved / Position and-or Title	

Specific Location of Incident
PPE in use, if any
Briefly describe the events of what happened, or how injury/illness occurred. Provide a diagram in the space provided on the back of this form if needed.

First Aid/Medical Treatment (if any)			
1) Injured Employee		**2) Injured Employee**	
Telephone Number		**Telephone Number**	
DOB	**DOB**	**SSN**	**DOB**
Mailing Address		**Mailing Address**	
Hospital/Clinic		**Hospital/Clinic**	
Hospital/Clinic Address		**Hospital/Clinic Address**	
Physician		**Physician**	
Injury		**Injury**	
Treatment		**Treatment**	

Incident / Event Report

Property Damage (if any)

Equipment Involved and Damage (if any)				UA Required? ($5,000) ☐ Yes ☐ No
Equipment #		Damage	Equipment Description / Unit #	Describe Damage
1				
2				
3				

Environmental Damage (if any)

Sketch of Incident Site
Use additional sheets as need

Report By:	Reported To:
Submitted By:	**Date Submitted**
Supervisor Signature	**Date**

HAZARD COMMUNICATION

AND

RIGHT-TO-KNOW STANDARD TRAINING FORM

Name: _____

Company: _____

By signing this form I acknowledge and accept the following:

1. I have been instructed about the Hazard Communication Program, Safety Data Sheets (SDS), and Physical Data Sheets (PADS), their use, location and procedures for obtaining copies.
2. I have been informed that some of my work may involve exposure to toxic substances.
3. I have been informed about the right of employees to have access to relevant exposure and medical records, and the procedures for requesting access.
4. I understand the employer must act upon a request in a reasonable amount of time to avoid the interruption of normal work operations but within 15 days.

Signature: _____

Date: _____

This page intentionally blank

INSTITUTIONAL CONTROLS VISUAL INSPECTION FORM

SITE NAME: **SITE LOCATION:** **CLIENT:**

Date		Time		Inspector(s)	
Weather Conditions				Temperature	

Visual Monitoring Items	Y/N/NA	Summary of Observations and Actions Taken	Photo Number	Actions		
Has site or adjacent land use changed since the last inspection?						
Are there signs of recent soil disturbance on the site?						
Is there visual evidence of unauthorized on-site well installation or groundwater use, or of discharge of water onsite?						
Are there locks on all monitoring wells?						
Are existing fences or structures intended to secure and protect the monitoring wells intact and effective?						
Is signage at the site present, legible, and in good condition?						
Are the monitoring wells clearly labeled as monitoring wells?						
Are the monitoring wells clearly labeled with well name?						
Notes:				Continue Inspections	Maintenance Required	Corrected
Current Institutional Controls:						

This page intentionally blank

Turbidity Meter Calibration Verification Check

Project Name/Location:
Project Number:
Equipment Make and Model:
Serial Number:

Date/Time	_____ NTU	_____ NTU	_____ NTU	Initials	**Date/Time**	_____ NTU	_____ NTU	_____ NTU	Initials

This page intentionally blank

WELL PURGE AND SAMPLING FORM

BRICE ENGINEERING **SITE ID:** **WELL ID:** **PAGE:** **of**

PROJECT NAME		**WELL CONDITION**		**DIAMETER**	**O.D.**	**I.D.**	**VOLUME (GAL/LIN FT)**
CLIENT		**DAMAGE PRESENT**		1" Sch40	1.315"	1.049"	0.05
SITE		**DEPTH TO WATER (FROM TOC)**		2" Sch40	2.375"	2.067"	0.17
SAMPLER(S)		**TOTAL DEPTH (FROM TOC)**		3" Sch40	3.5"	3.068"	0.38
WEATHER/ TEMPERATURE		**HEIGHT OF WATER COLUMN**		4" Sch40	4.5"	4.026"	0.66
DATE		**1 WELL VOLUME**		6" Sch40	6.625"	6.065"	1.5
START TIME		**3 WELL VOLUMES**		8" Sch40	8.625"	7.981"	2.6
END TIME		**DROWNED SCREEN?**		2" Sch80	2.375"	1.939"	0.15

SAMPLING DATA

SAMPLE TYPE (GW, PRODUCT, OTHER):

IF PRODUCT IS PRESENT **DESCRIPTION:**

COLLECTION METHOD: PUMP TYPE, OTHER

DEPTH TO PRODUCT (ft FROM TOC): **THICKNESS OF PRODUCT (ft):**

SAMPLING APPARATUS

TUBING SIZE/TYPE:

EQUIPMENT DECON PROCEDURE:

FLOW RATE		**SET DEPTH OF TUBING (ft btoc or ft btow)**
Purging		
Sampling		

SAMPLING NOTES:

1000 mL/min = 0.264 gal/min

1 gal/min = 1893 mL/min

1 gal = 3.785 L **1 L = 0.264 gallons**

DURING SAMPLING:

IF USING HYDRASLEEVE: DEPLOYED AT DEPTH (FT BTOC): DEPTH TO WATER AT TIME OF DEPLOYMENT (FT BOTC):

BOTTLE LOT NUMBER/S:

EQUIPMENT SERIAL NUMBERS: **YSI** **Turbidimeter** **Other**

FIELD WATER QUALITY PARAMETERS

Time	**Cumulative Purged Volume (Gallons)**	**Water Level (ft BTOC)**	**Draw Down**	**Temperature (°F or °C)**	**pH**	**Conductivity (µS/cm)**	**ORP (mV)**	**D.O. (mg/L)**	**Turbidity (NTU)**	**Color**	**Odor**
				± 3% (min ±0.2°C/0.36°F)	± 0.1	± 3%	± 10mV	± 10% or 0.2 mg/L	± 10% or min 1		

FINAL PURGE DATA: **START TIME:** **END TIME:** **CUMULATIVE VOLUME:** **MAX FLOWRATE WITH STABLE DRAWDOWN:**

ANALYTICAL SAMPLE INFORMATION

SAMPLE DESCRIPTION: (color, free product, odor, turbidity)

Sample ID	**Date**	**Time**	**Matrix**	**Containers**	**QC**	**Analysis/ Preservative**									**Remarks**

FIELD WATER QUALITY PARAMETERS **WELL ID:** **PAGE:** **of**

Time	Cumulative Purged Volume (Gallons)	Water Level (ft BTOC)	Draw Down	Temperature (°F or °C)	pH	Conductivity (µS/cm)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)	Color	Odor
				± 3% (min ±0.2°C/0.36°F)	± 0.1	± 3%	± 10mV	± 10% or 0.2 mg/L	± 10% or min 1		

YSI Calibration Log

Project Name/Location:
Project Number:
Equipment Make and Model:
Serial Number:

Date	Temperature	pH (3 point)		Conductivity (µs/cm)		ORP(mV)		DO (100% Saturation)		Initials
		Standard	Reading	Standard	Reading	Standard	Reading	Atm. Pressure (mmHg)	Reading	

This page intentionally blank

Brice ENGINEERING

SOIL BORING LOG

Sheet _____ of _____

Project:	Project Number:	Client:	Boring No.
Address, City, State		Drilling Contractor:	
Logged By:	Date: Started:	Drilling Method and Equipment Used:	
	Completed:		
Drill Crew:	Backfilled:		
	Groundwater Depth:	Elevation:	Total Depth of Boring:

Depth (feet)	Sample Interval	Inches Driven	Inches Recovered	PID (ppm)	Time	**Soil Description:** Soil Name, USCS Group Symbol, Color, Relative Density or Consistency, Soil Structure, Moisture Content, Mineralogy, additional facts
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

SOIL BORING LOG

Sheet _____ of _____

Project:	Project Number:	Client:	Boring No.

Depth (feet)	Sample Interval	Inches Driven	Inches Recovered	PID (ppm)	Time	**Soil Description:** Soil Name, USCS Group Symbol, Color, Relative Density or Consistency, Soil Structure, Moisture Content, Mineralogy, additional facts
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

ATTACHMENT C-2

FIELD STANDARD OPERATING PROCEDURES

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-01

Logbook Documentation and Field Notes

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes the criteria for the content and format of field logbooks and has been generated in accordance with the Alaska Department of Environmental Conservation (ADEC) *Field Sampling Guidance* (ADEC 2017). This SOP should be used to direct field personnel in the requirements for recording information in logbooks and to ensure that field activities are properly documented.

Adequate documentation is necessary to describe the work performed. Attention to detail is vital as field logbooks have been shown to be useful in the reporting process as well as in administrative and judicial proceedings. As a result, it is important that documentation be factual, complete, accurate, consistent, and clear.

2.0 PERSONNEL RESPONSIBILITIES

All site personnel who make logbook entries are responsible for maintaining the required documentation. The Field Team Lead will inform personnel as to who will be responsible for field notebook and form entries, care, and maintenance.

3.0 FIELD NOTEBOOK PROCEDURE

Field logbooks are bound, sequentially paginated, weatherproof notebooks used to record daily field activities. All notes will be entered in permanent ink.

3.1 FRONT COVER

The front cover of each logbook must include the following information:

- Project name and Site ID
- Project Month(s) and Year
- Name(s) of field logbook author(s)

3.2 PROJECT CONTACT INFORMATION

Include project contact information on the inside front cover or first page of the logbook. Contact information includes names and phone numbers of subcontractors, project assistants, field team members, and emergency numbers from the site-specific Health and Safety Plans.

3.3 DAILY ENTRIES

Logbook entries should abide by the following guidelines:

- Pages should never be removed from the logbook.
- All information must be printed legibly and in permanent ink.
- Entries should be written using objective and factual language and should be made in chronological order.
- Entries will be made on subsequent lines such that no blank lines exist on any page.
- If any space remains on the bottom of the last page of field entries at the conclusion of the day's entries, a diagonal line will be drawn and signed to obscure any additional entries on that page.
- If corrections are necessary, a single line may be drawn through the original entry. The corrected information may then be added and should be initialized and dated.

Each logbook page should include the following:

- Job name or number, date, and personnel at the top of each page.
- Date and signature at the bottom of each page, with a line through any remaining blank lines.

The daily standard logbook entries will include the following:

- Project name/ Site ID / Client
- Date and time of each activity (including work start/stop times); time will be based on the 24-hour clock (i.e., 2100 instead of 9 pm)
- Location of activity
- Weather conditions and changing weather that may impact site conditions
- Pertinent observations and comments
- Level of Personal Protective Equipment
- Full names of onsite personnel and affiliations (including all visitors)
- Daily objectives
- Field measurements and calibrations
- Deviations from the project-specific Work Plan
- Log of photographs
- Site sketches with reference to north direction (with approximate scale or "not to scale" noted), sample and field screening locations and depths (with results), and on-site groundwater flow direction (if known)
- Daily calibrations, equipment checks, and maintenance
- Survey and/or location of any sampling points, including swing-tie measurements
- For each sample record: date, time, sampler(s), sample ID, media, sample location, sample depth taken below ground surface (bgs), container(s), preservatives, QC (dup/MS/MSD), analysis, MeOH lot number, tare weight
- Sample shipments (when, what, destination)
- Waste tracking (when, how much, destination)
- References to relevant data sheets and documentation preserved outside of the logbook such as groundwater sampling data sheets, soil boring logs, etc. Do not duplicate information from the referenced sheets in the logbook.

- Decontamination times and methods
- Daily summary of activities (i.e. number of samples collected)

Correct erroneous field record or log book entries with a single line through the error. Do not erase incorrect information. Date and initial revised entries.

3.4 FIELD DATA SHEETS

All other supportive unbound data documentation that is a part of the field records should be maintained as part of the field forms. These records should be recorded in weatherproof ink and on weatherproof paper as necessary. Once back into the office, the unbound records will be scanned to create an electronic record to ensure document preservation.

3.5 ELECTRONIC DATA SHEETS

Electronic data documents include photographs, GPS and survey data, etc. All electronic data that are part of the field records will be downloaded to a designated location and maintained for project use. Take care when downloading, storing, and managing data. Naming conventions (according to the project-specific Work Plan) should be used to indicate the project, date, and other relevant information to ensure accurate use.

3.6 DOCUMENT CONTROL

At the conclusion of a task or project, all field documentation should be submitted to the Project Admin for record retention. All original documents should be kept in the project file.

4.0 REFERENCES

ADEC. 2017 (August). *Field Sampling Guidance*.

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-02

Sample Chain-of-Custody

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines for sample handling and custody and has been generated in accordance with the Alaska Department of Environmental Conservation (ADEC) *Field Sampling Guidance* (August 2017). This SOP will be used to direct field personnel in the techniques and requirements for maintaining the sample chain of custody (COC).

The purpose of the COC is to demonstrate accountability and document sample integrity from the time of sample collection until sample analysis by the laboratory.

2.0 COC ELEMENTS

The elements of a COC for sample collection include the following:

- Sample labeling
- Laboratory receipt forms
- Field custody form (COC form)
- Custody seals on each cooler
- Inter-laboratory transfer documentation, if applicable

3.0 SAMPLE HANDLING PROCEDURE

The following sections describe sample COC documentation, field custody procedures, COC record, sample packaging, custody seals, transfer of custody, and laboratory custody procedures.

3.1 SAMPLE COC DOCUMENTATION

Sample identification documents will be carefully prepared so that sample identification and COC are maintained. Sample identification documents include the field logbook, sample labels, custody seals, and COC records.

A sample is in custody if it meets one of the following conditions:

- In an authorized person's physical possession,
- in an authorized person's view after being in possession,
- was in an authorized person's possession then secured (locked up), or
- kept in a secured area that is restricted to authorized personnel.

3.2 FIELD CUSTODY PROCEDURES

The following procedures will be used by field personnel:

- The sample collector will be personally responsible for the care and custody of samples collected until they are properly transferred to another company representative or relinquished to the laboratory.
- The sample collector will record sample data (time of collection, sample number, analytical requirements, and matrix) in the field logbook and/or appropriate field form.
- Sample labels shall be completed for each sample, using weatherproof ink.

3.3 CHAIN-OF-CUSTODY RECORD

The COC record will be fully completed prior to the shipment of samples. Information to be included on a COC form includes the following:

- COC Number
- Project number
- Contractor name
- Sampler name or initials
- Sample identification
- Location ID
- Sample date and time (in 24-hour format)
- Laboratory analysis methods required for each sample jar
- Volume submitted
- Preservatives added to each sample jar
- Sample matrix (soil, water, or other)
- Quantity of containers per sample
- Turn-around-time
- Instructions or notes regarding the samples in the “Notes” section of the custody record

3.4 SAMPLE PACKAGING

Samples will be labeled and packaged according to the *Labeling, Packaging, and Shipping Samples* SOP (BE-SOP-03). The COC record will accompany all sample shipments. Two COC records should be prepared for each shipment. One COC record will be placed in a re-sealable plastic bag, the bag sealed shut to prevent water intrusion from the moisture in the cooler, and the bag taped to the inside lid of the cooler. The duplicate copy of the COC record will be retained by the sampler and distributed as necessary to the sample coordinators. Airway bills will also be retained with the COC record as documentation of transport.

3.5 CUSTODY SEALS

Custody seals are preprinted, adhesive-backed seals with security slots designed to break if the seals are disturbed. Seals will be signed and dated at the time of use. Sample shipping containers will be sealed in as many places as necessary to ensure that the container cannot be opened without tearing the custody

seals. Typically, one custody seal will be placed along the front corner of the cooler, and one along the opposite back corner of the cooler. Clear tape will be placed over the seals to ensure that seals are not accidentally broken during shipment. If the custody seal was broken at some point during transport, the reason for breaking the seal, condition of the container contents, the cooler temperature, and anything added to or removed from the container must be documented on the COC form. The container must then be sealed with a new custody seal.

If a sampler hand-transports the samples to the laboratory without sample shipment, custody seals are not required.

3.6 TRANSFER OF CUSTODY

When transferring the possession of samples from the field sampler to a transporter or to the laboratory, the sampler will sign, date, and note the time as "relinquished by" on the COC record. The receiver will also sign, date, and note the time as "received by" on the COC record. However, when samples are transported by a common commercial carrier such as Alaska Airlines or Federal Express, the carrier will not sign the COC record.

3.7 LABORATORY CUSTODY PROCEDURES

A designated sample custodian will accept custody of the shipped samples and verify that the sample identification number matches the COC record. Pertinent information about shipment, pickup, and courier will be entered in the "Remarks" section. The custodian then will enter sample identification number data into a bound logbook that is arranged by a project code and station number.

4.0 REFERENCES

ADEC. 2017 (August). *Field Sampling Guidance*.

ATTACHMENTS

Attachment 1 Chain of Custody Form

This page intentionally blank

Chain-of-Custody Report

Collection Organization: **Chain-of-Custody:** **Cooler ID:** **NPDL Number:**

Project Number: **Laboratory:** **Bill To:** **Report To:**

COC Sample ID	Loc ID	Collection Date	Collection Time	Sampler	Quantity	Container Type	Volume	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes:

Special Instructions:

Relinquish By: Relinquish By:

Signature/Printed Name Date/Time Signature/Printed Name Date/Time

Received By: Received By:

Signature/Printed Name Date/Time Signature/Printed Name Date/Time

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-03

Labeling, Packaging, and Shipping Samples

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) will be used to direct field personnel in the techniques and requirements of labeling samples for identification, packaging samples for safe transport, and shipping samples from the field to laboratory for analysis.

Proper labeling, packaging, transport, and shipping are necessary to maintain an accurate record to track the samples, as well as safe methods of packing and transporting samples.

2.0 MATERIALS

The term "environmental sample" refers to any sample that has less than reportable quantities of any hazardous constituents according to Department of Transportation (DOT) 49 CFR - Section 172. Equipment required for labeling, packaging, and shipping environmental samples include:

- Weatherproof labels for sample containers
- Coolers
- Contractor-grade plastic bags
- Sorbent pads
- Plastic zip-top bags, quart and gallon
- Clear tape
- Strapping tape
- Bubble wrap and/or foam inserts
- Gel ice packs
- Cooler labels: "keep cool/refrigerate/do not freeze," "this end up," "fragile," address, dangerous goods, excepted quantities, Saturday delivery (as necessary), etc.

3.0 PROCEDURES

This section describes the procedures for labeling, packaging, and shipping of samples that have been collected.

3.1 LABELING

Samples will be labeled using nomenclature defined in the project-specific Work Plan. All sample labels will be weatherproof and contain the following information:

- Project number
- Sampler name or initials
- Sample identification
- Sample date and time (in 24-hour format)
- Laboratory analysis methods required for sample jar
- Volume submitted
- Preservatives added to sample jar
- Sample matrix (soil, water, or other)
- Turn-around-time

Adhesive sample labels will be placed directly on the sample containers. If the labels do not adequately adhere due to moisture, secure the label by placing clear packaging tape over the label. Sample containers that are weighed by the laboratory prior to use **should not** have any additional labels placed on the container as it affects the weight. For those containers, use the label that is already provided on the jar. Only one label should be placed on each sample container.

3.2 PACKAGING

When packing sample containers for shipment, the steps below must be followed. Depending on how the samples are being kept to temperature, follow either section 3.2.1 or 3.2.2.

1. Choose a cooler with structural integrity that will withstand shipment. Secure and tape the drain plug with duct tape.
2. Be sure that the caps on all containers are tight and will not leak. Make sure not to over-tighten and/or break the cap.
3. Ensure that the sample labels are intact, fully completed with the correct information, and that identification exactly matches the chain-of-custody record.
4. Use sufficient ice in packaging to ensure that samples are received by the laboratory at the proper temperature of 4°C ± 2°C.
5. Wrap and package containers sufficiently to prevent cross contamination and ensure that containers remain intact during shipment.

3.2.1 Gel Ice

When packing samples with gel ice packs, the following steps must be taken:

1. Place a layer of frozen gel ice packs, along the bottom of the cooler. Cover the ice packs with a layer of bubble wrap and then place a sorbent pad over the bubble wrap.
2. Place sample containers in bubble wrap, bubble bags, in their original boxes, or in re-sealable bags with sorbent pads, depending on the type of container.
3. Place the containers into the cooler with caps up.
4. Fill excess space between sample containers with additional bubble wrap or gel ice,
5. Place another layer of bubble wrap along the top of the cooler, and as possible, place a layer of gel ice packs along the top of the cooler.
6. Fill remaining headspace with additional packing material.

Note that partially melted or soft gel ice packs should not be used to pack coolers for transport. A minimum of 8 frozen gel ice packs should be used to maintain sample temperature during transit for 24 hours.

After gel ice has been placed in cooler, the following steps must be taken:

1. Ensure that a temperature blank is included in each cooler. The temperature blank should be placed at the same level and next to the samples, preferably in the center of the cooler.
2. Place the completed Chain-of-Custody record for the laboratory into a plastic zip-top bag, tape the bag to the inner side of the cooler's lid, and then close the cooler.
3. Conduct a "shake test" by gently shaking the cooler and listen to hear whether the containers are shifting in the cooler. If so, add additional packing material until there are no sounds of shifting when shaken.
4. Wrap strapping tape around each end of the cooler two times to secure the lid. Place completed custody seals to the front and side of the cooler so that the cooler cannot be opened without breaking the seals. Place clear tape over custody seals.
5. Attach an address label containing the name and address of the shipper to the top of the cooler. Attach other stickers such as "Refrigerate" or "Keep Cool," "Do Not Freeze," and "Fragile." For samples with liquid (including preserved soil samples), place "up arrow" stickers on opposite sides of the cooler pointing in the same direction as the containers containing liquids.

3.3 SAMPLE SHIPPING

Environmental samples are shipped as non-hazardous materials unless the samples meet the established DOT criteria for a "hazardous material" or the International Air Transport Association (IATA)/International Civil Aviation Organization (ICAO) for air definition of "dangerous goods." If the samples meet criteria for hazardous materials or dangerous goods, then DOT and IATA/ICAO regulations must be followed, which includes having qualified personnel send shipments.

Attach a shipping address label to the top or front of the cooler, with sender information. Samples shipped as "Dangerous Goods in Excepted Quantities" must have the appropriate labelling and be declared as dangerous goods to the shipping carrier. However, no dangerous goods "candy-striped" form must be filled out and no Notification to Caption (NOTOC) is required (IATA 2016).

3.3.1 Soil Sample Shipments

Soil samples preserved with methanol, and any excess methanol vials, must be shipped as "Dangerous Goods in Excepted Quantities" per the IATA regulations. The volume for excepted quantities of methanol is 30 mL per container and 500 mL per cooler. The class number is 3, flammable liquid, UN 1230. Sample jars with methanol in excess of 30 mL and coolers with methanol in excess of 500 mL require shipment as "Dangerous Goods" and require the completion of a "candy-striped" form.

3.3.2 Water Sample Shipments

Water samples preserved with hydrochloric acid or other insignificant amounts of preservative are not shipped as dangerous goods. However, excess pre-preserved sample containers with preservative must

be shipped as “Dangerous Goods in Excepted Quantities” per IATA regulations. The volume for excepted quantities of hydrochloric acid or nitric acid is 30 mL per container and 500 mL per cooler respectively. The class number is 8, corrosive. Sample jars with hydrochloric acid or nitric acid in excess of 30 mL and coolers with hydrochloric acid or nitric acid in excess of 500 mL require shipment as “Dangerous Goods” and require the completion of a “candy-striped” form.

Upon shipping samples, notify the laboratory contact that samples have been shipped and provide the airway bill number.

4.0 REFERENCES

IATA. (2016). *Dangerous Goods Regulations (DGR) Limited/Excepted Quantities Labels.*

STANDARD OPERATING PROCEDURE

BE-SOP-04

Quality Control Samples

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to direct field personnel in the requirements necessary for collecting field quality control (QC) samples from certain matrixes. Field QC samples are collected to ensure the reliability and validity of field and laboratory data.

2.0 PROCEDURE

The following sections describe different QC sample types that will be required in project-specific Work Plans.

2.1 FIELD DUPLICATE

A field duplicate is collected to evaluate whether sample matrix inhomogeneity, contaminant distribution, or sample collection methods affect analytical precision. The field sampler will ensure the primary and duplicate samples are effectively identical. The duplicate sample is collected from the same location, at the same time, with the same techniques, and the same matrix.

Frequency of field duplicates, at a minimum, are 1 blind field duplicate per day and 1 blind field duplicate per 10 samples for each analytical method and matrix for offsite laboratory analysis of all field samples

Field duplicates be submitted as blind samples with a unique sample number and collection time to the approved laboratory for analysis (Alaska Department of Environmental Conservation [ADEC] 2017).

2.2 MATRIX SPIKE AND MATRIX SPIKE DUPLICATE (MS/MSD)

An MS/MSD sample is collected to evaluate the precision and accuracy of laboratory procedures in the project sample matrix. The MS/MSD compound will be added at the laboratory. This sample is collected at the same time as the primary sample using the same procedure, equipment, and type of container. The MS/MSD sample should be labeled the same as the primary sample with the same sample identification and time and denoted on the chain-of-custody (CoC) form to ensure that the project MS/MSD pair is used in the laboratory report. The frequency of MS/MSD samples collected, at a minimum, is one for each analytical batch. The required frequency of the MS/MSD sample collected is specified in the Quality Assurance Protection Plan (QAPP) and/or project-specific Work Plan, and the evaluation process is specified in the QAPP.

2.3 TEMPERATURE BLANK

A temperature blank will be included in each sample cooler. A temperature blank is measured by the laboratory to verify and document that the cooler temperature is received between 0-6 degrees Celsius (°C). Temperature blanks consist of plastic bottles filled with water, which the laboratory typically prepares. Once shipments are received by the laboratory, the temperature will be recorded on the CoC to document preservation requirements were met.

2.4 TRIP BLANKS

Trip blanks will accompany samples to be analyzed for volatile analysis including GRO, BTEX, and VOCs. Trip blanks are prepared by the laboratory and are used to establish that the sample has not been contaminated by external sources during the transport of sample bottles to and from the field. Trip blanks are samples of reagent-grade water, and properly preserved in a controlled environment prior to field mobilization by the laboratory. Trip blanks will be kept with the sample containers throughout the sampling process and returned to the laboratory with the other samples. One trip blank will accompany each cooler containing VOC and/or GRO samples, or as specified in the QAPP or project-specific Work Plan, and the evaluation process is specified in the QAPP. All trip blanks will be labeled and included on the CoC. Trip blank sample times will generally be recorded as 0800 on the CoC.

2.5 EQUIPMENT BLANKS

Equipment blanks will be used to evaluate the effectiveness of a decontamination procedure. The equipment rinsate blank is collected by pouring deionized water onto or into the sampling equipment after the equipment has been decontaminated, and then collecting the rinsate water for analysis of the identical suite of analyses performed for the associated soil sample(s). The required frequency of equipment rinsate blanks collected is specified in the QAPP and/or project-specific Work Plan, and the evaluation process is specified in the QAPP. Decontamination procedures are to be performed according to the *Equipment Decontamination* SOP (BE-SOP-14).

3.0 REFERENCES

ADEC. 2017 (August). *Field Sampling Guidance*.

STANDARD OPERATING PROCEDURE

BE-SOP-05

Drilling and Core Logging

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes a standard process for the classification and logging of soil core recovered using a drill rig or other mechanized equipment. This SOP also describes procedures for utility clearance, drilling methods, borehole advancement, core collection and logging, and borehole conversion or abandonment. These standards may vary as dictated by actual site conditions and equipment characteristics. Field notes will document adherence to these procedures and all details of variances to the standards presented in this SOP, and the project-specific Work Plan.

2.0 MATERIALS

Field materials will include, but are not limited to the following:

- Metal clipboard box case (container for well logs)
- Description aids (Munsell color & Unified Soil Classification charts)
- Hand tools (trowels, spoons, rock hammer, etc.)
- Soil Boring/Monitoring Well Field Data Collection Forms
- Tape measure
- Permanent ink pen
- Camera

3.0 PROCEDURES

The drilling subcontractor will manage the technical and operational aspect of drilling and recovery of soil cores under the direction of the onsite Brice Environmental Geologist. The drilling subcontractor will advance borings according to the depths provided in the project-specific Work Plan and under the direction of the Brice Geologist.

Soil core lithology will be determined and documented in general accordance with standards established by the Unified Soil Classification System (USCS), as described in *American Society for Testing and Materials* (ASTM) Method D2488 (Attachment 1). In general, the process involves visual observation of the soils and documentation in field notes or field data sheets (Attachment 2). It is important to note that since samples are generally collected for environmental sampling and contaminant characterization purposes, strict adherence to the USCS may not be required, unless specified by the project-specific Work Plan.

3.1 UTILITY CLEARANCE

Prior to beginning drilling activities, a utility clearance of the area within the proposed soil boring location(s) will be completed. Proposed boring locations will be marked with marking paint, survey lath, or pin flags. Utility locate procedures will be performed in accordance with the Alaska Statute Section 42.30 and will include calling the Alaska Digline locate request number at 811. The procedure for utility locates are outlined in further detail in the *Underground Utility Locates* SOP (BE-SOP-25) and in the project-specific Site Safety and Health Plan (SSHP).

3.2 DRILLING METHODS

Direct-Push Drilling: Direct-push drilling consists of advancing a macrocore or dual tube drill string in 4-foot or 5-foot long increments to the desired depth. Direct-push methods involve drilling equipment that hydraulically pushes or drives small-diameter, hollow steel rods into the subsurface without rotating the drill rods.

Hollow Stem Auger Drilling: The hollow-stem auger allows for continuous soil recovery and monitoring well installation. Comparison studies between direct push and hollow-stem auger drilled wells in a wide range of formations show little difference in performance.

Sonic Drilling: Sonic drilling is a technique that strongly reduces friction on the drill string and drill bit due to liquefaction, inertia effects and a temporary reduction of porosity of the soil. The combination aids in penetrating a large range of soil types.

Refusal (in all drilling methods) can be met in certain soil types such as gravel, or where large cobbles are present. If refusal is encountered, a secondary borehole location may be advanced, depending on site lithology, current conditions, or the recommendation of the on-site Brice Geologist.

3.3 BOREHOLE ADVANCEMENT

Teflon®-, fish oil-, or vegetable-based lubricants may be used to prevent seizing on downhole tooling. No other lubricants are approved for use without prior consent from Alaska Department of Environmental Conservation (ADEC 2013). Below the water table, potable water may be used as necessary to control heaving. No other drilling fluid may be used without prior consent from ADEC. The volume of added fluid will be noted in the field logbook. Drill tooling will be decontaminated according to the guidelines in the *Equipment Decontamination* SOP (BE-SOP-14).

3.4 CORE COLLECTION AND LOGGING

After samples are collected, soil cores will be logged in accordance with Standard Terminology for Soil Descriptions (Attachment 1) that was developed in general accordance with the Universal Soil Classification System (ASTM 2009). Waste soil and core liners will be handled and disposed of as described in the waste management section of the project-specific Work Plan.

3.5 BOREHOLE CONVERSION OR ABANDONMENT

Boreholes will either be converted to a monitoring well, extraction well, or abandoned following boring completion.

3.5.1 Borehole Conversion to a Monitoring Well or Extraction Well

The well will be converted as described in the *Monitoring Well Installation and Development* SOP (BE-SOP-22).

3.5.2 Borehole Abandonment

A borehole that is not converted to a well will be abandoned in accordance with the monitoring well decommissioning section of ADEC's *Monitoring Well Guidance* (ADEC 2013) and the *Monitoring Well Decommissioning* SOP (BE-SOP-23).

4.0 DOCUMENTATION

In addition to documentation requirements specified in the *Logbook Documentation and Field Notes* SOP (BE-SOP-01), a core log will be completed for each soil boring location. All fields on the core log will be used or an "NA" will be inserted to indicate a field that is not applicable.

5.0 REFERENCES

ADEC. 2013 (September). *Monitoring Well Guidance*.

ASTM. 2009 (July). *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure.* D2488. West Conshocken, Pennsylvania.

ATTACHMENTS

Attachment 1 Standard Terminology for Soil Descriptions

Attachment 2 Core Log

This page intentionally blank

Standard Terminology for Soil Descriptions

SOIL DESCRIPTION FORMAT

USCS SOIL NAME: angularity (coarse sand or greater), soil description (order of abundance), cobbles and boulders, *Munsell color (optional)*, color, density, moisture, *odor strength and type (optional*), *structure (optional), other comments (optional*), USCS symbol, *geologic environment (optional).*

EXAMPLES

WELL-GRADED GRAVELLY SAND: angular coarse sand, some gravel, trace silt/clay, 3-5 inch cobbles, 5Y 3/1 gray, very dense, moist, no odor, lensed, with trace fine organics and fine roots, SW, (GLACIAL TILL).

POORLY GRADED GRAVEL: angular fine gravel, some silt/clay, trace sand, 12-18 inch boulders, gray, dense, dry, weak petroleum odor, homogenous, GP.

SILT WITH SAND: silt, with fine to coarse sand, trace gravel, 5Y 3/1, gray, medium dense, wet, ML.

SILT/CLAY: silt, trace sand and gravel, tan, moderate organic odor, hard, wet, laminated, fine organics and roots, ML-CL, (LACUSTRINE).

NOTES:

- Descriptions are in general accordance with ASTM D2488, moisture content and particle abundance descriptors have been modified from the ASTM specification.
- Descriptions may include but are not limited to the information described in this procedure.
- Abundances of gravel, sand, and silt are estimated visually; sieve analysis is not performed typically.
- Blows should be counted when possible (e.g., pounding a split spoon on an auger or mud-rotary drill rig), but direct-push drill rigs typically lack a 140-pound hammer.

PARTICLE ABUNDANCE	
Descriptor	**Criteria**
Some	> 30%
With	15-30%
Little	5-15%
Trace	<5%
Notes: Boulders and cobbles should be listed as present with the range of size in inches.	

GRAIN SIZES	
Component	**Particle Size**
Boulders	>12 inches (30cm)
Cobbles	12 to 3 inches (30 to 7.6 cm)
Gravel	3 inch to #4 sieve (75 to 4.75 mm)
Sand	#4 to #200 sieve (4.75 to 0.075 mm)
Silt/Clay	<#200 sieve(<0.075mm)

MOISTURE CONTENT	
Description	**Criteria**
Dry	Absence of moisture, dusty, dry to the touch
Damp	Slight amount of water
Moist	No visible water, sand will hold together
Wet	Visible free water with effort, glistens
Saturated	Pore space filled (below water table)

SAND AND GRAVEL SIZE		
Description	**Sand Range**	**Gravel Range**
Fine	0.07 to 0.43 mm	0.5 to 1.9 cm
Medium (Sand Only)	0.43 to 2 mm	N/A
Coarse	2 to 5 mm	1.9 to 7.6 cm
Notes: Boulders and cobbles should be listed as present with the range of size in inches.		

RELATIVE DENSITY			
Fine-Grained Soil		**Coarse-Grained Soil**	
Density	**N-Value**	**Density**	**N-Value**
Very Soft	0 to 1	Very Loose	0 to 3
Soft	2 to 4	Loose	4 to 9
Medium Stiff	5 to 8	Medium Dense	10 to 29
Stiff	9 to 15		
Very Stiff	16 to 30	Dense	30 to 49
Hard	>30	Very Dense	>50
Notes: N-Value (Standard Penetration or Blow Count) is considered the number of blows to advance a 2-inch O.D. split-spoon sampler the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches (ASTM D1586). Any variation should be noted. If no blow counts are measured, density should be estimated.			

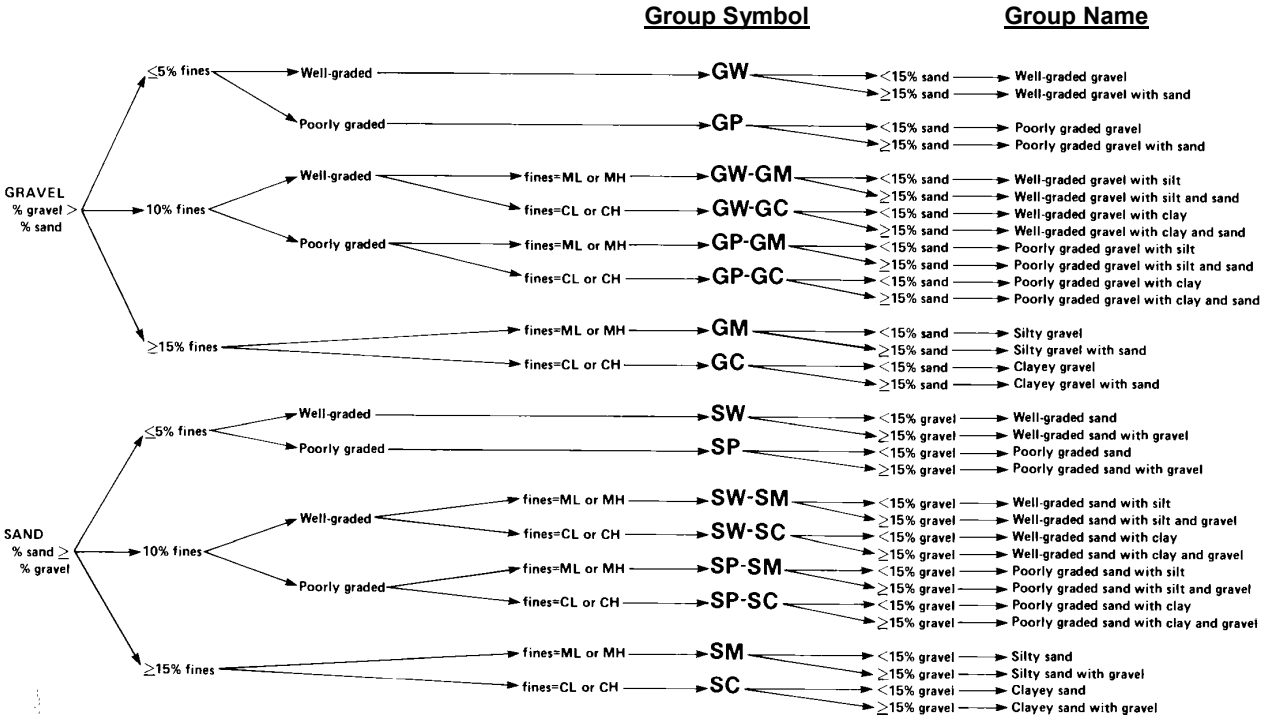
SIMPLIFIED USCS CLASSIFICATION SYSTEMS				
COARSE-GRAINED SOILS <50% passes #200 sieve	GRAVEL <50% coarse fraction passes #4 sieve	GRAVEL <5% pass the #200 sieve	GW	Well-graded gravel, gravel-sand mixture, little or no fines
			GP	Poorly-graded gravel, gravel-sand mixtures, little or no fines
		GRAVEL 5-15%pass the #200 sieve	GW-GM	Well-graded gravel with fines
			GP-GM	Poorly-graded gravel with fines
		GRAVEL >15% pass the #200 sieve	GM	Silty gravel, poorly-graded gravel-sand-silt mixture
			GC	Clayey gravels, poorly-graded gravel-sand-clay mixture
	SANDS >50% coarse fraction passes #4 sieve	SAND <5% pass the #200 sieve	SW	Well-graded sand, gravelly sand, little or no fines
			SP	Poorly-graded sands, gravelly sands, little or no fines
		SAND 5-15% pass the #200 sieve	SW-SM	Well-graded sand with fines
			SP-SM	Poorly-graded sand with fines
		SAND >15% pass the #200 sieve	SM	Silty sand, poorly-graded sand-gravel-silt mixture
			SC	Clayey sand, poorly-graded sand-gravel-clay mixture
FINE-GRAINED SOILS >50% passes #200 sieve	SILT/CLAY Liquid Limit <50%		ML	Inorganic silt & very fine sand, silty or clayey fine sands, clayey silt with slight plasticity
			CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay
			OL	Organic silt & clay of low plasticity
	SILT/CLAY Liquid Limit >50%		MH	Inorganic silt, micaceous or diatomaceous fine sand or silt
			CH	Inorganic clay of high plasticity, fat clay
			OH	Organic silt & clay of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, humus, swamp soils with high organic content
Notes: If coarse-grained soil contains >10% fines use a dual symbol, e.g. GP-GM. Full USCS chart on page 2.				

Standard Terminology for Soil Descriptions

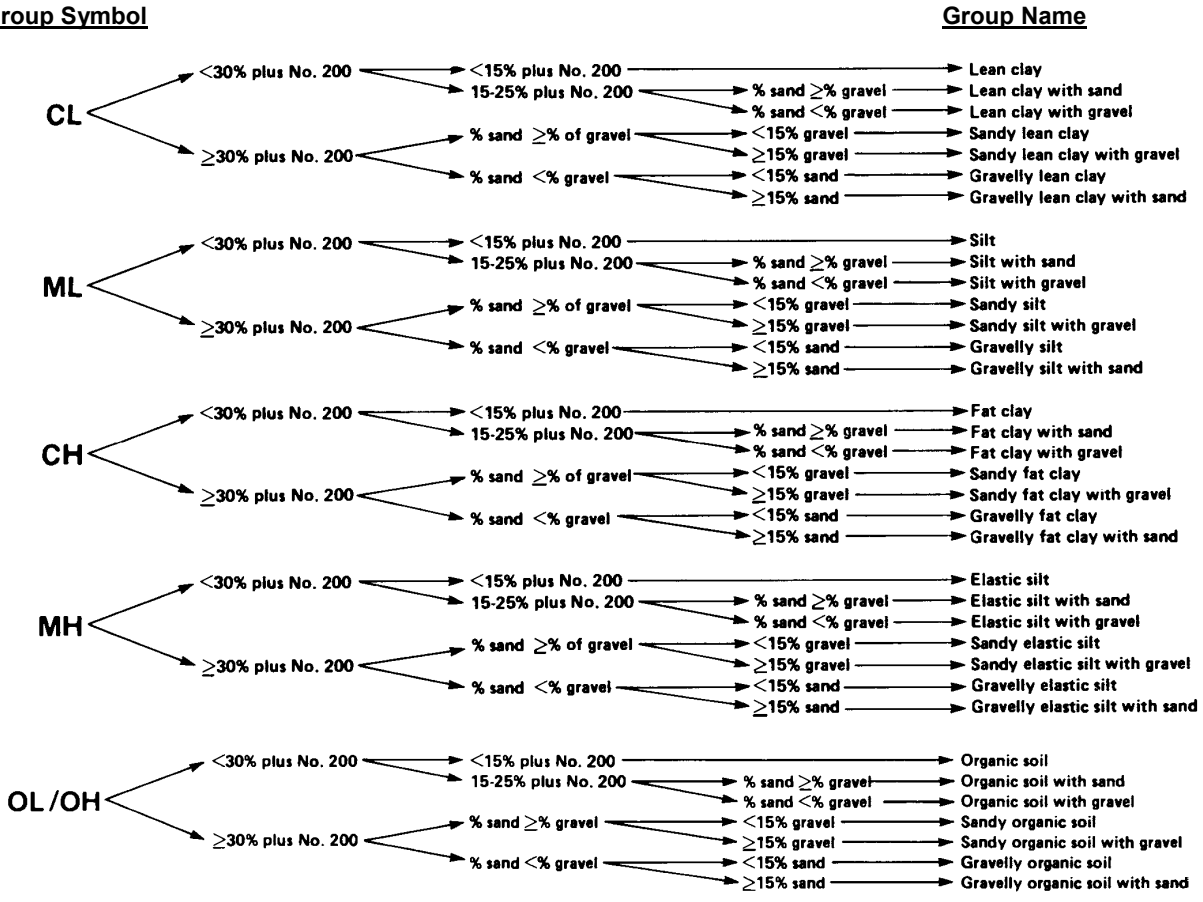
UNIFIED SOIL CLASSIFICATION SYSTEM

(from ASTM D2488)

COARSE-GRAINED SOILS



FINE-GRAINED SOILS



STANDARD OPERATING PROCEDURE

BE-SOP-06

Soil Sampling

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) will be used for collecting soil samples from both surface and sub-surface soils including stockpiles and excavations. The techniques described in this SOP are in accordance with the Alaska Department of Environmental Conservation (ADEC) *Field Sampling Guidance* (ADEC 2017).

The sampling methodology must be outlined in the project-specific Work Plan and be approved by ADEC prior to the initiation of the sampling activity. Refer to *Sediment Sampling* SOP (BE-SOP-07) for related procedures.

2.0 EQUIPMENT AND MATERIALS

The following equipment is typically used for soil sampling, but is not limited to the following:

- Photoionization Detector for field screening (BE-SOP-15)
- Spade or trowel
- Shovel, pick ax, pick mattock, or other excavating tools
- Hand auger with extension rods, as necessary
- Survey stakes, flags, or whiskers to mark sample locations
- Tape measure
- Sample gloves-plastic or latex, disposable, powderless
- Personal Protective Equipment (PPE)
- Stainless steel homogenization bucket or bowl
- Stainless steel lab spoons or the equivalent
- Zip-top plastic bags
- Scale
- Laboratory-supplied sample containers, preservatives, labels, custody seals, and temperature blanks
- Ice (gel ice or wet ice)
- Decontamination supplies/equipment
- Trash bags
- Field logbook
- Permanent pens and markers

Refer to Attachment 1, *Soil/Sediment Sampling Checklist* for a more detailed equipment list.

3.0 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment, depending on the depth of the soil profile, the type of sample required (disturbed vs. undisturbed), contaminants present, and soil classification. Under State of Alaska regulation 18 AAC 75.390(127), surface soil is defined as soil that extends no more than two feet below the ground surface (bgs). Subsurface soil is defined under State of Alaska regulation 18 AAC 75.390(123) as soil that is more than two feet bgs.

Soil is collected using a spoon, shovel, trowel, or auger. Always don a new pair of gloves prior to collecting a sample. Following collection, soil is transferred from the sampling device to a sample container of appropriate size for the analyses requested. If composite sampling techniques are employed, multiple grabs are placed into a container constructed of inert material, homogenized, and transferred to a sample container. Prior to sampling, confirm the availability of sample equipment and containers.

The homogenization procedure should not be used if sample analysis includes volatile organic compounds (VOCs) or gasoline range organics (GRO); in this case sample VOCs and GROs first. Soil, or multiple grabs of soil, should be transferred directly from the sample collection device to the sample container in a manner that minimizes disturbance of the sample. The sample should weigh approximately 25 grams. A scale will be used to weigh the sample before adding 25 milliliters of methanol solvent provided by the laboratory. The methanol solvent should cover the sample in its entirety. Additional methanol can be added to cover the sample, if necessary, but the exact quantity will be noted and provided to the laboratory prior to analysis.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Potential issues associated with soil sampling are cross-contamination and inadequate sample homogenization. To prevent cross-contamination, sampling equipment will be disposable and used only once, or reusable sampling equipment will be decontaminated according to the guidelines in BE-SOP-14 prior to each use. To ensure representative samples and to minimize the variance of duplicates, samples for all parameters, other than VOCs and GRO will be homogenized to the extent practicable prior to transferring the soil to the sample jar.

5.0 SAMPLE COLLECTION PROCEDURES

Prior to sample collection, determine the appropriate locations based on the project-specific goals and project-specific Work Plan specifications.

5.1 Manual Retrieval

Soil samples may be collected from surface or subsurface soils using hand tools, shovels, hand-auger, or by heavy-equipment in an excavation. For manual sampling, follow these general steps.

1. Ensure that the sampling area is safe for entry. If the sample is to be collected from within an excavation, ensure that the excavation meets all criteria for safe entry.

2. Use hand tools to access the depth required for sampling. If using a shovel or hand auger, place the soil cuttings on plastic sheeting or as specified in the project-specific Work Plan. If possible, lay the cuttings in stratigraphic order.
3. When collecting the sample, collect soil from **freshly** uncovered soil.

5.2 Discrete Sampling

Discrete sampling is when a single portion of soil is collected from a specific location at a given point in time. Typically, discrete sampling is the preferred method of sampling unless otherwise dictated for the specific project. The locations where discrete samples are to be collected will be explained in the project-specific Work Plan.

5.3 Composite Sampling

Composite sampling is when two or more grab sub-samples (aliquots) are taken from a specific soil and site at a specific point in time. The aliquots are collected and homogenized, and then a single average sample is collected from the mixture.

Composite sampling may only be conducted if previously-approved in a project-specific Work Plan. Composite samples will have equal measurement of soil (as measured by mass) collected as discrete samples from all sub-locations. Aliquots of volatile samples will be collected directly into laboratory-supplied jars and preserved immediately. Aliquots of non-volatile samples will be homogenized before placing into laboratory-supplied jars.

6.0 SAMPLE COLLECTION

After retrieval of soil, follow the general steps for all soil samples:

1. Remove bits of vegetation and large gravel from the sample as these items are not analyzed and reduce the available sample volume for analysis.
1. Take care to prevent cross-contamination and misidentification of samples.
2. Properly label the sample according to the project-specific Work Plan.
3. Record the sample location and depth, the sample date and time, and any other applicable information in the field notebook and on any applicable sampling forms prior to moving on to another sampling location.
4. Decontaminate any non-dedicated, reusable sampling equipment according to the Equipment Decontamination SOP (BE-SOP-14), prior to moving on to the next sampling location.
5. Samples that are degraded by aeration (volatiles) will be collected first and with the least disturbance as possible, and immediately preserved. Collect a volatile grab sample using a sampling spoon or gloved-hand, or as necessary, use a TerraCore® or EnCore® sampler to collect a pre-determined volume. Place volatile samples directly into a laboratory-supplied jar pre-tared jar, weigh the sample on a scale immediately following collection, and add the preservative.
6. Samples that are not degraded by aeration will be collected after soil is homogenized. Collect a non-volatile grab sample using a sample spoon or gloved hand, and place the soil into a re-sealable plastic bag or bowl/pan/tray to homogenize the soil. To homogenize the soil seal the plastic bag and mix and/ or stir the soil with a spoon or spatula. Place the homogenized soil directly into a laboratory-supplied jar.

7. Make notes on the boring log regarding the soil characterization and geologic features, including any staining or olfactory observations (see BE-SOP-05 for soil logging). Note that samples will generally be collected prior to characterization of soil to preserve the integrity of the volatile samples.
8. Wipe down the jar threads to remove any soil, close the jar with the lid, and wipe the outside of the jar using paper towels or other clean, dry wipes.
9. Label the sample container with the appropriate information, typically using a label with waterproof adhesive, or if not, securing the label with clear tape.

ATTACHMENTS

Attachment 1 Soil/Sediment Sampling Checklist

7.0 REFERENCES

ADEC. 2017 (August). *Field Sampling Guidance.*

Soil/Sediment Sampling Checklist

Prior to Sampling	Initial
Safety Tailgate meeting	
Obtain Permits	
Obtain Sample Containers from Lab	

Soil Sampling	Initial
Ekman or Ponar dredge device	
Spade/Trowel	
Shovel, pick ax, pick mattock	
Hand auger with extension rods	
Survey stakes, flags, or whiskers	
Tape measure	
Samplekits	
gel Ice	
Sample sheets	
DI & Alconox	
Paper towels	
Shovel	
Full socket set (14mm)	
Tool to open well lids	
zip lock bags	
laboratory supplied containers,	
preservatives, labels, custody seals,	
temperature blanks	
Plastic Sheeting	
Coolers	
Trash bags	
Decontamination equipment	
Sample kits	
Gel Ice	
Sample sheets	
DI & Alconox	
Paper towels	
Stainless steel homogenization bucket	
Stainless steel lab spoon or equivalent	
Scale	

PPE/Misc.	Initial
Nitrile gloves	
Shades	
Tailgate form	
Knee pads	
Safety gear (hard hat, gloves, vest, etc.)	
Water	
Laminated site map	
Garbage bags	
PEP/HSE Plan	
Camera	
Whiteboard and marker	

After Sampling	Initial
Address Waste	
Close out permits	
CoC and Samples in cooler	
Download Cameras	
Charge harmony	
QC, chill, and secure samples	
Complete field notes	
Debrief (tailgate form)	

Brice Engineering, LLC
Last Updated: 9/23/2015

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-09

Groundwater Sample Collection

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) provides field operation and protocols applicable to the collection of representative water samples from groundwater monitoring wells and temporary well points. This SOP is consistent with the Alaska Department of Environmental Conservation (ADEC) *Field Sampling Guidance* (ADEC 2017) and with the U.S. Environmental Protection Agency (EPA) *Low-flow (Minimal Drawdown) Ground-Water Sampling Procedure* (EPA 1996). For specific sampling locations and analytes, refer to the project-specific Work Plan.

2.0 EQUIPMENT AND SUPPLIES

Groundwater sampling equipment will include, but is not limited to the following:

- Appropriate level of Personal Protective Equipment (PPE)
- Camera
- Logbook, weatherproof pen, sharpie, etc.
- RAE Systems MiniRAE photoionization detector (PID) (or similar)
- *Well Purge and Sampling Forms*
- Sample labels
- Sampling containers and packing materials
- Tape measure
- Oil/water interface probe
- Submersible (stainless steel centrifugal Proactive Monsoon pump with low-flow controller, or equivalent), bladder pump, or peristaltic pump
- Disposable Teflon bailers and twine
- 5-gallon bucket
- Graduated cylinder or beaker
- Yellow Springs Instruments (YSI) water-quality meter (or similar)
- Potable water and/or deionized water
- Tubing (Teflon and/or silicone)
- Liquinox, Alconox, or equivalent

3.0 PROCEDURES

The following sections describe methods of recording field observations, field instrument calibration, air monitoring, free product and water level measurements; and purging and groundwater sampling using a submersible or peristaltic pump.

3.1 RECORDING FIELD OBSERVATIONS

The *Well Purge and Sampling Form* is intended to capture the information routinely collected during the sampling process for established monitoring wells. The field logbook is intended to record all equipment calibration checks, the wells sampled, sampling start and end times, or any other pertinent information not captured on the Groundwater Sampling Data Form. All data collected from temporary well points will be recorded in the field logbook.

3.2 FIELD INSTRUMENT CALIBRATION

Field instruments will be calibrated in accordance with the manufacturer's recommended procedures and frequency for each instrument. Operation and maintenance manuals will be available in the field for reference. Calibrations will be evaluated at the beginning of each day prior to use. If any reading is outside ± 5% from the expected calibration standard, the equipment will be re-calibrated. If after calibration, the instrument remains outside the expected calibration standard, the instrument will be removed from project use and replaced as soon as practicable.

3.3 AIR MONITORING

Air monitoring will be conducted to determine the presence of volatile organic compounds (VOCs) using a PID (MiniRAE 2000 or similar). PID readings will be monitored until stable and then recorded in the field logbook. Procedures in the Site-specific Safety and Health Plan (SSHP) will be followed if organic vapors are detected above concentrations listed in the air monitoring section of the SSHP. PID readings will be collected in the following situations:

- To monitor ambient conditions prior to removing the well plug and opening the well monument (either above ground or flush mount type).
- To monitor the ambient conditions in the breathing zone when opening the well or removing the well plug.
- To monitor the headspace immediately after removing the well plug.
- To monitor the breathing zone after the well plug has been removed.

3.4 FREE PRODUCT AND WATER LEVEL MEASUREMENT

The depth to free product (if present) and the depth to groundwater will be measured with an oil/water interface probe. Interface probes provide distinct responses when immersed in nonconductive product or conductive water. The type and order of measurement activities include determining the reference elevation, taking product and water level measurements, removing free product, and measuring the total casing depth as described below:

- Reference Elevation:
    - Pre-existing reference elevation (mark or notch on the casing)
    - No pre-existing reference elevation (typically for new wells)
        - Place a mark on the outside of the top north side of the well casing with indelible ink
- Product and Water Level Measurements (measured to the nearest 0.01 foot):
    - Measure the depth to free product (if present)

  - Measure the thickness of free product (if present)
  - Measure the depth to groundwater
- Free Product Removal (if present and more than 0.1 feet thick):
  - Remove free product with a bailer or peristaltic pump
  - Determine the volume of product removed
  - Dispose in accordance with the project-specific Work Plan
- Total Well Depth (after well construction is complete or after sampling in established wells):
  - Measure the depth to the bottom of the well casing
  - Compare to constructed well depth to determine the thickness of silt

3.5 PURGING

Purging is the process by which stagnant water is removed from the location prior to sampling and replaced with groundwater from the adjacent formation. This allows for a representative sample to be collected from the actual aquifer condition.

Purging will be conducted in accordance with EPA and ADEC low-flow guidelines (EPA 1996, ADEC 2017). Monitoring wells will be purged, at minimum, the equivalent of three times the well volume, or until the specific conductance, temperature, and pH parameters stabilize. The volume of water purged from each well will be calculated based on the length of the water column and well casing diameter. The formula to calculate the water volume to be purged is as follows:

Purge volume = 3 well casing volumes = (total depth of casing (ft) – depth to groundwater) * gallons per linear foot * 3. Refer to the *Well Purge and Sampling Form* for the various gallons per linear foot based on the casing diameter of the well.

$$V = *0.041D^2(d_2-d_1)$$

V= Volume in gallons

D = Inside diameter of well casing in inches

d_2 = Total depth of well in feet

d_1 = Depth to water surface in feet

*0.041 is based on a 1-inch diameter well.

Criteria for low-flow sampling are described below:

- Drawdown during purging will be less than 0.3 feet, if possible.
- Flow rates typically range from 0.1 to 1.0 liters per minute (0.03 to 0.3 gallons per minute), but higher rates are consistent with low-flow guidelines as long as the drawdown requirement is met.
- Water quality parameters will be measured and recorded as tabulated in Table 1.

If a well is purged dry, it will be allowed to recharge for 24 hours, or to 80% of its pre-purge volume. Without further purging, the well will be sampled. Water quality parameter stabilization is reached when three consecutive changes between successive readings at approximately 3-5 minute intervals are

within the criteria in Table 1. Turbidity readings consistently below 10 nephelometric turbidity units (NTU) are considered stabilized.

Table 1 Stability Criteria for Low-Flow Purging

Parameter[1]	Units	Recording Precision	Stability Criterion	Typical Value Range for Stability Criterion
pH	-	0.01	±0.1	5 to 8
Temperature	°C	0.01	±0.2°C or ±3%	0.1 to 15
Conductivity	µS/cm	1	±3%	80 to 1,000
Turbidity	NTU	0.1	± 10% or ± 1 NTU (whichever is greater)	0.3 to > 900
Oxidation Reduction Potential (ORP)	mV	1	± 10	-120 to 350
Dissolved Oxygen (DO)	mg/L	0.1	± 10% or 0.2 mg/L (whichever is greater)	0 to 12

Note: Stability criteria from ADEC *Field Sampling Guidance* (ADEC 2017).
[1] Only three parameters are required to stabilize, four when using temperature.

3.6 GROUNDWATER SAMPLE COLLECTION USING A SUBMERSIBLE OR PERISTALTIC PUMP

Low-flow sampling will use a submersible, bladder, or peristaltic pump. For collection of VOCs, a peristaltic pump should not be used unless approval from ADEC is obtained prior to sample collection. If a peristaltic pump is used for sample collection, VOC samples should be collected using Hydrasleeve groundwater samplers. Wells that contain free product are not typically sampled. Samples should be collected using the following steps:

- Line the ground with plastic sheeting to provide a clean work environment
- Lower the pump (submersible or bladder) or tubing (peristaltic) to the target depth below the static water level. Record the depth of the pump on the *Well Purge and Sampling Form*. For wells screened across the groundwater interface, a pump intake of 1.0 to 2.0 feet below the static water level is typically used. For wells with submerged screens, set the pump intake at the middle of the screened interval.
- Begin purging water into a container (i.e. 5-gallon bucket). Adjust the flow rate so that drawdown does not exceed 0.3 feet (where possible). The flow rate can be slowly increased or decreased as needed.
- After the turbidity of the water decreases, connect the flow-through cell to begin measuring stabilization parameters. Continue to purge until stabilization criteria are met (Table 1) or three well casing volumes are removed. Remove the supply line from the flow-through cell and place such that the purge water is captured in a container.
- Don new nitrile gloves prior to handling sample bottles.
- Collect samples in the appropriate containers (with preservatives if required by the analytical methods):

    - If ADEC approves the use of a peristaltic pump for the collection of VOC samples, the following procedure will be followed: 40 mL vials for VOCs/GRO must be filled slowly to prevent splashing and entrainment of air bubbles. Reduce the pumping rate, if necessary, to control the flow rate. Care should be taken to avoid touching the mouth of the discharge line, the top of the sample bottle, the inside of the cap, or the Teflon septum. A septum that falls out of the cap onto the ground cannot be used. The vial will be filled completely so that a convex meniscus forms. The cap will then be secured and the bottle inverted, tapped firmly, and checked for the presence of air bubbles. Analytical results will be compromised if air is trapped in the sample container.
        - If a Hydrasleeve groundwater sampler is used in conjunction with a peristaltic pump for VOC/GRO sample collection, the *Hydrasleeve Standard Operating Procedure: Sampling Ground Water with a HydraSleeve* will be followed.
- Remove the submersible pump or the tubing.
- Measure the total depth of the well as described in Section 3.4
- Record measurements on *Groundwater Purge and Sampling Form*.

Waste will be handled in accordance with the project-specific Work Plan.

4.0 POTENTIAL INTERFERENCES

Two potential interferences associated with groundwater sampling are cross-contamination and a lack of sample representation due to improper well purging or stabilization. To prevent cross-contamination between wells, dedicated tubing will be placed in each well and all non-disposable equipment that may directly or indirectly come in contact with samples, will be decontaminated prior to use at a different location. The *Equipment Decontamination* SOP (BE-SOP-14) outlines the decontamination procedure. To ensure that representative conditions within the aquifer are captured during sample collection, the purge rate will be maintained at a rate that produces minimal drawdown until three well casings have been collected or until water quality parameters have stabilized as described in Section 3.5.

5.0 SAMPLE HANDLING, PRESERVATION, AND STORAGE

The following procedure will be followed for sample handling, preservation, and storage:

1. Transfer the sample into a labeled container
2. Preserve the sample or use pre-preserved sample bottles (if required by analytical method)
3. Cap the container and place into a cooler to maintain 4 ± 2°C (if required by analytical method)
4. Record all pertinent data in the site logbook and/or on the field data sheet
5. Complete the chain of custody form
6. Attach the custody seals to the cooler prior to shipment

Refer to the *Labeling, Packaging, and Shipping* SOP (BE-SOP-03) for procedures on labeling, packaging, and shipping samples.

6.0 DATA AND RECORD MANAGEMENT

The chain of custody form is signed over to the laboratory. A copy is kept with the sampling records. Refer to *Sample Chain of Custody* SOP (BE-SOP-02) for procedures on sample chain-of-custody.

7.0 QUALITY CONTROL AND QUALITY ASSURANCE

All field Quality Control (QC) sample requirements in the project-specific Work Plan must be followed. These may include trip blanks, equipment blanks, field duplicates, and the collection of additional sample volumes for the laboratory's quality control (matrix spike and matrix spike duplicates). The frequency of QC samples will be outlined in the project-specific Work Plan. Refer to the *Quality Control* SOP (BE-SOP-04) for procedures on quality control samples.

8.0 DECONTAMINATION

Refer to the *Equipment Decontamination* SOP (BE-SOP-14) for procedures on decontamination.

9.0 REFERENCES

ADEC. 2017 (August). Field Sampling Guidance.

EPA. 1996 (April). Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. EPA/540/S-95/504. R.W. Puls and M.J. Barcelona (authors).

STANDARD OPERATING PROCEDURE

BE-SOP-14

Equipment Decontamination

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for decontamination of reusable equipment.

2.0 MATERIALS

Materials used for decontamination, include but are not limited to the following:

- Modified Level D Personal Protective Equipment (PPE)
- Brushes, typically stiff bristle
- 5-gallon buckets
- Liquinox, Alconox, or equivalent
- Spray or rinse bottles, or pump sprayer
- Paper towels
- Potable water and/or deionized water
- Distilled or deionized water
- Other hand tools for gross contamination (shovels, brooms, etc.)
- Garbage bags
- Plastic sheeting
- Approved waste containers

3.0 PROCEDURE

Decontamination of reusable sampling equipment will be conducted between sample locations and at the end of each work day. Drilling and excavation equipment will be decontaminated prior to beginning site activities, at the termination of site activities, and, if used for sampling, prior to each sampling event. Materials removed during decontamination will be collected and managed with similar waste streams and the project-specific Work Plan.

3.1 DECONTAMINATION AREA

Identify a localized decontamination area for drill rigs and other sampling equipment. Select the decontamination area so that decontamination fluids and soil wastes can be managed in a controlled area with minimal risk to the surrounding environment. The decontamination area should be large enough to allow temporary storage of cleaned equipment and materials before use, as well as to stage drums of decontamination investigation-derived waste (IDW). In the case of large decontamination

areas (for example, for hollow-stem auger decontamination), line each area with a heavy-gauge plastic sheeting and include a collection system designed to capture potential decontamination IDW.

Decontamination areas should be laid out in such a manner as to prevent overspray while performing equipment and personnel decontamination.

Smaller decontamination tasks, such as surface water and sediment equipment decontamination, may take place at the sampling locations. In this case, all required decontamination supplies and equipment must be mobilized to the site and smaller decontamination areas for personnel and portable equipment will be provided as necessary. These locations will include basins or tubs to capture decontamination IDW, which will be transferred to larger containers as necessary.

3.2 PERSONNEL AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personnel decontamination involves removal of gross contamination first. Contaminated solids such as mud should be scraped and wiped from boots, and gloves should be removed by rolling off the hands, starting at the cuff, in such a way that the gloves are turned inside out during removal. If necessary, a clean pair of gloves should be worn to complete the boot cleaning process. Boots can be cleaned while being worn or following removal. Any remaining contamination should be removed using soapy water, brushes or other similar means such as a pressure washer, if available. Once all debris is removed, rinse with clean water. If boots are not laden with gross solid materials, a brush can simply be used to knock off or remove any residual solid materials. If the boots have contacted liquid-phase contaminants, it is important that the contaminants be removed using soapy water and a brush followed by a clean water rinse. If the contaminants have adsorbed into the boots, the boots must be disposed of and a replacement pair obtained before conducting any further field activities.

Following removal and cleaning of reusable PPE, field personnel should wash their hands or any exposed body parts which may have been in contact with the associated contaminated substances.

3.3 SAMPLING EQUIPMENT DECONTAMINATION

All reusable sampling equipment will be cleaned prior to use. The following procedure will be used by field personnel:

1. Remove as much gross contamination as possible off equipment at the sampling site.
2. If heavy petroleum residuals are encountered during sampling, an appropriate solvent such as methanol should be used to remove any petroleum residues from sampling equipment.
3. Wash water-resistant equipment thoroughly and vigorously with potable water containing laboratory-grade detergent such as Liquinox, Alconox, or equivalent. Use a bristle brush or similar utensil to remove any remaining residual contamination.
4. Rinse equipment thoroughly with potable water (1st rinse).
5. Rinse equipment thoroughly with distilled or deionized water (2nd rinse).
6. For sensitive field instruments, rinse equipment with distilled, deionized, or reagent grade water (3rd rinse).
7. Air dry at a location where dust or other fugitive contaminants may not contact the sample equipment. Alternatively, wet equipment may be dried with a clean, disposable paper towel to assist the drying process. All equipment should be dry before reuse.

Clean, dry sampling equipment will be stored within a protective medium (plastic bag, etc.) or staged in a clean area for future use.

Cleaning and decontamination of the equipment will be accomplished in stages and in such a way that the contamination does not discharge into the environment. Cleaning and decontamination wastes must be properly contained and disposed of in accordance with applicable state and federal regulations.

Disposable sampling equipment should be used whenever possible (e.g. drum thieves, bailers, spoons, etc.) to minimize the need to decontaminate these items.

3.4 HEAVY EQUIPMENT DECONTAMINATION

Gross decontamination of equipment will be performed prior to transporting or walking equipment within different areas of or between contaminated areas or exclusion zones. Gross decontamination will focus on minimizing the spread of contaminated media as a result of equipment movement or transport. This decontamination process will use dry methods (brooms, wipes, shovels, etc.) within the exclusion zone in order to remove large, easily dislodged deposits of soil and other contaminated media prior to exiting the exclusion zone. The Site Manager may increase the level of gross decontamination based upon the effectiveness of the use of dry decontamination.

Final decontamination will occur when equipment is no longer needed on site within a decontamination pad in order to allow for the collection of decontamination materials, sludge, and water. When equipment is to be removed permanently, it will be decontaminated using brushes and/or a pressure washer with a detergent wash followed by a fresh water rinse. All areas of the equipment which were potentially contaminated will be decontaminated as described in Section 3.3.

3.5 DRY DECONTAMINATION

Where dry decontamination is required, the following steps will be followed at the sampling site by field personnel:

1. Remove as much debris or contamination as possible using a dry brush or paper towel.
2. Spray equipment with a detergent/water mix.
3. Wipe down with a clean, dry paper towel.
4. Spray equipment with potable water.
5. Wipe down with a clean, dry paper towel.
6. Spray equipment with deionized or distilled water.
7. Wipe down with a clean, dry paper towel.

Dispose of all paper towels with other IDW and disposable sampling supplies.

4.0 INTERFERENCES

Improper decontamination may cause cross-contamination across the sites, analytical samples, or field screening instruments. To prevent cross-contamination of analytical samples, sampling equipment will be disposed of after one use, or decontaminated after, or prior to each use. Additionally, laboratory-certified clean glassware will only be used for storing analytical samples.

5.0 QUALITY CONTROL

Quality Control (QC) samples may be collected in order to verify the decontamination process is effective. QC samples include the equipment rinsate blank and the equipment wipe sample which are described in detail in the *Quality Control* SOP (BE-SOP-04).

STANDARD OPERATING PROCEDURE

BE-SOP-15

Field Screening with a PID

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for the collection of field screening samples using a photoionization detector (PID). The instrument procedure is applicable to the MiniRae 2000 PID. The PID is a portable, nonspecific, vapor/gas detector employing the principle of photoionization to detect a variety of chemical compounds, both organic and inorganic, in air.

The MiniRae 2000 Portable Volatile Organic Compounds (VOCs) Monitor (Model PGM 7600) is a compact Monitor designed as a broadband VOC gas monitor and data logger for work in hazardous environments. It monitors VOCs using a PID with a 9.8 eV, 10.6 eV, or 11.7 eV gas discharge lamp. It gives real-time measurements and activates alarm signals whenever the exposure exceeds preset limits. Prior to factory shipment, the MiniRae 2000 is preset with default alarm limits and the sensor is pre-calibrated with standard calibration gas. After the monitor is fully charged, it is ready for immediate operation.

The rechargeable battery can run up to 10 hours of continuous monitoring. The instrument is designed to continuously monitor VOC vapor at parts per million levels. Preset alarm thresholds are set for STEL, TWA, and low and high level peak values. Audio buzzer and a flashing LED display are activated when the limits are exceeded. The instrument has a 15,000 point data logging storage capacity for data download to a PC.

2.0 EQUIPMENT

The following equipment is necessary but not limited to:

- Appropriate PPE;
- Moisture filters;
- Zip lock bags;
- Pie pans;
- Shovels/trowels;
- Camera; and
- Logbook.

3.0 INSTRUMENT CALIBRATION

3.1.1 Fresh Air Calibration

The calibration adapter consists of a simple 6-inch Tygon tubing with a metal adapter on one end.

1 The first sub-menu reads: “Fresh air Cal?”
2 Ensure that the MiniRAE 2000 is connected to one of the “fresh” air sources, usually ambient air.
3 Press the [Y/+] key, the display shows “zero in progress” followed by “wait...” and countdown timer.
4 After about a 15 second pause, the display will show the message “zeroed... reading = X.X ppm...” Press any key or wait approximately 20 seconds and the monitor will return back to “Fresh air Calibration?” submenu.

3.1.2 Span Calibration

This procedure determines the second point of the sensor calibration curve for the sensor. A cylinder of standard reference gas (span gas [Isobutylene]) fitted with a 500 cc/minute flow-limiting regulator or a flow-matching regulator is required to perform this procedure because the flow rate matches the flow rate of the pump inside. Alternatively, the span gas can first be filled into a Tedlar Bag. Connect the calibration adapter to the inlet port of the MiniRAE 2000 monitor, and connect the tube to the regulator or Tedlar bag.

1 Ensure that the monitor is connected to one of the span gas sources described above.
2 Press the [Y/+] at the “Span Cal?” to start the calibration. The display shows the gas name and the span value of the corresponding gas.
3 The display shows “Apply gas now!” Turn on the valve of the span gas supply.
4 Display shows “wait.... 30" with a countdown timer showing the number of remaining seconds while the monitor performs the calibration.
5 To abort the calibration, press any key during the count down. The display shows “Aborted!” and return to “Span Cal?” sub-menu.
6 When the countdown timer reaches 0, the display shows the calibrated value.
Note: The reading should be close to the span gas value.
7 During calibration, the monitor waits for an increased signal before starting the countdown timer. If a minimal response is not obtained after 35 seconds, the monitor displays “No Gas!” Check that the span gas valve is on and for lamp or sensor failure before trying again.
8 The calibration can be started manually by pressing any key while the “Apply gas now!” is displayed.
9 After a span calibration is completed, the display will show the message “Span Cal Done! Turn Off Gas”
10 Turn off the flow of gas. Disconnect the calibration adapter from the MiniRAE 2000 monitor.
11 Press any key and it returns back to “Span Gas Cal?”

3.1.3 Equipment Testing

Once the instrument is calibrated, it should be tested immediately after calibration, at frequent intervals during use, and at the conclusion of use (day, set of samples, etc.). Testing is completed by using a known calibration standard that meets the minimum requirements for source and purity recommended by the instrument manufacturer.

1. Turn the instrument on and allow it to warm up.

2. While the pump is on and collecting air, use a regulator or collapsible bag to deliver the known calibration gas to the instrument probe.
3. Record the reading in the field logbook.
4. Assess whether the reading is within the acceptance criteria in the project-specific Work Plan.

If the test indicates that the instrument is not reading within the control limits (typically 5% of calibration concentration), recalibrate the instrument and re-test. If the reading remains outside the control limits, perform maintenance or replace the unit.

Results of all calibrations and testing should be logged in the field notebook or appropriate field form.

3.1.4 Air Monitoring for Contaminant Exposure

A PID can be used to monitor ambient air for contaminant exposure. Following calibration, use the hygiene mode to ensure that the unit runs continuously and hold the PID in the area of interest and monitor the concentrations as shown on the PID screen. Areas of interest may include the breathing zone for employee exposure, the source for the worst-case scenario, and the perimeter for any by-standers. A concentration exceeding 10 ppm in the breathing zone should be further investigated with additional air monitoring equipment to ensure that the OSHA and NIOSH exposure limits are not exceeded for specific compounds.

3.1.5 Heated Headspace Screening

To screen soils for organic vapors using a PID in the heated headspace method, follow these general steps. The PID should be in the survey mode for this type of use.

1. Collect freshly-uncovered soil from the area of interest using a gloved-hand or sample scoop.
2. Place the soil in a clean quart-size re-sealable plastic bag until the bag is one-third to one-half full and seal the bag completely. It is important to use a quart-sized container as vapor diffusion and stratification effects can affect sample results. It is also important to be consistent with the volume of soil placed in the bag to ensure comparable screening results.
3. Warm the bagged sample to at least 40 ºF to enhance volatilization and detection with instruments. Warming should take at least 10 minutes but less than 1 hour. Agitate the sample for 15 seconds at the beginning and end of warming to assist volatilization.
4. Once the sample is adequately warmed, insert the PID probe into the bag by puncturing the bag at a point approximately one-half the headspace depth. Take care to prevent uptake of soil particles or moisture droplets. When samples are wet, use an in-line water filter on the PID probe to prevent damage to the instrument.
5. Record the highest concentration reading in the field logbook. The maximum reading typically occurs between 2 and 5 seconds after inserting the probe. If readings are erratic, make a note to that effect in the field logbook.

4.0 MAINTENANCE

Maintenance should be performed by qualified personnel only. The major maintenance items of the MiniRAE 2000 are:

- Battery Pack
- Sensor module
- PID lamp

- Sampling pump
- Inlet connectors and filters

4.1.1 Battery Charging and replacement

When the display shows a flashing message "Bat", the battery requires recharging. It is recommended to recharge the MiniRAE 2000 monitor upon returning from fieldwork. A fully charged battery runs a MiniRAE 2000 monitor for 10 hours continuously. The built-in charging circuit is controlled by the micro-controller to prevent over-charging. The battery may be replaced in the field (in area known to be non-hazardous) if required. Refer to the manual for instructions on "Replacing the Battery Pack and Replacing the Alkaline Battery adapter."

4.1.2 Troubleshooting

Refer to the table below for potential issues and solutions.

Problem	Reasons and Solutions
Cannot turn on power after charging the battery	**Reasons:** Discharged battery. Defective battery. Microcomputer hang-up. **Solutions:** Charge or replace battery. Disconnect, then connect battery to reset computer.
Reading abnormally high	**Reasons:** Dirty sensor module. Dirty water trap filter. Excessive moisture and water condensation. **Solutions:** Clean sensor module and lamp housing. Replace water trap filter. Blow dry the sensor module.
Reading abnormally low	**Reasons:** Incorrect calibration. Low sensitivity to the specific gas. Weak or dirty lamp. Air leakage. **Solutions:** Calibrate the monitor. Replace sensor. Clean or replace lamp. Check air leakage.
"Lamp" message during operation	**Reasons:** Lamp drive circuit. Lamp threshold set too high. Weak or defective PID lamp, defective. **Solutions:** Check and reset lamp threshold; replace the UV lamp.
Calibration error message	**Reasons:** No standard gas input, weak PID lamp, unit zeroed with gas present. **Solutions:** Make sure standard gas flows into monitor. Zero sensor & recalibrate, replace lamp.
Reading jumping around randomly	**Reasons:** Incorrect calibration gas value. Low sensitivity to cal gas. Weak or dirty lamp. **Solutions:** Calibrate the sensor. Use different cal gas. Clean or replace lamp. Check air leakage.

5.0 REFERENCES

RAE Systems. May 2005. MiniRAE 2000 Portable VOC Monitor PGM-7600, *Operational and Maintenance Manual*. Document No. 011-4001-000. The following sections describe sample COC documentation, field custody procedures, COC record, sample packaging, custody seals, transfer of custody, and laboratory custody procedures.

STANDARD OPERATING PROCEDURE

BE-SOP-17

Field Screening with a UVOST

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for the collection of field screening data using an ultraviolet optical screening tool (UVOST). This procedure is applicable to the UVOST system (also known as ROST, or rapid optical screening tool) developed and provided by Dakota Technologies, Inc. (DTI) of Fargo, ND. It is a requirement of the End User License (EUL) from DTI that the UVOST system be operated by a certified UVOST operator.

Principle Behind the UVOST

The UVOST uses laser-induced fluorescence (LIF) technology to identify POL contamination in the subsurface. The primary objective of this technology is to delineate the lateral and horizontal extent of petroleum contamination at a site with known or suspected contaminated soil and/ or groundwater in the non-aqueous phase liquid (NAPL) form. The UVOST is advanced through the subsurface using a percussion-driven, direct push drill unit. Each probe provides continuous, real-time data on petroleum contamination at a maximum rate of one datum reading per every two centimeters of downward push.

Fluorescence is a property within some compounds where absorbed ultraviolet (UV) light stimulates the release of photons (light) at a specific wavelength, often in the visible range. Since many aromatic hydrocarbons fluoresce, this property can be used to detect small amounts of a substance within a much larger matrix; such as gasoline in soil. Laboratories have used fluorescence as an analytical method for decades. The availability of high-powered light sources and optical fibers has recently allowed these fluorescence methods to be taken and applied to in-field activities.

The UVOST sends UV light through optical fibers that are strung through hollow direct push steel rods. The light reflects off a tiny mirror within the UVOST probe (known as the SPOC) and exits the SPOC through a small sapphire window. As the probe is advanced, soil sliding past the window becomes exposed to UV light. If contaminants with fluorescent compounds exist within the exposed media, the compounds will fluoresce. The fluorescence response is then transmitted back through a fiber line and analyzed by an oscilloscope. The specific analysis of the oscilloscope is interpreted and displayed instantaneously in graphical and numerical form on a fluorescence vs. depth (FVD) log. Since hydrocarbon bonds will fluoresce at different wavelengths, viewing the individual wavelengths provides distinct patterns of the waveform. These unique patterns are the 'fuel signatures' of the petroleum hydrocarbon within the soil matrix and can be used to differentiate between petroleum contaminants (such as diesel, gasoline, coal tar, etc).

2.0 EQUIPMENT

The following equipment is necessary but additional equipment may also be necessary:

- UVOST system;
- UVOST laptop;
- Central communication hub and data cables;
- Depth encoder
- Remote operator display;
- Fiber-optic cable;
- SPOC/ assembled;
- Power source/ generator;
- Probe rods and tooling;

3.0 STANDARD OPERATING PROCEDURE

The following sections briefly describe UVOST operations; however, the UVOST should only be operated by a DTI trained operator that has attended the appropriate training courses.

3.1 POWER UP/DOWN

To power up the UVOST, simply switch the power on using the power switch on the front of UVOST's e-deck. All peripheral devices are powered through the cabling, minimizing tangles and trip hazards. The laser takes several minutes of warm-up. If powering up from cold conditions (overnight, etc.), make sure you let the laser run at least 10-15 minutes prior to attempting your first Reference Emitter (RE) calibration. Overnight heaters are recommended if operating in sub-freezing conditions to minimize warm-up times in the morning. Extremely high or low temperatures negatively affect laser power; if used in extreme conditions one should attempt to store the UVOST system in a temperature-controlled environment to assure proper operation.

To power down the UVOST, switch off the power button.

3.2 BOOT PC AND CHECK SOFTWARE FUNCTION

Make sure all drivers are loaded and ready. Start the optical screening tool (OST) system software. Indicators in the software will assist in alerting you to problem connections and the general status of the components. See the software manual for specifics on the OST software.

3.3 PROPER SYSTEM FUNCTION

Once the OST software is started and functional, check the depth encoding and associated peripheral functions. Actuating the probe (or hand advancing the string pot) should show "Current Depth" changing on the OST software. The Remote Display should be functional and show the status. Activate the "Info Tab" and make sure the job information is updated for proper storage of each LIF log.

3.4 SPOC SETUP

Unscrew the window and carefully examine the mirror and window for ANY trace grease, lint, and moisture; it is important that they are very clean. Assure that all o-rings, seals, and adapters are in correct order. Screw in the window and check for moisture condensing inside the window by placing an

ice cube on the window for 10 seconds and then visually observing condensation. If there is condensation, dry the SPOC air again. Slightly tighten the mirror and fiber optic Swagelok seals (finger tight). Adjust fiber terminator up/down to achieve proper distance from mirror to collimate the laser beam. Use white paper to verify that the laser beam has been collimated. The energy may have to be increased to do this.

Place the RE in front of window and adjust the laser energy to achieve approximately ¾ scale with the oscilloscope's CH2 on 20 mV/div. Adjust the mirror (using window pick/hook) to image only the sapphire window – not epoxy or SPOC barrel (a full circle image should appear on paper, there should be no clipping of the circle). This generally occurs approximately 1/3 of the way down from top of window.

Clean/polish window and then make sure that background does not exceed ~2.5mV peak signals. If the background signal is high, carefully inspect it for imaging of the sides/epoxy or contamination (lint, cotton fibers, fuel, moisture, grease, etc.) An unacceptably high background can make interpretation extremely difficult.

Once the mirror/fiber/window system is achieving proper results, tighten the Swageloks securely. Use ONLY the supplied wrenches to hold the SPOC securely during tightening. This is most readily assured by laying the SPOC down and only handling the wrenches. Use the mirror pick/hook to hold the mirror firmly in place during tightening to prevent rotation. Make sure the laser beam stays centered in the window (side to side) and 1/3 down from the top (toward first rod).

With window/mirror/fiber terminator secured, proceed with attaching the drive tip, adapter, extension rod, and tighten extremely well with 2 pipe wrenches or a pipe wrench and a vice. Teflon tape helps reduce loosening from rattling/vibration.

3.5 BACKGROUND READING

Wipe the window clean and acquire a "Background" (blank) waveform. A perfect system would yield no waveform in the last 3 channels– only white noise. Try to achieve <2mV peak signal in the last 3 channels; aim for getting the signal as small as possible. A background waveform that looks like the contaminant of interest suggests leakage and contamination of the internal SPOC mirror/window or simply a dirty window. Clean the window with methanol or solvent if soap/water does not work.

3.6 RE CALIBRATION

Calibration should be done just before each UVOST logging event. Do NOT calibrate with RE until the direct push rig is ready to advance the probe. Pre-push with dummy tip if obstructions are likely or advancing the probe is difficult. Place the RE on the window (making sure window is very clean) and immediately acquire the RE reading. Extended exposure of the RE to laser light can form excimers and photodegradation, causing a morph in waveform shape/intensity and an inaccurate reading.

The RE signal levels should exceed 5,000 pVs but not exceed 12,000 pVs; 6,000 to 9,000 pVs is the optimum range. There should be consistency between RE readings (± 500 pVs), especially within the same project/site. Make sure the equipment is working properly and that you have attained an 8:1 (+/-1) ratio of fluorescence to scatter.

3.7 LOGGING

Follow these steps to acquire a UVOST log:

Step 1. With proper RE and background acquired, pertinent log information recorded, and probe in position (window just below ground surface [~1 inch]), activate the Record command.

Step 2. An RE should be acquired prior to each logging event, and the OST software will send an alert if this has not been done. Some reasons a new RE would not be acquired include: an aborted boring, a crooked log, or the probe is underground or under water and continued logging is desired. DO NOT purposefully continue logging without a new RE for each log if you're having problems acquiring a new RE due to a problem. FIX the problem, acquire a good RE, and then proceed. Failure to acquire a new RE for each log will generate inaccurate data.

Step 3. Choose a directory and name for the log. UVOST auto-suggests the name sequentially to reduce typing. The safest way to avoid accidental overwrites is let the software sequentially label the logs and rename the files later.

Step 4. Once the name is chosen, choose whether or not to "zero" the depth. For normal logs always choose "Yes" and zero out depth. If continuing an aborted log (accidental termination) choose "No". The log should continue at the depth where you left off.

Step 5. As the log progresses, make sure the system is operating properly. Observe the oscilloscope or OST display to watch for unusual events such as:

- The probe advancing at a speed other than approximately 0.75 inch/sec – although slower is acceptable, faster is not recommended.
- Strange background drifts several feet under (possible fogging), etc.
- Broken depth cable or poor connection. This will result in jumps in depth or a loss of depth increase – even though the operator is advancing the probe
- Incorrect depths indicating a possible rod length or string pot calibration factor mismatch
- Sudden loss of waveform (flatline) indicating a possible fiber optic break due to a broken probe
- Depth is advancing, but new waveform updates are not showing up indicating poor triggering. Verify that "**Trig'd**" is showing up on oscilloscope approximately every second. If it is not, hit the "Trigger 50%" button on the scope or look for other causes such as the "Stop" button on the laser being accidentally pushed.

Step 6. Once refusal or the target depth is reached, activate the End command. All pertinent data is stored and the oscilloscope scale is automatically returned to the default 20mV/div scale in preparation for next RE.

Step 7. Inspect the probe, window, etc. for leaks, breaks, and loose parts in preparation for next the next logging event (push).

3.8 PRINTING/EXPORTING LIF LOGS

Once the push is complete the log can be viewed. It is necessary to print the log to paper or export it to an electronic image (JPG file) before distribution; however, prior to print/export it is most often desirable to select callout waveforms. Reasons to select certain depths/regions for callout include:

- Bracketing what appear to be continually affected zones - this helps the client/consultant "summarize" the general NAPL zones and easily identify depths for future investigation, etc.

- It's best to bracket large zones of homogenous NAPL - do not span different products.
- Highlighting unusual signatures to "flag" things the client needs to investigate or discount.
- Highlighting a background waveform to remind the viewer what "clean" looks like.
- Highlighting any potential "false positives" such as mineral/plant/urban background/highly degraded NAPL to help the client understand that it's not the target contaminant.
- Use caution when highlighting single waveforms from the rising edge of NAPL hits. The waveforms in these areas are usually saturated because the oscilloscope scaling wasn't able to fully respond; they are morphed and may cause unnecessary confusion and alarm

It is best that the UVOST operator and the client discuss depth/RE scales, depths of interest, etc. ahead of time to hopefully avoid lots of "reprints".

4.0 MAINTENANCE

Maintenance should be performed by qualified personnel only. The major maintenance items of the UVOST are:

• Laser power/ charge
• Regular inspection of SPOC condition
• Regular inspection of cables

4.1 LASER RECHARGE

During the M1 calibration, the RE signal level needs to exceed the 5,000 pVs minimum and should not exceed 12,000 pVs; with 6,000-9,000 pVs being optimal. When the response drops below 6,000 pVs, it is appropriate to recharge the laser with the DTI pre-mix. It is also common to give the laser a "fresh" charge prior to each new project area to increase consistency and data quality."

4.2 EQUIPMENT INSPECTION

At the start of each UVOST, the physical condition of the probe equipment (SPOC and rods) should be inspected to identify any damage that might cause interference or indicate possible future interference with collecting quality data. During the probe, the UVOST operator should closely monitor the data acquisition to identify any peculiarities in the data and/or the system. Unusual behavior can be an indication of faulty communication lines.

Equipment should be subjected to simple trouble shooting procedures to ensure proper function. The remedy to improper equipment is almost always replacement.

5.0 REFERENCES

Dakota Technologies, *UVOST Standard Operating Procedures*.

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-20

Water Quality Measurements

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the methods for calibrating, maintaining, and operating the YSI 556 Multi-Parameter Water Quality Meter. The YSI 556 simultaneously measures numerous water quality parameters including temperature, conductivity, salinity, dissolved oxygen (DO), pH, and oxidation Reduction Potential (ORP). This SOP also describes the guidelines of operation for the Hach Portable Turbidity Meter.

2.0 EQUIPMENT

Water quality meters and instruments vary. Below is a list of the typical instruments used in the field:

- YSI 556 MDS Multi-Parameter Datalogger
- YSI 6-Series Sonde Field Cable
- Flow-Thru Cell
- Hach 2100P Portable Turbidity Meter
- Discharge hoses and fittings to attach sample tubing to the flow-thru cell
- Distilled water
- Calibration solution for YSI (pH 4, 7, and 10, ORP, and conductance)

3.0 PROCEDURES

It is important to note that different instrument models exist and therefore the appropriate operation and procedure manual should be referenced prior to use.

3.1 CALIBRATION FOR YSI 556

Calibration of all instruments for all field parameters needs to be conducted daily. Calibration readings should be documented in the field logbook. If a field instrument will not calibrate, perform troubleshooting as described in the manufacturer's manual. If the issue cannot be resolved, use a backup instrument. If that is not an option, contact the PM on whether data collection will continue or any other corrective actions should be taken. Flag any data recorded from a meter with suspected calibration problems on the field forms. Calibrate the YSI for pH, conductivity, ORP, and DO.

3.1.1 pH Calibration

Always calibrate pH with a 3-point calibration method. The 3-point calibration method accounts for the full pH range and assures maximum accuracy when the pH of the media to be monitored cannot be anticipated.

3.2 YSI MULTI-PARAMETER WATER QUALITY METER

3.2.1 Groundwater parameters

Follow the general procedure for collecting water quality parameters using a flow-thru cell:

- Secure the multi-meter probe to the flow-thru cell. Connect a short discharge tube to the effluent connector at the top of the flow-thru cell and run the other end of the discharge tube into a purge water container.
- Place the tube from the pump directly into the 5-gallon purge water bucket and start to purge approximately half a minute or until the purge water begins to visually clear up. The intent is to limit any initially high turbidity water from filling and settling in the flow-thru cell.
- Once visually clear, turn off pump briefly and secure the tube from the pump to the influent connector at the bottom of the flow-thru cell. Turn on the pump again and allow the flow-thru cell to completely fill with water.
- Begin low flow purging of the well at a flow rate of approximately 1 liter (0.25 gallons) every 3-5 minutes.
- Routinely measure and record DO, ORP, conductivity, pH, turbidity, temperature, and the depth to groundwater every 3-5 minutes until stabilized. A minimum of three recordings will be monitored and recorded.
- Continue to monitor until stabilized or until three well casing volumes have been purged. Use the following stabilization parameters:
    - ± 3% for temperature (minimum of ± 0.2 ◦C),
    - ± 0.1 for pH,
    - ± 3% for conductivity,
    - ± 10 mv for redox potential,
    - ± 10% for dissolved oxygen (DO), and
    - ± 10% for turbidity.

Note: Low flow purging and sampling are particularly useful for wells that purge dry or take one hour or longer to recover. If a well is low yield and purged dry, do not collect a sample until it has recharged to approximately 80% of its pre-purge volume, when practical.

- When parameters have stabilized, record final measurements and collect samples as per the project-specific Work Plan.

3.2.2 Surface Water Parameters

When collecting surface water samples a flow-thru cell is not required. Instead connect the probe sensor guard to the connector nut to protect the sensors. Place the probe in the water being careful not to disturb the bottom. Let sit for about 5 – 10 minutes and then take parameters.

3.3 HACH 2100P PORTABLE TURBIDITY METER

The Hach Model 2100P Portable Turbidimeter measures turbidity from 0.01 to 1000 NTU in automatic range mode with automatic decimal point placement. Use the following generic procedure for turbidity measurements:7

- Collect a representative sample in a clean container. Fill a sample cell to the line (about 15 mL), taking care to handle the sample cell by the top. Cap the cell.
- Wipe the cell with a soft cloth to remove water spots and fingerprints.
- Apply a thin film of silicone oil. Wipe with a soft cloth to obtain an even film over the entire surface.
- Turn the instrument on and place on a flat sturdy surface.
- Insert the sample cell in the instrument call compartment so the diamond or orientation mark aligns with the raised orientation mark in from of the cell compartment.
- Press READ and the result will show in units of NTU.

Refer to the user's manual provided with rental equipment for calibration and maintenance documentation.

4.0 REFERENCES

Hach Company. 2008 (April). *Hach Portable Turbidity Meter Model 2100P Instrument and Procedure Manual*

YSI Environmental. 2009 (August). *YSI 556 Multi Probe System Operations Manual*

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-21

Groundwater and LNAPL Measurements

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the procedures and equipment that should be used to determine water levels, depth to floating product, or total depth in a groundwater monitoring well. Groundwater measurements can be used for several purposes during field activities, including but not limited to, measuring changes in time, and determining the magnitude of horizontal and vertical hydraulic gradients in an aquifer system.

A water level meter will typically be used to measure depth to groundwater (DTW), depth to product (DTP), and total depth (TD) in wells. If Light Non-Aqueous Phase Liquid (LNAPL) is present in the well, an oil-water interface probe will be used.

2.0 EQUIPMENT

Groundwater and LNAPL measurement equipment will include:

- Water Level meter with audible alarm and a cable marked in 0.01 foot increments
- Oil-water interface meter (only if LNAPL layer is suspected)
- Decontamination equipment

2.1 DEPTH TO WATER/DEPTH TO LNAPL MEASUREMENT

If the well is sealed with an airtight cap, allow time for the pressure to equilibrate after the cap is removed before measuring water levels. Take measurements until consecutive readings are within 0.01 foot.

Before taking measurements, ensure a reference point is established. For easy reference, mark the point with a permanent surveyor's reference mark, such as a small notch cut into the casing or a permanent ink mark at the top of the casing. If no reference mark is present, mark the north side of the monitoring well casing.

Measure DTW and DTP as follows:

- With the water level indicator switched on, slowly lower the water level meter or oil-water indicator probe down the monitoring well until the probe contacts the groundwater or LNAPL surface, as indicated by the audible alarm. Do not let the probe tip and tape free-fall down the well. Always hold onto the meter's reel handle.
- Raise the probe out of the water or LNAPL until the audible alarm stops. Continue raising and lowering the probe until a precise level is determined within 0.01 foot.

- If LNAPL is present in the well, measure and record the depth from the TOC reference point to the top surface of the LNAPL layer (that is, DTP). The oil-water indicator probe alarm will sound a continuous tone when LNAPL is detected.
- Continue to lower the probe until the meter indicates the presence of groundwater. The alarm will typically emit a beep when water is detected. Measure the first static groundwater level and record the measurement (DTW) from the reference point to the top of the static groundwater level.
- Record the measurements in the field logbook or on the *Well Purge and Sampling Form*.

2.2 TOTAL DEPTH MEASUREMENT

Use the following procedures to measure the TD of a groundwater monitoring well:

- Slowly lower the water level meter until the cable goes slack. Do not let the probe tip and tape free-fall down the well. Always hold onto the meter's reel handle.
- Gently raise and lower the water level meter probe to tap the bottom of the well.
- Record the reading on the cable at the established reference point to the nearest 0.01 foot.

If there is an offset between the bottom of the probe and the water level sensor, adjust the measurement accordingly. Record the TD measurement in the field logbook or on the *Well Purge and Sampling Form*.

STANDARD OPERATING PROCEDURE

BE-SOP-22

Monitoring Well Installation, Development, and Decommissioning

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) is to be used as reference to describe the process for constructing, installing, and developing groundwater monitoring wells provided by a drilling subcontractor via drill-rig operation. This SOP provides a standard set of procedures applicable under typical site conditions and may vary based on actual site conditions and/or equipment characteristics. This SOP is consistent with *Monitoring Well Guidance* issued by the Alaska Department of Environmental Conservation (ADEC 2013). Specific monitoring well design and installation procedures depend on project objectives and subsurface conditions, and should be discussed in the project-specific Work Plan (WP).

Monitoring wells can be installed as long-term monitoring wells, which can be repeatedly sampled over several years, or as temporary well points, which allow for a one-time groundwater sampling event. Following development, purging, and sampling - a temporary well point is usually removed and backfilled in accordance with ADEC regulations.

2.0 EQUIPMENT AND MATERIALS

The drilling subcontractor will supply all materials and equipment necessary to perform drilling activities in accordance with the Drilling and Core Logging SOP (BE-SOP-05) and will install monitoring wells in locations based on field observations, the Statement of Work (SOW), and in the project-specific WP.

Temporary well points are most commonly 1- to 2-inch diameter screened PVC or stainless steel pipe, which can be pre-packed with filter material, or used without a filter pack. Temporary well points can be installed using a direct push drill rig or by hand, if in unconsolidated material with a shallow water table.

Monitoring wells are usually installed with pre-packed screens, using a direct push drill rig or a hollow stem auger.

Equipment and materials needed for monitoring well installation include, but are not limited to, the following:

- Geoprobe® 66 series drill rig or equivalent
- Well casing and screen
- Filter pack materials
- Bentonite
- Surface seal materials (concrete)
- Potable water and/or deionized water

- Weighted tape measure

Monitoring well development equipment includes, but is not limited to the following:

- Water level meter or Oil/Water interface probe
- Surge block (with foot valve)
- Submersible pump
- Sprinkler pump (useful for removing large volumes of silt and fine sand laden water)
- Inertial pump and tubing (optional-consider for deep wells greater than 30 feet)
- Disposable polyethylene or Teflon bailers
- 5-gallon buckets
- Graduated cylinder or beaker
- YSI water-quality meter
- Hach portable turbidity meter
- Potable water and/or deionized water
- Disposable polyethylene tubing

3.0 DOCUMENTATION

Fill out the attached *Well Installation and Well Development Forms* following installation and when developing the monitoring well. All fields on the installation form must be completed for long term monitoring wells as well as temporary well points. All fields on applicable field forms will be used or an "NA" will be inserted to indicate a field that is not applicable. The field form sections are outlined below:

- Well designation;
- Date of well installation;
- Date of development;
- Static water level before and after development;
- Quantity of drilling fluid lost during drilling;
- Well volume;
- Depth from top of well casing to bottom of well;
- Screen length;
- Depth from top of well casing to top of sediment inside well, before and after development, if present;
- Physical characteristics of removed water, including changes during development in clarity, color, particulates, and odor;
- Type and size/capacity of pump and/or bailer used;
- Height of well casing above/below ground surface;
- Typical pumping rate;
- Estimate of recharge rate; and
- Quantity of water removed and time of removal.
- The *Drilling and Core Logging* SOP (BE-SOP-05) will be followed in compliance with the ASTM D2488 Unified Soil Classification standards. The *Core Log* SOP (BE-SOP-05 Attachment) field form

must be completed during installation and before leaving the site to ensure all details are captured and are complete and accurate.

- Monitoring wells will be surveyed within a horizontal accuracy of 1.0 feet and a vertical accuracy of 0.01 foot. The top of the well casing will be surveyed as well as ground surface for use as a reference point to determine water-level elevation, sampling depths, and groundwater flow direction. All survey information will be documented in the field log book.

4.0 WELL INSTALLATION PROCEDURES

This section describes drilling, borehole, casing, well screen, bentonite seal, and monitoring well completion requirements.

Prior to monitoring well installation, ADEC recommends developing a conceptual model of the site geology and hydrology. This allows for a better understanding of the distribution of aquifers and aquitards at or near the site, hydrologic boundaries, the water surface table, and other hydrogeographic properties. This is a working model to be updated as new data is obtained.

4.1 DRILLING REQUIREMENTS

Several drilling methods are available for creating a borehole for well installation. Primary methods include hollow stem, direct push, air rotary, mud rotary, and cable tool. The drilling method is chosen based on physical subsurface properties.

All drilling activities will be supervised by a qualified environmental professional. The drill rig will be decontaminated appropriately before it enters and leaves the site in accordance with the *Equipment Decontamination* SOP (BE-SOP-14). All leaks will be repaired prior to coming to the site or as soon as they are discovered at the site. The drill rig will not leak any fluids that may enter the borehole or contaminate equipment placed in the hole. The use of rags or absorbent materials to soak up leaking fluids is unacceptable. Brice, or the drilling subcontractor, will have spill response equipment on site at all times to ensure constant preparedness in the case fluids begin to drip from the rig so they do not impact the site.

Drilling mud, synthetic drilling fluids, petroleum or metal based pipe joint compounds, and other potential contaminants will not be used unless necessary. Only high yield sodium bentonite clay free of organic polymer additives will be used if drilling mud is needed to stabilize the hole.

Decontamination water must be potable and obtained from a known water source.

An “as built” drawing will be constructed for each monitoring well. Each well point will be surveyed.

4.2 BOREHOLE REQUIREMENTS

Borehole diameters should be at least three inches larger than the nominal outside diameter of the casing and well screen. If using a hollow stem auger, the inside diameter of the auger should be at least four inches larger than the nominal outside diameter of the casing and well screen, unless otherwise specified in the approved project-specific Work Plan.

The completed monitoring well must be straight and plumb to allow passage of pumps or sampling devices.

4.3 CASING REQUIREMENTS

The following lists requirements for the casings of monitoring wells:

- All casing will be new, unused, and pre-cleaned (if necessary).
- Glue or solvent will not be used to join casing; casings will be joined only with water-tight flush-joint threads or thermal welds that will not interfere with the planned use of the well.
- Pop rivets or screws should not be used on casings or other monitoring well components.
- All monitoring wells will conform to the American Society for Testing Materials (ASTM) F-480-06b. The inside diameter should be at least 1.9 inches, with the exception of well points for piezomenters and transducers. Polyvinyl chloride (PVC) is a durable monitoring well material with good chemical resistance (EPA 1991).
- All metal casing will be seamless stainless steel casing.
- The casing will be straight and plumb within the tolerance stated for the borehole.
- A notch in the top of the casing will be cut to be used as a measuring point for water levels and survey activities. Boring location will be noted based on the identification number.
- The addition of bentonite surrounding the PVC casing will be visually verified during well installation activities to ensure that bridging is not occurring during withdrawal of the drill string/equipment.

4.4 WELL SCREEN REQUIREMENTS

The following are the requirements that must be met for well screens:

- All requirements that apply to casing will also apply to well screen, except for strength requirements.
- Monitoring wells will not be screened across more than one water-bearing unit. Screens will be factory slotted or wrapped.
- Screen slots will be sized to prevent 90 percent of the filter pack from entering the well, and for wells where no filter pack is used, the screen slot size will be selected to retain 60 to 70 percent of the formation materials opposite the screen.
- The bottom of the screen is to be capped, and the cap will be joined to the screen by threads.

In most hydrogeologic settings, screen lengths should not exceed 10 feet. The use of shorter well screens may allow for contaminant detection by reducing excessive dilution.

4.5 FILTER PACK REQUIREMENTS

Surrounding the monitoring well intake with materials that are coarser, of uniform grain size, and have a higher permeability than natural formation material allows the groundwater to flow freely into the well from adjacent formation material while minimizing or eliminating the entrance of fine gained materials. Determine the appropriate filter pack (natural or artificial) application for a given well. An artificial filter pack typically meets these conditions. Deciding between natural and artificial filter pack depends on the grain size distribution of the natural formation materials in the monitored zone. Grain size is determined by conducting a sieve analysis of a soil sample for the intended screened interval. The filter pack should extend above the well screen to a length of 20 % of the well screen length, but no less than 2 feet (ASTM

D5092 2005). The thickness of the filter pack should be at least 2 inches between the borehole and the well screen, and no greater than 8 inches (EPA 1991).

4.6 SEAL REQUIREMENTS

An annular seal should be installed to restrict vertical movement of water or contaminants by sealing the well casing to the adjacent soil formation. The annular seal consists of bentonite chips from the filter pack to approximately 2 feet below the ground surface.

The bentonite seal requirements for wells installed deeper than 12 feet below ground surface, are as follows:

- The bentonite seal will consist of at least two feet of bentonite between the filter pack and the silica sand used to fill the borehole to the ground surface.
- The bentonite will be hydrated after placement.
- Only 100 % sodium bentonite will be used.

The bentonite seal will be terminated 2 feet from the ground surface. The remainder of the annulus will be backfilled using silica sand to minimize bentonite intrusion into the well monument and to promote drainage of water from inside the monument. If the monitoring well is advanced in frozen ground, the annular space between the casing and any permafrost should be sealed to minimize effects on the subsurface thermal regime and to prevent water within the well from freezing.

Seal requirements for wells with submerged screens or screened in deep confined aquifers will be described in the site-specific work plan.

4.7 SOIL BORING AND LOGGING

Soil borings will be logged at each site where monitoring wells will be installed. Refer to BE-SOP-05 for the drilling and core logging procedure.

4.8 MONITORING WELL SURFACE COMPLETION REQUIREMENTS

Surface completion is not necessary for temporary well points.

If flush-mounted completions, cut the casing approximately six inches below the ground surface and provide a water-tight casing cap to prevent surface water from entering the well. A freely draining surface monument with a locking cover should be placed over the casing. The surface monument should be placed in well-sorted sand to allow water drainage. If the well is located on a gravel pad, the top of the monument must be completed at least three inches below pad grade to protect it from snow removal equipment. The top of the casing will be at least one foot above the bottom of the surface monument. The identity of the well should be permanently marked on the monument lid and the casing cap.

For above-ground monitoring well completions, extend the well casing two or three feet above ground surface. Provide a casing cap for each well, and shield the extended casing with a steel sleeve that is placed over the casing and cap and seated in a 3-foot by 3-foot by 4-inch concrete surface pad. To allow for escape of gas, a small diameter (e.g., 1/4-inch) vent hole must be placed in the well casing, or a

ventilated well cap will be used. The diameter of the sleeve should be at least six inches greater than the diameter of the casing. Install a lockable cap or lid on the guard pipe. The identity of the well should be permanently marked on the casing cap and the protective sleeve.

Well locations must be designed to ensure groundwater samples and water level measurements characterize discrete stratigraphic intervals. This is achieved by positioning the screened interval relative to the water table elevation.

Well locations and designs must prevent surface contaminants from entering the groundwater as well as leakage of groundwater or contaminants between the stratigraphic intervals in the well bore or along the well annulus. Complete wells above grade to decrease potential of surface contaminants entering the well.

Install monitoring wells where there is no chance of seasonal inundation by floodwaters, unless the wells have special watertight construction.

Long-term monitoring well development:

- A drilled, long term monitoring well is typically composed of well casing, well screen, and filter pack.
- Place the filter pack into the annulus to a minimum of two feet above the top of the screen and one foot beneath the well endcap.
- Reduce the required filter pack height to allow for annular space sealant.
- Apply bentonite chips to seal the annular space.

5.0 WELL DEVELOPMENT PROCEDURES

Monitoring wells should not be developed for at least 24 hours after installation.

Wells can be developed using a submersible pump, peristaltic pump, and or bailer. Bailers are more commonly used in wells where there is a small volume of water.

Monitoring wells can be developed by first purging the well dry, if possible, then allowing the monitoring well to refill with formation water. If the recovery rate by the formation water is too slow, up to one well casing volume of potable water can be added to the well. The well should be surged vigorously for approximately 10 minutes using either a surge block or bailer. Add more water as necessary. Purge the well dry again to complete the development process (ADEC 2013).

A minimum of three borehole volumes (calculated from the borehole diameter and the length of screen below the water table, corrected for 30 percent porosity of the filter pack) of water and twice the volume of water added during drilling and construction will be removed.

In the event of submerged wells, the borehole volume is calculated over the interval of the filter pack (length of screen plus 2 feet of added sand above the screen).

After initial surging and pumping, groundwater parameters will be monitored for stability criteria (described below).

Groundwater parameter stability is reached when three changes between successive readings at approximately 5-minute intervals at a low-flow pumping rate (drawdown less than 0.3 feet) are less than the criteria provided in Table 1.

Table 1
Stability Criteria for Low-Flow Purging

Parameter[1]	Units	Recording Precision	Stability Criterion
pH	—	0.01	±0.1
Temperature	°C	0.01	±0.2
Conductivity	µS/cm	1	±3%
Turbidity	NTU	0.1	± 10% or ± 1 NTU (whichever is greater)
Oxidation Reduction Potential (ORP)	mV	1	±10
Dissolved Oxygen (DO)	mg/L	0.1	±10% or 0.3 mg/L (whichever is greater)

Notes:
°C = degrees Celsius
µS/cm = microSiemens per centimeter NTU
= nephelometric turbidity units mV =
millivolts mg/L=milligrams per liter
Stability criteria from ADEC *Field Sampling Guidance* (ADEC 2016).
[1] Only three parameters are required to stabilize, four when using temperature.

Low-yielding wells are exceptions to the above criteria. Such wells should be purged dry, then either be allowed to recover or be filled with potable water to the static water level for surging. Add water as needed to maintain the water level during surging. Satisfactory recovery is defined as 80 percent of the well volume. After the initial recovery period, such wells will be surged and pumped dry again to complete the development process.

Alternative development procedures may be used if they will not affect the ability of the well to provide representative samples. Wells installed with an annular seal must not be developed until 24 hours after well installation to allow annular seal materials to set or cure. ADEC recognizes that remote site work may make this impractical. Contact your ADEC project manager for site-specific approval if development is to be conducted prior to the 24-hour waiting period. Sample the monitoring well in accordance with the ADEC *Field Sampling Guidance* (ADEC 2017).

Well purge water can be discharged to the ground surface within 25 feet of the monitoring or recovery well casing, unless there is contamination present, or otherwise specified by the ADEC project manager. If there is evidence of contamination present, the purge water will be remediated based off of the project-specific Work Plan.

A well is considered fully developed when the following criteria are met:

- The well water is clear to the unaided eye (based on observations of water clarity through a clear glass jar); and/or
- If stability cannot be achieved, the well is considered developed when the total volume of water removed from the well equals five times the standing water volume in the well plus the volume of drilling fluid lost or potable water added (if fluids were added).

6.0 WELL DECOMMISSIONING

The purpose of decommissioning monitoring wells and temporary well points is to protect the aquifer. Monitoring wells and temporary well points should be decommissioned as soon as ADEC has determined they are no longer needed. This SOP is consistent with the decommissioning section of the *Monitoring Well Guidance* issued by the Alaska Department of Environmental Conservation (ADEC 2013). Specific monitoring well decommissioning procedures depend on project objectives and subsurface conditions, and must be discussed and presented in the project-specific Work Plan (WP). ADEC approval of the WP is required prior to decommissioning the wells.

1. Knock the bottom of the screen out with a steel drill rod/ pipe, which allows the well to be used as a tremie pipe.
2. Remove the well casing and screen until the screened interval is above the groundwater interface. This allows the material surrounding the well to collapse into the borehole. Keep a 1:1 ratio when pulling out the screen (i.e., if you have a 10' screen, pull the well out 10').
3. After the casing is withdrawn above the groundwater interface, add some bentonite chips to the well. Withdraw the casing further and continue adding bentonite chips. Continue this iterative process (pull the casing, fill the borehole, pull the casing, fill the borehole) to within 2 feet of the ground surface.
4. If the well is shallow, add water to hydrate the bentonite chips. Add additional bentonite chips as necessary to seal the well to within 2 feet of the ground surface.
5. If the well is deep, using a grout pump to place a bentonite slurry in the well. The use of the grout pump will ensure complete seal of the borehole and minimize the potential for bridging.
6. If the well is located in a confined aquifer, bentonite chips should begin to be placed within the confining stratum.
7. Fill the remaining 2 feet of the borehole with sand or gravel and restore the site as necessary.
8. Record decommissioning procedures and report to ADEC.

If the well casing and screen are unable to be removed at the time of decommissioning, and it is known that the well construction included a competent annular seal of bentonite chips surrounding the well casing, the screen should be filled with sand and the casing should be completely sealed in-place with bentonite chips up to the casing cutoff point located near the ground surface.

If the monitoring well is damaged, broken, filled or plugged with soil or other extraneous material preventing successful decommissioning efforts by the methods described previously, decommissioning can be achieved by re-drilling the monitoring well. The PVC casing and well screen may be destroyed by re-drilling the original borehole to the total depth of the well. When the auger is at the bottom of the well, bentonite chips should be added continuously as the auger is carefully removed.

7.0 REFERENCES

ADEC. 2013 (September). Monitoring Well Guidance.

ADEC. 2017 (August). Field Sampling Guidance.

ASTM. 2009 (July). *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure.* D2488. West Conshocken, Pennsylvania.

U.S. EPA .1991. Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells, Office of Research and Development.

U.S. EPA, Region 4. 2008 (February). Design and Installation of Monitoring Wells, Science and Ecosystem Support Division.

ATTACHMENTS

Attachment 1 Record of Well Construction

Attachment 2 Well Development Data Sheet

This page intentionally blank

Record of Well Construction

Project	Project Number	Client	Boring No.

Address, City, State		Drilling Contractor	

Logged by	Date	Started	Drilling Method and Equipment Used
Drill Crew		Completed	

Groundwater Depth	Elevation	Total Depth

Depth (feet)	Diagram	Field Installation Information
1		_____ Surface Monument (material _____)
2		_____ Surface Seal
3		_____ Bentonite Seal
4		_____ Casing (material _____)
5		_____ Screen (material _____)
6		_____ Screen Filter (material _____)
7		_____ Surface Elevation
8		_____ Casing Elevation
9		_____ Casing Stickup
10		_____ Depth of Well
11		_____ Depth of Boring
12		_____ Depth to Groundwater from _____ on (date) _____
		Development Method _____
		Development Time and Purge Volume _____

Field Notes from Drilling

Date	End Time	Start Time
Note-Taker Name		Boring Number
Surface Conditions		

Well Development Data Sheet

Project Name	Event Initial development	Well ID	Project Number
Weather Conditions	PID Readings of Total VOCs (ppm) Ambient _____ Breathing Zone _____ In Well _____	Date	Developer Initials

Well Information

Well Material / Size (in)	Drilling Water Added (gal)	As-Built TD of Casing (ft)	Borehole Diameter(in) / Gallons per linear foot (gal/ft)
PVC / 2 SS / 2 ___/___			3.75 / 0.286 4.5 / 0.362 6 / 0.555 8 / 0.898 (filter pack porosity = 0.3)
Depth to Product (ft TOC)	**Depth to GW (ft TOC)**	**Initial TD of Casing (ft)**	**Product Thickness (ft) and Volume Recovered (mL)**

Borehole Vol. (BV) water table well = (TD of casing – depth to water) * gal/ft; submerged well = (TD of casing – Depth Top Filter Pack *gal/ft

Min Purge Vol. = 2 * Added Water + 3 * BV Max Purge Vol. = 2 * Added Water + 10 * BV

BV = (_____ ft – _____ ft) * _____ gal/ft = _____ gal (* 3.785 L/gal = _____ L)

Min Purge Vol. = 2 * _____ gal + 3 * _____ gal = _____ gal (* 3.785 L/gal = _____ L)

Max Purge Vol. = 2 * _____ gal + 10 * _____ gal = _____ gal (* 3.785 L/gal = _____ L)

Well Purging Information

Start Time	Finish Time	Final TD of Casing (ft)		Equipment Used for Purging	
				sprinkler pump w/ surge block submersible pump peristaltic pump	
Color	**Odor**	**Sheen**	**Purged Dry**	**Stabilization Meters**	**Pump Intake Depth (ft btoc)**
Clear Cloudy Brown Other:	None Moderate Faint Strong	Yes No	Yes No	YSI Multi Meter Turbidimeter	(during stabilization)

Purging reached: Stability Max Vol. Purge water was: Treated Stored Other Note:

Time (HH:mm)	Volume (Gallons or Liters)		Acceptable Range to Demonstrate Stability						Water Level (feet btoc)
			± 1.0 °C	± 3%	± 10% or 0.3 mg/L (whichever is greater)	± 0.1	± 10 mV	± 10% or ±1 NTU	
	Change	Total	Temperature (°C)	Conductivity (µS/cm)	DO (mg/L)	pH (std units)	ORP (mV)	Turbidity (NTU)	

Suggested Notation

"____" = not measured "✓"= stable "+" = rising "-" = falling "*" = all parameters stable ____ Additional observations on back

Well Development Data Sheet

Project Name	Event Initial development	Well ID	Project Number
		Date	Developer Initials

Time (HH:mm)	Volume (Gallons or Liters)		Acceptable Range to Demonstrate Stability						Water Level (feet btoc)
			± 1.0 °C	± 3%	± 10% or 0.2 mg/L (whichever is greater)	± 0.2	± 10 mV	± 10% or ±1 NTU	
	Change	Total	Temperature (°C)	Conductivity (µS/cm)	DO (mg/L)	pH (std units)	ORP (mV)	Turbidity (NTU)	

STANDARD OPERATING PROCEDURE

BE-SOP-25

Underground Utility Locates

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines that will be met during underground utility locates. This SOP will be used to direct field personnel in the techniques and requirements for underground utility identification and clearance.

Underground utility identification and clearance is critical to every site in which investigation, drilling or any construction activities occur. Knowledge of underground line locations is vital for safe operations. Many states have laws that require all excavators, contractors, and other parties to notify utility companies before beginning excavation on public property. Most utility companies require notice at least 48 hours in advance. The location and identification of these lines by the utility companies reduces the contractor's liability should lines be mis-located, and therefore damaged during drilling or excavation activities. Underground utilities lines are preferential pathways for organic vapor or liquids to migrate along. Therefore, knowing their location may aid in the site investigation and remediation processes.

2.0 PROCEDURES

Where excavation, trenching, and/or drilling is anticipated, a project team member will contact the Alaska Digline (811 anywhere in Alaska or 1-800-478-3121) and the local utility companies for locate information. The team will also utilize a Schondstedt magnetic locator to investigate for potential underground utilities in areas prior to excavation, trenching, and/or drilling activities.

Regardless of who or what method is used to locate underground utilities, never take their exact location for granted. Always begin each excavation and borehole slowly and cautiously, taking care to check for the presence of underground structures or lines for at least the first three feet of depth. If the soil is not too hard (i.e. gravelly), hand auger the first three feet of the borehole. Once drilled, check the first three feet with a (non-conductive) probe to make sure that no utilities are present in the sidewall of the borehole. If drilling on active military installations, follow their protocol which will likely include completion of dig permits and obtaining of signatures from facility engineering units.

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-29

GeoXH GPS Location Survey

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to direct field personnel in the proper use of a Trimble GeoXH global positioning system (GPS) unit for the collection of locations. This SOP applies to all personnel engaged in surveying locations with a handheld Trimble GeoXH GPS. This unit is mapping-grade capable of sub-meter accuracy and should be used only when contract requirement allow for this resolution. If higher resolution/accuracy of surveyed locations is required, a survey-grade GPS should be used.

The Trimble GeoXH handheld GPS is a high precision, dual frequency, differential GPS with accuracy capabilities to the decimeter. A GeoXH 3000 and a GeoXH 6000, both running Windows Mobile with Trimble Terrasync software, may be utilized. The GeoXH 6000 has Floodlight technology, which performs better in areas with multipath errors and should be used in conditions with heavy canopy or around tall buildings.

GPS uses 24 satellites and their associated ground stations to form a world-wide radio-navigation system. The GPS receiver (the handheld GeoXH) determines the relative positions of items using the geometry of triangles (trilateration) created from the position of the receiver and the satellites it detects, and time, synchronized to universal time. A minimum of 4 satellites are needed to determine position; typically more are required for accuracy. Trimble GeoXH systems can receive up to 12 satellite positions simultaneously.

Errors can be introduced into the GPS system from a variety of sources including atmospheric conditions and physical objects causing obstructions and reflected signals. Care must be taken to ensure the best conditions for collecting location data. A tool on the Trimble GeoXH helps to plan the best time to collect locations by graphing satellite positions for the next 12 hours.

2.0 EQUIPMENT

The following equipment is necessary, but not limited to:

- Trimble GeoXH handheld unit
- External Tornado antenna and connection cable
- Range pole with level bubble and connection brackets
- Stylus
- Metal measuring tape (in feet and meters)
- Computer with internet connection and Pathfinder Office Software

Note that this SOP is intended to be used in conjunction with *Logbook Documentation and Field Notes* (BE-SOP-01).

3.0 INSTRUMENT

Prior to collecting location data, determine where the data is going to be collected, and where the nearest GPS base stations are located for differential correction of the data. The nearer the differential correction station, the greater the potential accuracy of the data. Typical base stations include continuously-operating reference stations (CORS) and UNAVCO stations. These are shown on maps at the National Geodetic Survey (NGS) website and UNAVCO website, respectively. Additional base stations are maintained by various organizations throughout Alaska such as the Department of Transportation (DOT) and universities, and can be found on those websites.

3.1 SETTING UP THE UNIT

1. Turn on the unit by pressing the green button at the bottom.
2. On the main screen, click on "GNSS Application Launcher." This will boot the GPS program. This program can also be launched by clicking on the Start icon ( ) and selecting "Terrasync."
3. Within the Terrasync software program, there are two stacked menus in the upper left-hand corner. They will be referred to in this SOP as the upper menu and the lower menu.
4. Click the down arrow on the upper menu and choose "Data." This allows to either create a new file to store data (click "Create" and enter the file name and height of the antenna), or to open an existing file (click "Existing File" on the lower menu, choose the appropriate file, and click "Open").
5. Check the number of satellites the unit is receiving signals from by clicking the down arrow in the upper menu and choosing "Status." In the lower menu choose "Skyplot." There should be at least 5 satellites for the unit to get lock. The satellites shown in black are the ones the unit is using to calculate position.
6. Check the settings for data collection by clicking the down arrow in the upper menu and choosing "Setup." Click the down arrow in the lower menu and choose "Options." These settings should typically be the following, although there may be exceptions based on site conditions. Refer to the work plan for details on survey setup.
    - Logging Settings:
        - Accuracy Value for Display/Logging should be Horizontal, Post-processed.
        - Post-Processing Base Distance is determined from the nearest base station (See Section 5.2)
        - Use Accuracy-based Logging – Yes, and apply to all features
    - Real Time Settings:
        - Choice 1 – Integrated SBAS
        - Choice 2 – Use Uncorrected GNSS
    - GPS Settings:
        - Make sure that the GPS is connected
    - Coordinate System:
        - Use Latitude/Longitude WGS 84, Height above ellipsoid

- Units:
  - Use US survey feet
- External Sensors – Typically none will be used

7. Set up the range pole, brackets, and external Tornado antenna (if necessary). The internal antenna is suitable for many conditions; the Tornado antenna can improve yield under canopy and improves accuracy for post-processing. Setup the antenna (both internal and external) by clicking the down arrow in the upper menu and choosing "Setup." Click the down arrow in the lower menu and choose "Logging Settings."
   - Antenna Settings:
     - Measure Height To: Bottom of Antenna Mount for the external antenna or Bottom of Bracket for the internal.
     - Antenna Height: Use the measurement (to the thousandth of a meter) from the ground to the bottom of the antenna as show in the images below.

     - C Type: If using the external, choose "Tornado." If using the internal, choose "Internal."
     - Confirm: Choose how often to ask the antenna height (user preference).
     - Type: If using the external, choose "Tornado." If using the internal, choose "Internal."
8. Check the GPS status. Along the top of the screen is a notification bar.
   - A battery icon shows the remaining power left in the battery. The left half shows the charge level of the receiver battery. The right side shows the status of the computer battery. If fully green, the battery is fully charged. Yellow indicates low power and red indicates critically low.
   - A little satellite icon show with a number next to it shows the number of satellites that the unit is connected to for determining position. When there are not enough satellites to calculate position, the number flashes. If the GPS is not connected, two unconnected plugs will animate.
   - When successfully locked to satellites for position, a double-headed arrow with a number above indicates the estimated accuracy. Typically this is showing horizontal accuracy in real-time (uncorrected).
   - When collecting the location of a feature, a count appears indicating the number of seconds of occupation at that location. A bullseye with the count indicates a line or point feature rather than a point feature.

3.2 COLLECTING LOCATIONS

1. There are three types of locations, called features that can be collected with the GeoXH – points, lines, and areas.
2. To collect a point, place the GeoXH antenna on the location to collect and ensure that it will be stationary for the entire length of the occupation (approximately 1-2 minutes).

3. Click the down arrow in the upper menu and choose “Data.” Click the down arrow in the lower menu and choose “Collect.”
4. Click on the type of feature to collect. This will begin collecting data to log the point. Occupy the location for at least 60 seconds. If the estimated accuracy icon indicates poor accuracy, occupy the location for longer. As the point is being collected, use the keyboard to type a name of the point. Refer to the work plan for naming conventions.
5. When the time has been reached to collect the point, click “Done.”
6. Review collected locations by using the Map feature. Click the down arrow of the upper menu and choose “Map.” This will display a map of the features that have been collected.
7. When all features have been collected, close the file by choosing “Close.”

Many additional features are available with the GeoXH including offsets, background files, setting waypoints and navigating, using data dictionaries, taking photographs, and more. To use these features, refer to the GeoXH User’s Manual.

3.3 DOWNLOAD DATA

Connect the GeoXH device to a computer to download the data, follow these steps:

1. Make sure the device and the computer are switched on.
2. Make sure that the computer has the Windows Mobile Device Center (WMDC) for Windows Vista, 7 or 8, or ActiveSync for Windows XP or 2000 to be able to recognize the device when it is connected.
3. Connect the USB data cable to the device port and to the USB computer port.
4. WMDC or ActiveSync should automatically recognize the device and start a manager dialog box.
5. To transfer files manually, click on “File Management” and copy and paste files from the device to the computer. If the computer has Trimble Pathfinder Office software installed, click on the Data Transfer utility to download the location data via the software.
6. Save the files in the project folder and ensure that the Project Manager and GIS Manager know where the files are located.

3.4 POST FIELD

Once all data is downloaded to a computer, the data should be differentially corrected for maximum accuracy. Use Trimble Pathfinder Office software to differentially correct data automatically. Typically for projects in Alaska we are unable to differentially correct data real time in the field due to limited connectivity and this must be done after data collection. Base files are typically available 24 hours after the data is collected.

3.5 TROUBLESHOOTING AND MAINTENANCE

Additional details on the GeoXH device can be find in the User’s Manual, which is kept in the hard case with the GPS unit at all times. The following table shows some typical problems that occur with the GeoXH.

TABLE 1: GEOXH TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
The handheld will not turn on.	The battery is dead.	Recharge or swap the battery.
The handheld is not charging.	The internal temperature has risen above the allowed maximum for charging (104°F).	Remove the unit from any external heat sources and the unit will automatically start charging again when the internal temperature has dropped.
Concentration is dropping very slowly back to zero after taking a reading.	There is an obstruction in the filter or probe.	Replace the filter and any tubing connected to the instrument probe.
The backlight does not come on when you tap the screen or press a button.	The backlight is not set to turn on in the Backlight control.	Tap > Settings > System > Backlight to view the Backlight control and make sure that the brightness is not set to dark, and the turn on backlight box is checked.
The handheld is not receiving GNSS positions.	The integrated GNSS receiver is not activated.	Use the Connect or Activate GNSS/GPS command in the field software to open the GNSS COM port and activate the integrated GNSS receiver.
	Incorrect configuration of serial COM port.	When supplying GNSS data to an external device using the COM1 USB to serial converter cable, set the baud rate to the high-speed TSIP setting: 38400, 8, 1, Odd.
	The GNSS COM port is already in use. Only one application at a time can have the port open.	Do the following • Exit the software that is using the GNSS COM port and then retry in your application. • Check that a GNSS application is not running in the background. Tap / Task Manager and then select and close (click End Task) any GNSS applications you are not using. • Make sure that connections are not left in use by the GNSS Connector software; close the application when you are not using the connections.
	The GNSS field software is using the wrong GNSS COM port.	Connect to COM2 if the GNSS field software uses NMEA messages, or COM3 for TSIP messages. For information on which protocol to use, check the documentation for the application.
	Not enough satellites are visible.	Move to a location where the receiver has a clear view of the sky and ensure the antenna is not obstructed. Alternatively, adjust the GNSS settings to increase productivity.
	The DOP (Dilution of Precision) value for the current position is above the maximum DOP setting.	Wait until the DOP value falls below the maximum DOP specified. Alternatively, adjust the GNSS settings to increase productivity.
	Wait for real-time is selected in the GNSS field software and the integrated receiver is waiting to receive real-time corrections.	If you are collecting data for post processing, clear the wait for real-time selection.
	External antenna connected but not receiving data.	The handheld can take up to two seconds to detect that an external antenna has been connected or disconnected.

4.0 REFERENCES

Trimble, 2012. GeoExplorer® 3000 Series User Guide, Version 1.00, Revision B, May.

Trimble, 2011. GeoExplorer® 6000 Series User Guide, Version 1.00, Revision A, February.

STANDARD OPERATING PROCEDURE

BE-SOP-51

Material Handling/ Manual Lifting

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines that should be met when material handling/manual lifting at and around a job site.

2.0 GENERAL POLICY

Back injuries are one of the most common and most preventable injuries on the job site. After determining the object is within lifting capabilities, warm up by stretching before doing any lifting or strenuous work. Use proper lifting procedures - bend at the knees rather than the waist, and use your leg muscles, not your back. Keep a wide base of support by standing with legs hip distance apart, and never twist while lifting. Take proper breaks during repetitive tasks, and get help when moving heavy or awkward objects. Use lifting devices when possible. If necessary, have a competent worker or supervisor demonstrate the proper method of bending and lifting.

Identifying when materials require lifting equipment, such as slings and chokers, is key. Conduct an evaluation of the proper equipment to use to assist in lifting if manual lifting techniques are not safe.

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-52

Driver Safety Program

1.0 INTRODUCTION

This standard operating procedure (SOP) is for all individuals who will operate motorized vehicles.

2.0 DRIVER SAFETY AND POLICIES

Statistics show that many accidents involve those in company vehicles. The purpose of this SOP is to avoid injuries, possible loss of life, and costs related to accidents involving company vehicles.

2.1 COMPANY AUTO USAGE POLICIES

- Company vehicles are for company business only, and are to be driven by active employees only (unless permission is given by a supervisor) who are appropriately licensed, certified, and/or trained for the vehicle in which they are operating.
- Vehicles are to be maintained in good operating condition. Drivers will conduct a complete safety walk-around prior to entering the vehicle and inspect the vehicle on a daily basis prior to use.
- Occupants will wear seatbelts when vehicles are in motion.
- Vehicles may not be operated while using cell phones. This includes sending or receiving calls, texting, emailing or any other application on the phone (this includes personal vehicles on company business).
- Vehicles are strictly prohibited from use while under the influence of alcohol.
- Vehicles may not be operated while eating or drinking, reading, or using other devices that distract from driving.
- Vehicles must be driven within the laws and regulations for operating motorized vehicles (i.e. valid license, posted speed limits, etc.) and within the manufacturer's operating guidelines.
- Vehicles may not be used to transport alcohol.
- Vehicles must be clean of all garbage, paper, boxes, etc. when no longer in use.
- Smoking is prohibited in company vehicles.
- Vehicle loads must be secured and within the manufacturer's specs and the legal size/weight limits.
- If involved in an accident while on company business, it must be reported to the Safety Officer as soon as possible. All required forms must be completed in a timely manner.

2.2 NEAR MISS POLICY

Near misses should be reported to one's immediate supervisor and forwarded to the Safety Officer. An investigation will be conducted as soon as possible.

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-59

Site Traffic

1.0 INTRODUCTION

This standard operating procedure (SOP) is for all individuals who will work in and around roadways while conducting job related activities and may need to set up work zones as protection from vehicular traffic. It is also for response and recovery workers operating or working near heavy equipment who will need to establish and follow traffic safety procedures to avoid injury and equipment damage.
While OSHA requires that operators be familiar with the pieces of machinery they operate, there is also a need to implement controls to ensure these activities are performed safely. Controls are needed where multiple pieces of heavy equipment, vehicles, and response and recovery workers are in close proximity.

2.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The following PPE is recommended for all operations:

- Hard hat
- Eye protection with side shields
- Gloves appropriate for job hazards expected (e.g., heavy-duty leather work gloves for handling debris with sharp edges and/or chemical protective gloves appropriate for potential chemical contact)
- ANSI-approved protective footwear
- High visibility safety vest

Additional PPE may be warranted depending on site conditions. This evaluation is to be made prior to commencement of work activities.

3.0 PROTECTING WORKERS FROM VEHICULAR TRAFFIC

When working around traffic, the following should be used to warn oncoming traffic that there are people working in the area:

- Flaggers;
- Traffic cones;
- Flood Lights;
- “Reduce Speed” signs and/or message boards to warn approaching vehicles of work area.

Ensure that the work zone is well lit, but control glare to avoid temporarily blinding passing motorists.

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-61

Working around Drill Rigs

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines that should be met when working around a drill rig, traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tool. This SOP should be used to direct field personnel in the techniques and requirements for working with and maintaining drill rigs.

2.0 FIELD SAFETY OFFICER (FSO)

Every drill crew will have a designated FSO (often the drill rig operator). The FSO has the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to listen to the safety directions of the FSO. Responsibilities specific to the FSO pertaining to the drill rigs include:

- Understanding and communicating that proper maintenance of tools and equipment and general "housekeeping" on the drill rig to promote and ensure a safe work environment.
- Ensuring the operator (who may be the safety supervisor) has had adequate training and exposure to the drill rig, operating controls, and operating capabilities.
- Inspecting the drill rig daily for structural damage, loose bolts and nuts, proper tension of chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and or damaged pressure gauges and pressure relief valves.
- Checking and testing all safety devices, such as emergency shutdown switches, at least daily and preferably at the start of a drilling shift. Drilling should not be permitted until all emergency shutdown and warning systems are working correctly.
- Ensuring that emergency devices are not wire-grounded, bypassed, or removed.
- Checking that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds on each starting of an engine.
- Ensuring that all new drill rig workers are informed of safe operating practices on and around the drill rig and that each new employee reads and understands the safety and operations and maintenance manuals.
- Instructing a crew worker in drilling safety and observing the new worker's progress towards understanding safe operating practices.
- Ensuring that there is a first-aid kit, blood borne pathogen kit, and a fire extinguisher on each drill rig and on each additional vehicle, and ensuring that they are properly maintained.
- Ensuring that crew members are well trained and capable of using first-aid kits, fire extinguisher, and all other safety devices and equipment.

3.0 SAFETY DURING START-UP AND DRILLING OPERATIONS

The Brice project manager (PM) and safety personnel are responsible for determining the appropriate procedures to be followed to ensure drilling work is performed safely, and must review local, state, and federal laws and regulations that are applicable to each project. If required, client drilling guidelines and/or procedures will be implemented.

Prior to drilling, the PM and FSO will ensure that a site-specific Health and Safety Plan and Activity Hazard Analyses have been developed. Drill rigs must be operated safely in accordance with manufacturer's operating procedures.

The FSO observes drilling start-up and operations to ensure adherence to safety requirements. The operator must not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. The drill rig and tools must be used only for the purposes for which they are intended and designed.

3.1 UTILITIES

Safety requirements established in the *Underground Utilities Locate* SOP (BE-SOP-25) must be observed during drilling operations.

3.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

For most drilling projects, PPE will include a safety hard hat, safety shoes, safety glasses, and close-fitting but comfortable clothes, without loose ends, straps, draw strings, belts, or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry should not be worn during work shifts.

For some drilling operations, the environment or regulations may dictate additional PPE be used. The design and composition of the PPE must be determined jointly by the management of the drilling organization and the FSO. Such equipment might include, but is not limited to, face, ear, or reflective clothing protection. Each drill rig worker should wear noise reducing ear protectors when appropriate. When drilling is performed in chemically-or radiologically- contaminated ground, special protective equipment and clothing may be required. Additional information regarding PPE is provided in the project-specific Work Plan. The client can also have specific requirements concerning PPE. This must be addressed prior to any work and included in the Site Safety and Health Plan (SSHP).

3.3 HOUSEKEEPING AND DRILL RIG MAINTENANCE

It is critical for safe field operations that the safety supervisor understands and fulfills the responsibility for maintenance and housekeeping on and around the drill rig. General housekeeping requirements are established in *Housekeeping* SOP (BE-SOP-57).

3.4 CLEARING THE WORK AREA

Prior to drilling, adequate site clearing and leveling should be performed in accordance with *Clearing, Grubbing Operations* SOP (BE-SOP-58) to provide a safe working area.

3.5 SAFTEY DURING TRAVEL

The individual who transports a drill rig on and off a drilling site must observe traffic safety requirements established in *Site Traffic* SOP (BE-SOP-59).

3.6 FIRST AID

A first-aid kit will be available and well maintained on each drill site. At least one or more members of each drill crew will be trained to perform first aid. Training should be provided or sponsored by the American Red Cross or a similar organization. For drilling operations, it is particularly important that the individual responsible for first aid be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin.

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-64

Working with Hand Tools

1.0 INTRODUCTION

This standard operating procedure (SOP) is for all individuals who will work with hand tools.

2.0 GUIDELINES

Hand tools must be kept in proper working order. All tools must be inspected before each use and all employees must be trained to use tools with proper safety.

3.0 TOOL USE

Hand tools will be kept in good condition (undamaged handles and proper working edges) that are not cracked or mushroomed with the potential to chip or create flying objects.

When using hand tools, the tools will:

- Be used within their designated capacity,
- Not be carried or left in a position that could cause injury to employees,
- Be put in storage when work is finished,
- Disconnected from their sources and pressures in lines released prior to any repair work.

4.0 PERSONAL PROTECTIVE EQUIPMENT

It is critical to use proper personal protective equipment (PPE) when using hand tools. When using hand tools, proper PPE will be implemented:

- Glove selection based on hand tool: leather work gloves versus cut resistant; and
- Safety glasses with side shields

This page intentionally blank

STANDARD OPERATING PROCEDURE

BE-SOP-66

Breathing Zone Air Monitoring

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines for protection against occupational exposure where potential hazards exist for dust, fumes, mist, radionuclides, toxic gas, vapors, or oxygen deficiency. A Respiratory Protection Program will be implemented in accordance with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.134 and USACE's Safety and Health Requirements Manual (USACE 2014).

Breathing zone screening measurements will be periodically collected during activities which warrant air monitoring with a photoionization detector (PID) or colorimetric gas detector tubes to verify that workers are not exposed to contaminants above the levels specified in the project-specific Work Plan. Although not anticipated, if the levels exceed established thresholds, work at the location will be stopped and the respiratory protection program will be updated as necessary.

Downwind locations may also be monitored, as described in the Work Plan.

2.0 MATERIALS AND EQUIPMENT

Air Monitoring Equipment includes but is not limited to:

- PID equipped with a 9.8-, 10.6-, or 11.7-electron volt lamp
- Colorimetric gas detector tubes
- Personal Protective Equipment (PPE)

3.0 PROCEDURE

Under supervision of the site safety and health officer (SSHO), air monitoring will be conducted where contaminant-bearing vapors or dust, lead dust, POLs, or other air-borne contaminants of concern may be present. The project-specific Work Plan will provide air monitoring requirements and action levels for the sites. The type and extent of monitoring will depend upon site-specific conditions and the contaminants encountered at the sites. If a change in conditions is observed at either site, additional air monitoring may be required.

3.1 AIR MONITORING WITH A PID

PIDs should be calibrated daily and tested regularly, as described in Field Screening with a PID SOP (BE-SOP-15).

Prior to PID use, background levels must be established by monitoring outside the exclusion zone or controlled area and upwind of the site.

Once background levels are established, begin taking readings. The PID reads in units of parts per million (ppm), and the readings should be sustained for at least one minute to determine exposure. Record readings on a regular basis. If readings exceed thresholds established in the Work Plan, work will be stopped and the SSHO or superintendent will be notified to determine the appropriate course of action.

3.1.1 Benzene

The PID method is not sensitive enough to detect harmful levels of benzene. If the PID detects organic vapors (readings greater than 1 ppm above background) in the breathing zone at a site where benzene is a known contaminant of concern, the breathing zone shall be tested with a direct reading instrument for benzene. If benzene is detected, personnel will wear passive dosimeters and will modify procedures in accordance with the project-specific Work Plan. The AHAs will also address the required PPE for potential exposure for specific activities. Conditions that exceed project action levels will require an upgrade of PPE until monitoring demonstrates otherwise. The SSHO, with the assistance of trained field personnel, will identify these conditions.

3.2 AIR MONITORING WITH COLORIMETERIC GAS DETECITON TUBES

Instructions for using colorimetric gas detection tubes vary by manufacturer. Always review and follow the manufacturer directions, which are usually printed on the box.

Instructions usually include the following:

- Break both sides of the tube being careful not to puncture or cut skin
- Place the tube in the appropriate pump in the correct orientation. Only use pumps that are in good condition and regularly maintained.
- Draw a fixed volume of gas into the tube. Follow directions to ensure the appropriate volume is being drawn into the tube.
- Wait the appropriate amount of time and then immediately measure the color change. Colors may fade with time.
- Make any humidly or temperature corrections if necessary.
- Record results.

If readings exceed thresholds established in the Work Plan work will be stopped and the SSHO or superintendent will be notified to determine the appropriate course of action.

4.0 REFERENCES

U.S. Army Corps of Engineers (USACE). 2014 (November). Safety and Health Requirements Manual. EM385-1-1.

STANDARD OPERATING PROCEDURE

BE-SOP-75

Managing Fatigue at Work

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) for Brice Engineering, LLC (Brice) describes the procedures and guidelines for recognizing and managing fatigue in the workplace. This SOP applies to employees, contractors, visitors, clients, trainees, and volunteers while they are working or visiting a Brice site, property, or workplace.

This SOP relates to an individual's ability to manage fatigue when physical or mental limits have been reached. Fatigue is associated with physical exertion, mental exertion, and inadequate or disturbed sleep. Long term health problems have been associated with prolonged fatigue.

Fatigue management allows for steps to be taken towards ensuring a safe work environment, eliminating unsafe conditions and work practices that could potentially lead to illness, personal injury, equipment or other property damage.

2.0 PURPOSE AND OBJECTIVES

This procedure aims to provide an overview of Brice's process for controlling the occupational risks associated with fatigue. The following provides guidance for the stringent monitoring of personnel, specifically when they have been exceeded. These are consistent with the metrics outlined in EM 385-1-1 (2014).

- Exceed 10 hours a day for more than 4 consecutive days
- Exceed 50 hours in a 7 day work week
- Exceed 12 hours a day for more than 3 consecutive days, or
- Exceed 58-hours a week of sedentary work (to include office work)

2.1 OPERATOR WORK HOUR LIMITATIONS

Operators of equipment such as hoisting equipment and draglines, mobile construction equipment, electrical power systems, hydropower plants, industrial manufacturing systems, hydraulically operated equipment, powered vessels, and boats will not be permitted to exceed 12-hours of duty time in any 24-hour period, including time worked at another occupation. A minimum of 8 consecutive hours of rest between shifts in a 24 hour period is required.

All floating plant personnel will be scheduled to receive a minimum of 8 hours rest in any 24 hour period except when quarters are provided immediately adjacent to, or aboard, the work site. These hours of rest may be divided into no more than 2 periods, one of which must be at least 6 continuous hours in length.

Rest periods may be interrupted in case of emergency, drill, or other overriding operational necessity

3.0 FATIGUE MANAGEMENT

This section discusses the signs and consequences of fatigue, and how to manage it.

3.1 FATIGUE SIGNS

Fatigue signs and symptoms include, but are not limited to:

- Blurred vision
- Difficulty keeping eyes open
- Head nodding
- Drowsy, relaxed feeling
- Irritability
- Tired feeling
- Falling asleep at work

3.2 FATIGUE CONSEQUENCES

Safety consequences associated with fatigue include, but are not limited to:

- Decreased awareness
- Slowed reaction time
- Poor hand-eye coordination
- Poor communication
- Higher error rates
- Reduced vigilance
- Reduced error rates
- Reduced decision making abilities
- Poor judgement of performance, epically when assessing risks
- Focus reduced
- Difficulty responding in emergencies
- Inability to recount events sequentially

3.3 MANAGING FATIGUE

Fatigue management is a shared responsibility between management and workers monitoring each other as well as themselves.

Management responsibilities include, but is not limited to:

- Ensuring workers are provided enough time for a continuous 7 to 8 hours of sleep in each 24 hours.
- Ensuring sufficient cover for workers on annual or sick leave.
- Limiting the amount of overtime so workers do not exceed 12 hour per work day.
- Limiting night shifts.
- Developing creative work schedules to prevent repetitive work breaks at critical times in the work cycle, control of environmental factors (heat, cold, use of personal protective

equipment), buddy check-in for individuals working alone, and alternate transportation for long commutes.

- Providing training to employees to better recognize signs and symptoms of fatigue, and how to communicate concerns to management.

Employee/contractor responsibilities include, but are not limited to:

- Ensuring they are fit for work, in particular, not adversely affected by lack of sleep, physical, or mental fatigue.
- Raising concerns if they perceive themselves as being effected by fatigue or unable to perform their job functions.
- Raising concerns if they perceive their co-workers are being affected by fatigue or unable to perform their job functions.

Management will provide training to employees that relate to recognizing the signs and symptoms of fatigue, and how to mitigate it in the workplace. The training will focus on communication methods between co-workers, and also between management and employees so concerns can be raised in a safe environment. The training will also include topics such as creative work scheduling and tracking of work/break hours.

This Page Intentionally Left Blank

STANDARD OPERATING PROCEDURE

BE-SOP-76

Water Seep Sampling

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines and procedures of collecting water seep samples. The methodologies discussed in this procedure is applicable for liquid samples, both aqueous and non-aqueous, from seeps and pools associated with seeps. These procedures are applicable for samples collected at the surface of seep pools and from the face of the seep.

Collection and handling of water seep samples will be executed or directly supervised by a qualified environmental professional, as defined in 18 AAC 75.

2.0 MATERIALS AND EQUIPMENT

Collection of water from water seeps includes, but is not limited to:

- Logbook
- Waterproof pen
- Field datasheets (e.g., sample description sheets, etc.)
- Tape measure
- Survey stakes, flags (white)
- Sampling jars
- Preservatives
- Safety equipment
- Decontamination fluids and equipment
- Bottle labels
- Coolers and ice

2.1 REAGENTS

Reagents are used for the preservation of water seep samples including hydrochloric acid (HCL), nitric acid (HNO3), sodium hydroxide (NaOH), sodium sulfite, and ascorbic acid. HCL, HNO3, and NaOH are used to preserve water seep samples collected in the field for volatile organic compound (VOC), metals, and cyanide analyses respectively. It is not expected that water seep samples will contain free (residual) chlorine unless they are treated effluent samples or are collected near the outfall of a treated water effluent. If chlorine is suspected, the water will be tested for free chlorine using chlorine test strips according to manufacturer directions. If samples are collected for VOC, semi-volatile organic compound (SVOC), or cyanide analyses, samples that test positive for residual chlorine will require treatment with a reducing agent before sample preservation. Ascorbic acid is used as a reducing agent for samples collected for VOC and cyanide analyses, and sodium sulfite is used as a reducing agent for samples

collected for SVOC analysis. Samples collected for oil analysis may sometimes be preserved with HCL or sulfuric acid to prevent degradation by microbial action.

Reagents used for decontamination of sampling equipment is found in the *Equipment Decontamination* SOP (BE-SOP-14). Non-aqueous samples are typically not preserved due to the uncertain nature of the matrix, which may evolve harmful gases upon addition of acid or base to the sample.

3.0 PROCEDURE

3.1 SAMPLING PREPARATION

Prior to conducting sampling activities, a sampling preparation meeting will be held by the team to discuss the proposed sampling strategy for the project-specific Work Plan. Site history, contaminant concerns, sampling methodology, individual responsibilities, sample shipment or delivery, health and safety issues, and lines of communication anticipated during the sampling event will be discussed.

3.2 SAMPLE COLLECTION FROM SEEP POOLS

Water seep samples will be collected using hand tools. Typically, seep samples are collected from just below the water surface where the seep has formed a pool. Sampling locations greater than 1 foot below water surface is considered outside the scope of the procedure. For situations where no pool is associated with the seep, Sample collection is described in section 3.3.

Samples will be collected at a frequency specified in the project-specific Work Plan. Samples will be collected as follows:

- Don new PPE (gloves, etc.) before starting sample collection.
- Verify that all needed equipment is readily available and that the sample containers are new and have been properly prepared.
- Label container and sample-specific data sheet, if applicable.
- Using decontaminated or disposable sampling equipment, collect water from the sampling location by slightly submerging the sample container just below the water surface at a slight angle. If preservatives are in the sampling container, use a sampling container with no preservatives to collect the water seep and fill any pre-preserved sampling containers.
- Allow the container to fill with minimal agitation of the water. Be sure to avoid overfilling of the sample container by leaving a slight amount of headspace in the sample jar.
- Place the cap on the sample jar and tighten.
- Wipe the outside surface of the sample jar using a paper towel
- Place samples upright in a pre-chilled cooler immediately after sample collection.
- Record in the field logbook the sample identification, the sample collection location (sketch), the depth from which the sample was collected, and if a duplicate sample was collected, any discoloration or odor, and other pertinent details.
- Decontaminate any reusable sampling equipment or discard used disposable sampling equipment between samples. The *Equipment Decontamination* SOP (BE-SOP-14) will be followed for decontamination procedures.

3.3 SAMPLE COLLECTION FROM DIRECT SEEPS

Samples will be collected at a frequency specified in the project-specific Work Plan. Samples will be collected as follows:

- Don new PPE (gloves, etc.) before starting sample collection.
- Verify that all needed equipment is readily available and that the sample containers are new and have been properly prepared.
- Label container and sample-specific data sheet, if applicable.
- Using decontaminated or disposable sampling equipment, collect water from the sampling location by placing sample container directly underneath or in the seep. Alternatively, a syringe can be used by placing the syringe directly in the seep, and then transferring collected liquid to the sample container. If preservatives are in the sampling container, use a sampling container with no preservatives to collect the water seep and fill any pre-preserved sampling containers.
- Allow the container to fill with minimal agitation of the water. Be sure to avoid overfilling of the sample container by leaving a slight amount of headspace in the sample jar.
- Place the cap on the sample jar and tighten.
- Wipe the outside surface of the sample jar using a paper towel
- Place samples upright in a pre-chilled cooler immediately after sample collection.
- Record in the field logbook the sample identification, the sample collection location (sketch), the depth from which the sample was collected, and if a duplicate sample was collected, any discoloration or odor, and other pertinent details.

Decontaminate any reusable sampling equipment or discard used disposable sampling equipment between samples. The *Equipment Decontamination* SOP (BE-SOP-14) will be followed for decontamination procedures.

3.4 HANDLING AND PRESERVATION

Samples will be collected using the appropriate unused sample containers (with preservative, if required by the analytical method) provided by the analytical laboratory. Sample containers will be labeled with the sample identification number, date and time of collection, sampler initials, and analysis requested. Samples will maintained at 4 degrees Celsius (°C) ± 2 °C while in storage (if required by the analytical method). Samples will then be packaged and transported to the subcontracted laboratory for analysis.

3.5 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance and quality control samples will be collected in accordance with the *Quality Control Samples* SOP (BE-SOP-04) and the project-specific Work Plan.

This page intentionally blank

ATTACHMENT C-3

ANALYTICAL STANDARD OPERATING PROCEDURES

This page intentionally blank

Controlled copy distributed to Kelly Carson at Brice Environmental.

SGS	SGS North America, Inc. - Alaska Division Standard Operating Procedure
NOTE: This document contains CONFIDENTIAL business information and is not intended for distribution.	
S.O.P. Title: Diesel Range Organics/ Residual Range Organics (DRO/RRO)	**Revision Date**: January 2018
Method No: AK102 & AK103 & 8015C	**SOP No**: 712r16
Page: 1 of 21	**Supersedes**: 712r15

Signatures below reflect periodic review of Standard Operating Procedures. If the procedure is found adequate with little or no editing necessary, this page is signed and dated. An Addendum may be issued for minor changes that need to be implemented immediately. If it is determined that major edits are required, a new revision will be released with a new signature page.

Technical Director	Date	Quality Assurance (QA) Manager, QA Staff or their Designee	Date
Stephen C. Ede	1/30/18		1/30/18

Original cover pages with wet signatures and the digitally signed electronic SOP versions are available in the Quality Assurance Office.
A limited number of controlled hard copies will be issued for the Section Method SOPs & Technical Director's offices.

This document will be converted into a PDF file with the QA Manager's, QA Staff's or QA Designee's electronic signature and posted on the network: \\usfs700\ANK_GroupData\Public\DOCUMENT\SOP\~Approved_SOPs~

This electronically signed PDF will be considered the controlled copy for staff. Any printouts or photocopies are invalid.

Each staff member responsible for this SOP will print & sign this coverpage upon successful review, retaining it as a record in their training folder.

I have reviewed and understand the method reference(s) and this version of the SOP.
I agree to use only this currently approved version of the SOP.

Signature: _____ Printed Name: _____ Date: _____

Document Control Number _____ Issued by _____ Date _____

Controlled copy distributed to Kelly Carson at Brice Environmental.

Summary of Changes from Previous Revision:

- Section 20 Maintenance was added
- Section 7.5 was moved to section 20.1
- Section 10.5.1.2 was updated to reflect the correct R^2 value for initial calibrations of 0.99 for AK102/103 methods
- Section 10.4 was removed
- Section 11.17.2.1 was updated to include the calculation form number
- Section 11.17.2.2 was updated to include the calculation form number
- Table 1 Initial Calibration was updated to reflect current practices

Controlled copy distributed to Kelly Carson at Brice Environmental.

Table of Contents

1.0. OBJECTIVE: 4
2.0. SCOPE AND APPLICATION: 4
3.0. DEVIATIONS FROM REFERENCE METHOD: 4
4.0. RESPONSIBILITIES: 4
5.0. INTERFERENCES: 5
6.0. SAMPLE HA NDLING: 5
7.0. APPARATUS: 6
8.0. REAGENTS: 6
9.0. EXTRACTION: 9
10.0. CALIBRATION: 9
11.0. ANALYSIS: 10
12.0. QUALITY CONTROL: 13
13.0. CALCULATIONS, REVIEW AND REPORTING: 15
14.0. HEALTH AND SAFETY: 15
15.0. POLLUTION PREVENTION: 16
16.0. METHOD PERFORMANCE: 16
17.0. DETECTION LIMIT (DL) STUDY: 16
18.0. LIMIT OF DETECTION (LOD): 16
19.0. LIMIT OF QUANTITATION (LOQ): 16
20.0. MAINTENANCE: 17
21.0. REFERENCES: 17
22.0. ATTACHMENTS: 17

1.0. OBJECTIVE:

This standard operating procedure provides conditions for the analysis of diesel range and residual range organics and other extractable petroleum hydrocarbons. Upon completion of extraction procedures, the concentrations of diesel range and residual range organics are determined by Gas Chromatography employing a Flame Ionization Detector (FID).

2.0. SCOPE AND APPLICATION:

This SOP provides a GC method for determining the concentration of diesel range organics (DRO) and residual range organics (RRO). These analyses are applicable to aqueous, soil, and oil matrices. All products identified by this method will be quantified using diesel fuel #2 (DRO) and/or oil blend (RRO) calibration curves.

2.1 **DRO by AK102** measures the area response of the instrument from C10 through to the beginning of C25. **RRO by AK103** is measured from the beginning of C25 through C36.

2.2 **DRO by 8015C** measures the area response of the instrument from C10 through to the beginning of C28. **RRO by 8015C** is measured from the beginning of C28 through C36.

3.0. DEVIATIONS FROM REFERENCE METHOD:

Note: Sections referenced are as published in AK 102/103 Version 4/8/2002:

3.11 The LOQs for soils and waters are less than 5X the method detection limit.

9.2.2.2. Performance criteria of mass discrimination and separation number will not be calculated.

AK102-3.3. SGS uses 5-alpha-androstane instead of o-terphenyl for the surrogate.
NOTE: Alternate is allowed by method.

AK102-8.1 SGS preserves samples to a pH of less than 2, as well as maintaining them at 4ºC until extraction.
NOTE: This is a NELAP deviation; however, it is recommended by the reference method.

9.5.2 Surrogates are not calibrated with DRO/RRO standards; they are calibrated separately.
NOTE: This is a NELAP deviation; however, it is permitted by the reference method.

4.0. RESPONSIBILITIES:

4.1 The QA Office maintains a master list of this SOP to ensure review on a timely basis. This system serves as an accounting of SOP distribution and ensures that distributed SOPs are current and complete. This includes destruction of controlled copies of expired and retired SOPs. The QA Office also maintains a historical file of original cover pages with wet signatures and digitally singed electronic versions of this SOP; including the current revision and any versions archived within the past 5 years.

4.2 The electronic (Word Document) versions of this SOP, both current and any prior versions, are maintained on the computer network in a secure location as a “read only” file.

Controlled copy distributed to Kelly Carson at Brice Environmental.

4.3 It is the responsibility of all personnel to follow this SOP as written, document and gain QA or Technical Director approval for deviations to the SOP, and submit needed SOP revisions to the QA Office.

4.4 This SOP is scheduled for review on an annual basis. Any addendum will be incorporated into the SOP and a new revision of the SOP will be distributed by QA. The superseded version will be returned to the QA Office. If there are no addenda to incorporate or updates to make, the SOP is reviewed and given a new revision number. The cover page is signed and dated by the Technical Director and QA then distributed.

4.5 A PDF version of each SOP (generated in Adobe or scanned) is digitally signed by a member of the QA Office as a security measure. The digitally signed PDF, used online, is considered to be a controlled copy of the SOP and is stored on the network.

\\usfs700\ank_groupdata\Public\DOCUMENT\SOP\~Approved_SOPs~

All staff have "read" access to these SOPs. Only QAQC has access to "write" on SOPs. Staff is directed to use the controlled electronic versions of SOPs. A limited number of controlled hardcopies are to be distributed by the QA Office.

5.0. INTERFERENCES:

5.1. Contamination due to sample carry-over can occur whenever high-level and low-level sample extracts are sequentially analyzed. Biogenic sample extracts or heavy oil sample extracts may also result in sample carry-over. To reduce carryover, the sample syringe is rinsed between sample runs with solvent (methylene chloride). When an extract is suspected to have a high concentration (or other suspect matrices), solvent blanks are subsequently analyzed to check for cross contamination (or carry-over). See SOP #500 for further guidance on determining carry over.

5.2. Other organic compounds including, but not limited to, animal and vegetable oil, grease, chlorinated hydrocarbons, phenols, phthalate esters and biogenic terpenes are measurable under the conditions of this method. Heavier petroleum products such as lubricating oil and crude oils also produce a response within the retention time range for DRO. As defined by this method, the DRO/RRO results may include these compounds.

6.0. SAMPLE HANDLING:

6.1. **Sample Matrix** – Methylene chloride extractions of waters, soils and oils.

6.2. **Sample Collection and Preparation** – See individual extraction SOPs for sample handling and preparation criteria. Continuous Liquid-Liquid Extraction: SW 3520C, SOP #759; Sonication Extraction on Solids by SW 3550C, SOP #761; and Waste Dilution on Oils by SW 3580A, SOP #762.

6.3. **Sample Size** – Final extraction volume is determined by the sample preparation methods.

6.4. **Sample Container** – Sample extracts are stored in sealed, clear autosampler vials until analysis or disposal.

6.5. **Sample Preservation** – Extracts are stored ≤ -10˚C.

6.6. **Holding Times** – Extracts must be analyzed within 40 days of sample preparation. Sample extracts outside of the hold time are disposed of as chlorinated waste.

Controlled copy distributed to Kelly Carson at Brice Environmental.

6.7. **Criteria for Acceptance/Rejection of Samples** – If any discrepancies are found between a sample and the extraction bench sheet then the batch should not be analyzed until the issue is resolved.

7.0. APPARATUS:

7.1 Gas Chromatograph: HP 7890, HP 6890 Plus, 7683 Agilent autosampler and tray, 7683 Agilent injection towers, or equivalents, and a Flame Ionization Detector.

7.2 A data system capable of determining peak areas by baseline-baseline integration and forced baseline integration, and of storing chromatographic data. HP Chemstation or equivalent.

7.3 Other Equipment: Assorted Class A volumetric glassware, 5 – 1000 µL gas-tight syringes, 11 mm aluminum crimp caps, 2 mL wide top crimp vials, crimper, de-capper, fused silica wool, glass inlet liners, ¼ inch thermo 'o' ring seals or equivalents.

7.4 Performance Criteria: GC run conditions and columns must be chosen to meet the following criteria:

7.4.1. The methylene chloride solvent front must be resolved from C10.

7.4.2. Resolution between C24 and C25 and C28 and C29 must be achieved.

7.4.3. Column compensation is considered an acceptable practice by the State of Alaska, but is not currently employed at this laboratory.

8.0. REAGENTS:

8.1 **Solvents**: Methylene chloride, carbon disulfide. ACS reagent grade solvents must be used in all tests unless otherwise indicated. The date opened, date of expiration, and date received must be written on the bottle.

8.2 **Stock Standards**: Stock standards are prepared by diluting neat products by mass or certified standards by volume. Transfer the stock standard solution to a vial with a Teflon-lined screw cap and store at ≤ -10˚C. Stock standard solutions should be checked frequently for signs of degradation or evaporation, especially prior to preparing calibration standards. Stock standards are replaced after one year or when the neat standard expires, whichever is sooner, or if comparison with check standards indicates a problem. (See Standards Labeling and Traceability SOP #112 for standards documentation.)

8.3 **Working Solutions**: Working solutions are prepared by diluting neat products, certified standards, or stock standards. Working solutions are replaced after one year or when the neat standard expires, whichever is sooner, or if comparison with check standards indicates a problem.

8.4 **Standard Descriptions**:

8.4.1 **Normal Alkane Standards (NAS)**

8.4.1.1 Normal Alkane Standard Solution (NAS) Stocks: Use Ultra Scientific (UST-210 or equivalent) n-C10 through n-C25 DRO mixture in methylene chloride (at 1000 µg/mL per alkane) for diesel range alkanes. Use Ultra custom alkane mixture (CUS-3999) in methylene chloride/carbon disulfide (9:1) for residual range alkanes (at 1000 µg/mL per alkane) n-C26, n-C28, n-C30, n-C32, n-C34, and n-C36.

Controlled copy distributed to Kelly Carson at Brice Environmental.

8.4.1.2 Working NAS Solution: Combine 1mL of each stock with 2 mL of methylene chloride.

8.4.2 **DRO Standards**

8.4.2.1 DRO Neat Stock Standard**:** Use diesel fuel #2 (summer diesel) from a local gas station. Diesel must be collected annually while summer diesel is available for the season.

8.4.2.2 DRO Stock Standard: Dilute 10 g of DRO Neat Stock to a final volume of 500 mL with methylene chloride. The final concentration is 20,000 µg/mL.

8.4.2.3 **DRO Continuing Calibration Verification Standard (CCVB) /** 8015 Matrix Spike Solution: Dilute 50 mL DRO Stock Standard to 200 mL with methylene chloride. The final concentration is 5,000 µg/mL.

8.4.2.4 Initial Calibration Verification Standard for DRO (ICVB)**:** Use Ultra part # RGO-616 diesel fuel #2 at 50,000 µg/mL (or equivalent). Dilute 1 mL of diesel fuel #2 with methylene chloride to a final volume of 10 mL. The final concentration is 5,000 µg/mL.

8.4.3 **RRO Standards**

8.4.3.1 RRO Neat Stock Standard: Use a commercial brand of SAE 30 motor oil and SAE 40 motor oil. These lube oils are given a shelf life of 10 years.

8.4.3.2 RRO Stock Blend**:** Create an equal blend (1:1) by weight of the RRO Neat Stocks. For example: combine 5.0 g of each RRO Neat Stock.

8.4.3.3 RRO Stock Standard: Dilute 10.0 g of the RRO Blend to 500 mL with methylene chloride. The final concentration is 20,000 µg/mL. Alternatively, weigh the RRO Neat Stocks directly for dilution. For example: weigh 5.0 g of each RRO Neat Stock and dilute to 500 mL with methylene chloride.

Note: Let the RRO Neat Stock oils sit overnight to thaw prior to use.

8.4.3.4 **RRO Continuing Calibration Verification Standard (CCVR):** Dilute 50 mL of RRO Stock Standard (20,000 µg/mL) to 200 mL with methylene chloride. The final concentration is 5,000 µg/mL.

8.4.3.5 Initial Calibration Verification RRO Neat Stock (ICVR Neat Stock): Use a secondary commercial brand of SAE 30 motor oil and SAE 40 motor oil. These lube oils are given a shelf life of 10 years.

8.4.3.6 ICVR Blend Standard: Create an equal blend (1:1) by weight of the ICVR Neat Stocks. For example: combine 0.5 g of each ICVR Neat Stock.

8.4.3.7 ICVR: Dilute 0.5 g of the ICVR Blend to 100 mL with methylene chloride. The final concentration is 5,000 µg/mL. Alternatively, weigh the ICVR Neat Stocks directly for dilution. For example: weight 0.5 g of each ICVR Neat Stock and dilute to 200 mL with methylene chloride.

Controlled copy distributed to Kelly Carson at Brice Environmental.

Note: Let the ICVR Neat Stock oils sit overnight to thaw prior to use.

8.4.4 Calibration Standards for DRO and RRO**:** The Calibration standards are diluted from DRO and RRO Stock Standards (See Table 2).

8.4.5 **DRO/RRO Matrix Spike:** This standard is used in the extraction process to spike the LCS, LCSD, MS and MSD. Use the DRO and RRO Stock Standards at 20,000 µg/mL (see Sections 8.4.2.2 and 8.4.3.3) to make a working solution by combining the Stock Standards and diluting with methylene chloride. For example: combine 250 mL of each DRO and RRO Stock Standard and dilute to 1000 mL. The final concentration is 5,000 µg/mL for DRO and RRO.

8.4.6 **Surrogate Standards**

8.4.6.1 Surrogate Standard Stock Solution**:** Use Sigma Chemical Company or equivalent certified product. Dissolve 0.100 g of 5α-androstane and 0.100 g of triacontane-d_{62} (DTC) into 5 mL of carbon disulfide and sonicate in a warm water bath. Dilute this solution with methylene chloride to a final volume of 100 mL. Let this solution sit over night. The concentration is 1000 µg/mL. This standard is further diluted for use as Surrogate Calibration Stock or Surrogate Working Solution.

8.4.6.2 Surrogate Working Solution (100 µg/mL): Dilute the 100 mL of the Surrogate Stock Solution to 1000 mL with methylene chloride. Final concentration is 100 µg/mL for each surrogate. This standard is used as the Instrument Blank (IB) and in the extraction process for most samples.

Note: During the summer season it is recommended to double this solution preparation.

8.4.6.3 Surrogate Calibration Stock / Silica Gel (SG) Surrogate Working Solution (200 µg/mL): Dilute the 100 mL of the Surrogate Stock Solution to 500 mL with methylene chloride. The final concentration is 200 µg/mL. This standard is used to prepare the surrogate calibration curve (See Table 2) and in the extraction process for surrogate spiking solution for silica gel cleanup samples.

8.5 **Reagent Storage and Shelf Life**

8.5.1 All stock, working, and calibration solutions are stored ≤ -10˚C, or at the manufacturer's recommended storage conditions, when not in use. All standards must be stored with minimal headspace and protected from light.

8.5.1.1 Working standards and stock standards will be discarded if they are older than one year, if signs of degradation/concentration are noticed, or when the parent standard expires.

8.5.1.2 Certified products will expire according to the manufacturer's expiration date.

8.5.1.3 Solid standards are given an expiration of one year from the date they are opened, or sooner if signs of degradation are noticed.

8.5.1.4 Carbon disulfide is given an expiration of five years from opening.

8.6. **Standard Verification**

Controlled copy distributed to Kelly Carson at Brice Environmental.

Standard verification shall be within ± 10% of instrument response of the previously made/verified solution (the solution you are retiring) **AND** shall not be outside of ± 25% of the true value of the curve (the recovery shall not be below 75% or above 125%). The ± 10% criterion may be waived if no prep batches are waiting to be analyzed and the ± 25% of the true value requirement is still met. Record the data files used to determine the acceptance criteria in the secondary standard log, as well as the percent recovery.

9.0. EXTRACTION:

See individual extraction SOPs criteria. Continuous Liquid-Liquid Extraction: SW 3520C, SOP #759; Sonication Extraction on Solids by SW 3550C, SOP #761; Waste Dilution on Oils by SW 3580A, SOP #762.

10.0. CALIBRATION:

10.1. **Establish gas chromatographic operating parameters:** See maintenance log book for individual instrument(s).

10.2. **Calibration Standards:** Prepare calibration standards as indicated in Table 2. The low calibration point must be at or below the Limit of Quantitation (LOQ). Refer to the Analytical Chemistry Quality SOP #500 for additional specifications regarding the allowable number of calibration points.

10.3. The sequence for the calibration will start with an IB and NAS followed by the calibration curves and finally the ICVs.

10.4. **Setting Retention Time Group/Windows**

10.4.1. **For Method AK102/103:** The DRO range begins at the peak start of C10. The RRO range ends with the peak end of C36. The end of DRO range and corresponding beginning of the RRO range lies at the peak start of C25.

10.4.2. **For Method 8015C:** The DRO range begins at the peak start of C10. The RRO range ends with the peak end of C36. The end of DRO range and corresponding beginning of the RRO range lies at the peak start of C28.

10.4.3. **For surrogates**: Set the retention time of the surrogates using the instrument blank or the mid-point of the surrogate calibration curve.

10.5. **Calibration Acceptance Criteria**: (*Note*: Linear Regression is the preferred curve fit for DRO and RRO.)

10.5.1. **For Method AK102/103**:

10.5.1.1. The percent relative standard deviation (%RSD) of the response factors must be less than or equal to 25% to assume linearity through the origin so an average response factor can be used for quantitation.

10.5.1.2. If a linear regression or quadratic fit are used for quantitation, the curve fit must be $r^2 \geq 0.99$. If a quadratic fit is used for quantitation, the curve must have six calibration points.

10.5.1.3. Initial verification of calibration is accomplished by running the ICV (see Section 8.4.2.4 and 8.4.3.7). Acceptance criteria range is defined as 75% - 125% recovery.

10.5.2. **For Method 8015C**:

10.5.2.1. If the percent relative standard deviation (%RSD) of the calibration factors is less than 20% over the working range, then linearity through the origin can be assumed, and the average calibration factor can be used in place of a calibration curve.

10.5.2.2. If a linear regression or quadratic fit are used for quantitation, the curve fit must be $r^2 \geq 0.99$. If a quadratic fit is used for quantitation, the curve must have six calibration points.

10.5.2.3. Initial verification of calibration is accomplished by running the ICV (see Section 8.4.2.4 and 8.4.3.7). Acceptance criteria range is defined as 80% - 120% recovery.

11.0. ANALYSIS:

11.1. **Run a minimum of two blanks** (rinses) to ensure no artifacts are present.

11.2. **Inject the Instrument Blank (IB).** See Section 12.2 and Table 1 for acceptance criteria. The Instrument Blank is a solvent blank that has been spiked with surrogate. At a minimum, the IB is run at the beginning of every analytical sequence.

11.3. **Inject NAS.** If the NAS is not within the previously set range, check to make sure parameters (both instrument and data processing) are correct. If the operating parameters are correct and the alkanes are not within the set windows, save a new method and reset the retention time windows for the current processing method. Name the subsequent methods alphabetically: A, B, C, etc. Document on the runlog (F0050) "Updated RT's". The retention times (RT's) of the surrogates should also be updated at this time.

11.3.1. For Method AK102/103: Verify each day (*or every 24 hours of analysis*) that the retention times for *C10, C25, and C36* are within the integration windows set during calibration.

11.3.2. For Method 8015C: Verify each day (*or every 12 hours of analysis*) that the retention times for *C10, C28, and C36* are within the integration windows set during calibration.

11.4. **Inject CCVB and CCVR.**

11.4.1. **For Method AK102/103**: The CCVB and CCVR must be subsequently analyzed *after every 20 field samples* and at the end of the analytical run. The final CCVB and CCVR must be analyzed *within 24 hours* of the NAS analysis.

11.4.2. **For Method 8015C:** The CCVB and CCVR must be subsequently analyzed *after every 10 field samples* and at the end of the analytical run. The final CCVB and CCVR must be analyzed *within 12 hours* of the NAS analysis.

11.5. **All methods for DOD samples:** In the event of a recovery failure for analytes of interest in continuing or closing CCV samples, the Analyst may immediately (within 1 hr of the failing CCV and before any other samples have acquired) rerun 2 successive CCVs. If both meet QC criteria for all analytes of interest, then the samples already analyzed may be reported and the run sequence may be continued. Samples following the two passing CCVs are also valid. **All CCVs must be reported in LIMS.** Refer to SOP#101 for nomenclature (e.g., CCCV, CVC, CVCA, etc.)

Controlled copy distributed to Kelly Carson at Brice Environmental.

11.5.1. **All methods for non-DOD samples:** the analysis may be repeated once, if QC criteria is still not met, the instrument should be recalibrated and samples reanalyzed.

11.6. **Extraction Sheet Review:** At the time of creating a sequence, the analyst is responsible for checking the extraction bench sheet against the samples presented. Extraction batch comments should be reviewed at this point also, as well as final volumes of the extracts. If a discrepancy is found between a sample and the extraction bench sheet, then the batch should not analyzed until the issue is resolved.

11.7. **Analysis Sequence:** Extracts and instrument QC are placed into autosampler vials, sealed and loaded into the sample trays. IB, NAS and CCVs precede sample extract injections. Recommended sequence order for sample extracts is as follows: Method Blank (MB), Laboratory Control Sample (LCS), Laboratory Control Sample Duplicate (LCSD), and for MS/MSDs, if needed: Parent Sample (PS), Matrix Spiked Sample (MS), and Duplicate Matrix Spiked Sample (MSD).

11.8. Silica Gel Split batches: Biogenic compounds may contribute to the residual range and may be present at higher than regulatory cleanup levels, depending on soil matrix. Biogenic compounds may be polar or semi-polar in nature. Silica gel cleanup preferentially removes polar and semi-polar compounds. When queuing silica gel cleanup samples in a run sequence it is preferred to label the silica cleaned-up samples with 'SG' to prevent confusion with the non-silica cleanup portion.

11.9. **Dilutions:** The analyst dilutes the extracts and determines extract injection order based on the extract color and sample descriptions. It is recommended to periodically inject an instrument blank or rinse to check for carry-over. The following guidelines are intended as suggestions only.

11.9.1. For samples that appear to be biogenic (chunky or applesauce-like appearance), have a greenish tinge, or that the extraction sheet indicates were high in some type of organic content, start with a 4X and run extra rinses subsequent to each sample. Biogenic compounds are very prone to carryover in the RRO range.

11.9.2. For samples that appear dark chocolate color or a dark amber color, start with a 4X dilution and label them 'Dark'. Run at least one rinse after these samples if the dilution is still dark.

11.9.3. For samples that are dark and appear to stick to the inside of the glass vial, start with a 10X dilution. Run at least one rinse after these samples.

11.9.4. For oils, a screening run is necessary to establish the correct dilution as well as to establish column tolerance of the sample. Especially if the extract is colored, start with a 50X and several subsequent rinses to establish what the final dilution will be, taking into account any carryover present in the rinses. Consultation with the Project Manager may be necessary to establish the LOQ needed.

11.9.5. For samples that have been identified on the prep sheet as having a fuel odor, start with a 4X dilution. If they are identified as having a 'strong fuel odor' start with a 10X dilution.

11.9.6. Any other suspect samples, such as brightly colored extracts suspected of being glycols, transformer fluids, etc., should be run at a screening dilution with rinses to establish the final dilution.

11.9.7. For soil samples, if the shaken vial produces a lot of bubbles or a foam-like appearance, the sample may be high in DROs. Start with a 4X dilution for these samples.

Controlled copy distributed to Kelly Carson at Brice Environmental.

11.10. **Narrating Dilutions:** The analyst is required to label the sample with its dilution in the analytical sequence and on the vial containing the diluted extract (x4, etc.). The dilution will also be narrated in the description section of the run log.

11.11. **Maintenance of Sequence Order:** The analyst is to insure that all sample extract vials are placed in the autosampler tray in the order reflected in the instrument sequence. After the samples are run and are removed from instrument, they are placed on trays in the same order as they were on the autosampler. The trays are then labeled with the instrument name and run date. Autosampler vials are recapped and retained for 40 days. Dispose of extracts over 40 days old as chlorinated waste.

11.12. **Data Analysis:**

11.12.1. **AK102/103**: All peaks that fall within the C10 to the start of C25 group (excluding the 5α-androstane surrogate) are identified as diesel range organics. All peaks that fall within the start of C25 through C36 group (excluding the DTC surrogate) are identified as residual range organics.

11.12.2. **8015C**: All peaks that fall within the C10 to the start of C28 group (excluding the 5α Androstane surrogate) are identified as diesel range organics. All peaks that fall within the start of C28 through C36 group (excluding the DTC surrogate) are identified as residual range organics.

11.13. **Reportable Results** are those between the limit of quantitation (LOQ) and that which corresponds to the highest calibration standard used. Sample results less than the LOQ are reported as not detected (ND) unless otherwise requested by a client. (Refer to SOP #136 for additional information.) Samples with concentrations above the highest calibration standard are diluted to a level estimated to be near the mid-point of the calibration curve and reanalyzed. Alternately, if a sample is <LOQ when analyzed at a dilution, then the sample must be reanalyzed at a lesser or no dilution. The maximum recommended dilution for non-detect DRO soil samples is ≤ 4X. The maximum recommended dilution for non-detect RRO soil samples is ≤ 100X. Exceptions may be made for the sake of the instrument, but the Project Manager should be notified and the data must be reported with a sample comment regarding the reason for the elevated LOQ.

11.14. **Data Reduction or Processing**: Processing of standards and extracts should be reviewed sequentially, i.e., alkane standard, CCVs, QC, extracts, LCSs, MSs, extracts, etc. (especially to evaluate for any problems, mechanical or otherwise, or biasing from sample carry-over). **For acceptance criteria see Table 1.**

11.14.1. Valley-to-valley integration will be performed on the surrogate of any field sample or QC sample where the software does not set an appropriate integration. For further guidance on Manual Integration, see SOP #144. It is preferred to report surrogates at the same dilution as their associated analyte. For example, if DRO is being reported at a 1x and RRO is reported at a 10x, 5α-androstane will be reported at the 1x and DTC will be reported at the 10x.

11.14.2. **QC Failures:** If any QC (IB, CCV, MB, LCS/D, Sample Surrogates) does not meet requirements re-inject once to confirm sample carryover or mis-injection has not occurred. If the reanalysis confirms the failure, take appropriate corrective actions. Document appropriately in the run log. It is recommended to also record the critical percent recovery values for all extraction QC in the run log. Any sample not bracketed by passing CCVs must be reanalyzed.

Note: Surrogate recovery may be biased high or low due to matrix interference. If it is biased high due to matrix, the sample does not need to be re-run.

Controlled copy distributed to Kelly Carson at Brice Environmental.

11.14.3. **LCS, LCSD, MS and MSD Relative Percent Difference (RPD):** If recovery of a standard and/or RPD does not meet requirements and the run has completed, rerun the pair of extracts together for the purpose of the RPD calculation in LIMS.

11.15. If the chromatogram indicates carry-over from the previous injection, document the carryover in the analytical run log, and rerun the sample extract when the baseline indicates the system is free of analyte or other contaminants.

11.16. When fuel ID is requested, please see SOP 500 for the identification and reporting process.

Retention Time Window Width Studies:

11.17.1. Retention time window width studies are to be performed yearly or whenever instrument conditions, such as flow and temperature programs, are changed. Refer to SOP #500 for further guidance on reporting and submission of retention time window width studies.

11.17.2. **Determining Retention Time Windows Widths:**

11.17.2.1. **For Method AK102/103:** Be certain the GC system is within optimum operating conditions. Make three injections of the normal alkane working standard (NAS) and the IB throughout the course of a 72 hour period. Calculate the standard deviation of the three absolute retention times for C10, C25, and C36, 5-α, and DTC. The retention time window width for the individual peaks is defined as the average RT plus or minus 3 times the standard deviation of the absolute retention time for each component. To calculate these values, Form CF-008 is used. In those cases where 3 times the standard deviation is less than 0.05 minutes, the laboratory should use ± 0.05 minutes as the retention time window width. Retention Time Window Width Studies are completed yearly as a minimum.

11.17.2.2. **For Method 8015C:** Be certain the GC system is within optimum operating conditions. Make three injections of the normal alkane working standard (NAS) and the IB throughout the course of a 72 hour period. Calculate the standard deviation of the three absolute retention times for C10, C28, and C36, 5-α, and DTC. The retention time window width for the individual peaks is defined as the average RT plus or minus 3 times the standard deviation of the absolute retention time for each component. To calculate these values, Form CF-008 is used. In those cases where 3 times the standard deviation is less than 0.03 minutes, the laboratory should use ± 0.03 minutes as the retention time window width.

12.0. QUALITY CONTROL:

For quality control criteria, see also the Quality Control Criteria and Corrective Action Summary (Table 1).

12.1. The experience of the analyst performing gas chromatography is invaluable to the success of the methods. Each day that analysis is performed, the response from the calibration check standards should be evaluated to determine if the chromatographic system is operating properly. Questions that should be asked are: Do the peaks look normal? Is the response obtained comparable to the response from previous runs?

12.2. The extraction procedure and analytical system must be free of contamination. The instrument blank (IB) and method blank (MB) must have DRO and/or RRO values less than the LOQ. For DOD projects, the MB must have analyte concentrations below ½ LOQ.

Controlled copy distributed to Kelly Carson at Brice Environmental.

12.2.1. If the IB or MB concentration is above the LOQ, but the sample extracts are either non-detect or the concentration of the contamination is not significant (i.e. sample concentration is >10x the contamination in the blank value), the samples may be qualified on reporting and flagged in the QC report.

12.2.2. If the IB or MB concentration is above LOQ and the concentration of the contamination is significant (i.e. sample concentration is <10x the blank value), re-extraction will most likely be necessary. If hold time has been exceeded contact the Project Manager and Production Manager to determine whether to re-extract beyond the hold time or report the original data with a B-flag.

12.3. Surrogates (5α-androstane and DTC) are used to monitor the performance of the extraction, the instrumental system, and the effectiveness of the method in dealing with each matrix. The surrogates in the instrument blank (IB) verify instrument response to the surrogates; surrogates in the field samples and QC samples verify the performance of the extraction.

12.4. LCS/LCSD: The LCS/LCSD set are used to verify the extraction efficiency of the method. Known concentrations of the diesel #2 and oil blend RRO are added to a blank matrix. The relative percent difference (RPD) must be ≤ 20%. If the RPD is outside this criterion, reanalyze the set once.

12.4.1. **For Method AK102/103**: An LCS/LCSD set are performed with every extraction batch of up to 20 field samples.

12.4.2. **For Method 8015C**: One LCS is required with every extraction batch of up to 20 field samples. If sample is unavailable for MS/MSD extraction, an LCSD may be prepared in lieu of the MS/MSD pair.

12.5. MS/MSD: A known concentration of diesel #2 and oil blend RRO are added to two aliquots of a field sample in the extraction batch. The relative percent difference (RPD) must be ≤ 30% for waters and ≤ 50% for soils. If the RPD is outside this criterion, reanalyze the set once. If the RPD is still outside criterion, flag the MS/MSD as non-homogenous. These limits are for guidance in data interpretation only.

12.5.1. **For Method AK102/103**: An MS/MSD set are extracted at the client's request.

12.5.2. **For Method 8015C**: An MS/MSD pair is required for 8015C; in the event of insufficient sample, an LCSD may also be prepared in lieu of the MS/MSD pair.

12.6. The Continuing Calibration Verification Standards (CCVB and CCVR) are used to monitor the performance of the instrument and the validity of the respective calibrations. These check standards are run on a daily, as well as an intermittent basis (see 11.4), to confirm the accuracy of the calibrations and the performance of the analytical system.

12.7. Initial Demonstration of Capability: Consists of four passing LCSs and is performed once by a new analyst and thereafter updated yearly. Limits are the same as LCS limits.

12.8. Any corrective action(s) needed to address a QC outlier or other technical challenges that are not listed in this SOP require the prior approval of the QA Office or Technical Department.

12.9. Data Archiving should be done according to SOP 142.

13.0. CALCULATIONS, REVIEW AND REPORTING:

13.1. **Accuracy:** % Recovery of True Value

$$\%R = \frac{(SSR-SR)}{SA} \times 100$$

Where: %R = Percent Recovery
SSR = the analytically determined spiked sample concentration (µg/mL)
SR = the analytically determined sample concentration (µg/mL)
SA = the true concentration of the spike (µg/mL)

(Where SSR or SR equals the solution concentration of the analyte times the corresponding dilution factor)

13.2. **Calibration Factor or Response Factor:**

$$CF \text{ or } RF = \frac{\text{Total Area of All Peaks in Integration Window}}{\text{Theoretical Concentration (µg/mL)}}$$

13.3. **Precision:** Relative Percent Difference (RPD)

$$RPD = \frac{|D1 - D2|}{(D1 + D2) \div 2} \times 100$$

Where: D1 = Sample value (µg/mL)
D2 = Sample duplicate value (µg/mL)

13.4. **Dry Weight (Mass):**

DW = (% Solids/100) * (Wet Weight or Mass)

13.5. **Dilution Factor:**

Solid DF = Final Extract Volume ÷ Dry Weight or Mass of Sample Used
Liquid DF = Final Extract Volume ÷ Volume of Sample Used

Where volume is in milliliters and mass is in grams.

13.6. **Hand Calculation of Solution Concentration from Area Counts:**

Area ÷ RF (response factor) = Solution Concentration (µg/mL)

14.0. HEALTH AND SAFETY:

14.1. Samples shall be returned to the approved storage location until such time as it is determined that no further analysis will be required.

14.2. Once it has been established that no more analysis of a sample will be required, acid and alkaline preserved samples may be neutralized using the Elementary Neutralization Hood located in GC Prep, unless it is considered to be hazardous (i.e. mercury waste, cyanide waste). Refer to the current version of SOP #108 for further instruction.

Controlled copy distributed to Kelly Carson at Brice Environmental.

14.3. All surplus acids shall be neutralized on a daily basis using the Elementary Neutralization Hood located in GC Prep.

14.4. Small volumes of surplus volatile reagents may be allowed to evaporate in a hood at the end of the analytical session.

14.5. Proper Personal Protective Equipment (PPE) must be worn at all times. Proper PPE when handling samples include a lab coat, gloves and safety glasses. In addition, when handling concentrated acid or base preservative a face shield and apron must be worn.

15.0. POLLUTION PREVENTION:

15.1. SGS is committed to evaluate all areas of the lab with regard to current and potential pollution prevention. Pollution prevention is described as any technique that reduces or eliminates waste at the point of generation. Further discussion on pollution prevention programs in the laboratory can be found in *SGS Pollution Prevention Plan* (Form F053).

15.2. Pollution prevention techniques utilized in this method are the consolidation of all sample extracts, standards and waste material as chlorinated waste, which is disposed of by trained personnel in accordance with SOP 108.

16.0. METHOD PERFORMANCE:

There are no method performance measures to report at this time.

17.0. DETECTION LIMIT (DL) STUDY:

17.1. Detection Limit (DL) studies are performed when a new instrument is purchased, a new method is developed, or if there are significant modifications to the instrument. The DL is intended to demonstrate the capability of this method as it is implemented at SGS. An update to the DL does not necessitate an update to this document. Further guidance on performing a DL study can be found in SOP #116 or SOP #500.

17.2. Suggested DL spiking levels: See section 19.2 and refer to the suggested LOQ spiking levels for guidance on DL spiking levels.

18.0. LIMIT OF DETECTION (LOD):

The LOD is defined per SOP #116; LOD verification shall be performed according to the schedule set by the QA Office.

19.0. LIMIT OF QUANTTITATION (LOQ):

The LOQ is defined per SOP #116; LOQ verification shall be performed quarterly according to the schedule set by the QA Office. An update to LOQ does not necessitate an update to this document.

19.1. For the 8015 quarterly LOQ check samples, 2 extracts must be used. DRO is reported off an extract spiked with the 8015 matrix spike. RRO is reported off an extract spiked with the regular AK102/103 matrix spike. As such, the RRO portion can be posted from the AK102/103 soil extract and the AK102/103 high volume water extract.

Controlled copy distributed to Kelly Carson at Brice Environmental.

19.2. Suggested LOQ spiking levels:

- DRO/RRO High Volume Waters: 100 µL of 5000 µg/mL DRO/RRO spike [0.5 mg/L]
- DRO/RRO Soils: 120 µL of 5000 µg/mL DRO/RRO spike [20 mg/kg]
- DRO/RRO Low Volume Waters: 25 µL of 5000 µg/mL DRO/RRO spike [0.5 mg/L]

- RRO 8015 Waters: 100 µL of 5000 µg/mL DRO/RRO spike [0.5 mg/L]
- DRO 8015 Waters: 100 µL of 5000 µg/mL DRO by 8015 spike [0.5 mg/L]
- RRO 8015 Soils: 120 µL of 5000 µg/mL DRO/RRO spike [20 mg/kg]
- DRO 8015 Soils: 120 µL of 5000 µg/mL DRO by 8015 spike [20 mg/kg]

- DRO/RRO Silica Gel High Volume Waters: 200 µL of 5000 µg/mL DRO/RRO spike [0.5 mg/L]
- DRO/RRO Silica Gel Soils: 240 µL of 5000 µg/mL DRO/RRO spike [20 mg/kg]
- DRO/RRO Silica Gel Low Volume Waters: 50 µL of 5000 µg/mL DRO/RRO spike [0.5 mg/L]

20.0. MAINTENANCE:

20.1. For instrument maintenance and troubleshooting, see the instrument manual. For computer, hardware, or software, refer to IT.

21.0. REFERENCES:

ADEC Method AK102, Nov 7, 2002 Version 4/8/02
ADEC Method AK103, Nov 7, 2002 Version 4/8/02
USEPA "SW-846 Test Methods for Evaluating Solid Waste"; Method 8000 & 8000A
ADEC Underground Storage Tank Procedures Manual, Nov 7, 2002
8015C Revision 3, Feb. 2007

22.0. ATTACHMENTS:

Table 1: Quality Control Criteria and Corrective Action Summary
Table 2: Calibration Dilution Summary

Controlled copy distributed to Kelly Carson at Brice Environmental.

Table 1:
Quality Control Criteria and Corrective Action Summary

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Reporting Criteria
Initial Calibration for all analytes	Periodic, prior to sample analysis.	**AK102/103**: %RSD ≤ 25% or $r^2 \geq 0.99$ **8015C**: %RSD ≤ 20% or $r^2 \geq 0.99$	1. Correct source of problem. 2. Recalibrate.	Do not proceed with sample analysis without a passing calibration.
Second Source Initial Calibration Verification (ICV)	Once following initial calibration.	**AK102/103**: All analytes within ± 25% **8015C**: All analytes within ± 20%	1. Correct source of problem. 2. Repeat analysis once. 3. Recalibrate if needed.	Do not proceed with sample analysis without a passing ICV.
Instrument Blank (IB)	Once at the beginning of the day's run.	All analytes below the instrument LOQ **AK102/103**: Surrogates ± 25% **8015C**: Surrogates ± 20%	1. Correct source of problem. 2. Repeat analysis once. 3. Evaluate data 4. Recalibrate if needed.	1. If associated samples >10x IB, or non-detect, post and apply appropriate comment. 2. If associated samples <10x IB, re-analyze with passing IB. 3. If IB has a surrogate(s) that is biased low, and MB surrogates are within criteria, post with comment.
Normal Alkane Standard (NAS)	At the start of a run. **AK102/103:** a minimum of every 24 hours. **8015C:** a minimum of every 12 hours.	Range bars set correctly. Peaks all present. No significant tailing.	1. If ranges have shifted, update method. 2. Significant tailing: perform instrument maintenance.	Do not proceed until method update/instrument maintenance is complete.
Calibration Verification (CCV)	At the start and end of the run. **AK102/103:** after every 20 field samples. **8015C**: after every 10 field samples.	**AK102/103**: DRO/RRO ± 25% recovery **8015C**: DRO/RRO ± 20% recovery	**For non-DOD samples:** 1. Repeat analysis once. 2. If QC criteria not met, then recalibrate and reanalyze. **For DOD samples:** 1. Immediately (within 1 hr and before any other samples have acquired) run two successive CCVs. If both meet QC criteria, then samples already analyzed may be reported and the run may continue.	CCV with high bias: Report ND samples with appropriate comment.
Method Blank (MB)	One MB per extraction batch of 20 field samples.	All analytes below LOQ **For DOD**: < ½ LOQ	If greater than the LOQ, evaluate the data/prep. 1. If problem is instrumental, correct problem and reanalyze QC and samples. 2. If problem is prep, re-extract affected samples.	1. If associated samples >10x MB or ND, post and apply appropriate comment. 2. If associated samples <10x MB, re-extract. *RP of silica gels require original AND silica cleanup be re-extracted.

Controlled copy distributed to Kelly Carson at Brice Environmental.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Reporting Criteria
Laboratory Control Sample (LCS / LCSD)	**AK102/103:** One LCS/LCSD pair per extraction batch of 20 field samples. **8015C:** One LCS per extraction batch of 20 field samples or one LCS/LCSD pair in lieu of an MS/MSD.	Recoveries: **AK102/103 & 8015C:** 75 - 125% for DRO 60 - 120% for RRO RPD ≤ 20 **Silica Gel Cleanups:** 70-125% for DRO/RRO RPD ≤ 20	1. Evaluate the data/prep info. 2. Correct source of problem. 3. Repeat analysis once of both LCS and LCSD.	1. Failing RPD or high recovery: report ND samples 2. Low recovery: Re-extract samples. If re-extraction was performed outside of hold time, report originals and comment on confirmation. *RP of silica gels require original AND silica cleanup be re-extracted.
MS/MSD or BMS/BMSD	**AK102/103:** One set per extraction batch at client request. **8015C:** One set required per extraction batch or an LCSD may be used if sample volume is not sufficient	Recoveries: 75 - 125% DRO (water) 60 - 140% RRO (water) 60 - 140% DRO (soil) 60 - 140% RRO (soil) RPD: ≤ 30% (water) ≤ 50% (soil)	None. *NOTE: MS/MSD Limits are for guidance in data interpretation only.*	Apply appropriate comment in LIMS.
Surrogate Spike: Extraction QC Samples	Every Extraction QC Sample	Recoveries: 60 - 120% 70 - 125% for Silica Gel	1. Evaluate the data/prep info. 2. Correct source of problem. 3. Repeat analysis once. 4. Refer to Reporting Criteria or Consult QA. Re-extract and rerun entire batch if needed.	1. If biased high and sample surrogates pass: Post and apply comment in LIMS to QC sample as well as all affected paying samples. 2. If batch QC surrogates are biased low: re-extract associated samples. 3. If sample was re-extracted outside of hold time, report original data and comment on confirmation. *RP of silica gels require original AND silica cleanup be re-extracted.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Reporting Criteria
Surrogate Spike: Field Samples	Every field sample	Recoveries: 50 - 150%	1. Evaluate the data/prep info. 2. Correct source of problem. 3. Repeat analysis once. 4. If problem is instrumental, correct source of problem and reanalyze sample. 5. Refer to Reporting Criteria for further information. Re-extract and rerun sample if needed.	1. If surrogate recovery is biased high and sample is ND, apply appropriate comment. 2. If surrogate is biased high due to matrix, report and apply appropriate comment. 3. If surrogate is biased low due to dilution, report and apply appropriate comment. 4. If the above criteria are not met, re-extract and rerun the sample. 5. If sample was re-extracted outside of hold time, report original data and comment on confirmation. *RP of silica gels require original AND silica cleanup be re-extracted.

SGS	SGS North America, Inc. - Alaska Division Standard Operating Procedure
NOTE: This document contains CONFIDENTIAL business information and is not intended for distribution.	
S.O.P. Title: Diesel Range Organics/ Residual Range Organics (DRO/RRO)	**Revision Date**: January 2018
Method No: AK102 & AK103 & 8015C	**SOP No**: 712r16
Page: 21 of 21	**Supersedes**: 712r15

TABLE 2: CALIBRATION DILUTIONS

DRO/RRO/Surrogate Calibration Dilutions

$MeCl_2$ Lot # : XXXX Date: X/XX/XXXX Analyst: XXX

Surrogates	Standard ID:	XXX-XXX-X		Expires:	XXX-XXX-X
SGS Lot #		Stock Added (µL)	$MeCl_2$ (µL)	Conc. (µg/mL)	Final Vol. (mL)
XXX-XXX-X		100*	900	15	1
XXX-XXX-X		250	750	50	1
XXX-XXX-X		500	500	100	1
XXX-XXX-X		750	250	150	1
XXX-XXX-X		500	0	200	0.5
* The concentration of the stock standard is 150 µg/mL.					
DRO	Standard ID:	XXX-XXX-X		Expires:	XXX-XXX-X
SGS Lot #		Stock Added (µL)	$MeCl_2$ (µL)	Conc. (µg/mL)	Final Vol. (mL)
XXX-XXX-X		100**	900	100	1
XXX-XXX-X		60*	940	300	1
XXX-XXX-X		50	950	1000	1
XXX-XXX-X		250	750	5000	1
XXX-XXX-X		500	500	10000	1
XXX-XXX-X		500	0	20000	0.5
* The concentration of stock is 5000 µg/mL. ** The concentration of stock standard is 1000 µg/mL.					
RRO	Standard ID:	XXX-XXX-X		Expires:	XXX-XXX-X
SGS Lot #		Stock Added (µL)	$MeCl_2$ (µL)	Conc. (µg/mL)	Final Vol. (mL)
XXX-XXX-X		250***	750	125	1
XXX-XXX-X		250**	750	250	1
XXX-XXX-X		100*	900	500	1
XXX-XXX-X		50	950	1000	1
XXX-XXX-X		250	750	5000	1
XXX-XXX-X		500	500	10000	1
XXX-XXX-X		500	0	20000	0.5
***The concentration of stock standard is 500 µg/ml **The concentration of stock standard is 1000 µg/mL. *The concentration of stock standard is 5000 µg/mL.					
ICVB	Standard ID:	XXX-XXX-X		Expires:	XXX-XXX-X
		500	0	5000	0.5
ICVR	Standard ID:	XXX-XXX-X		Expires:	XXX-XXX-X
		500	0	5000	0.5

This page intentionally blank

ATTACHMENT D: CORRECTIVE ACTION TABLE

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration for all analytes	Periodic	% RSD ≤ 15% or $r^2 \geq 0.99$ or $r \geq 0.995$ Minimum response factors meet criteria in Attch. C.	Correct source of problem. Repeat analysis. Recalibrate if needed. See Section 10
Second Source Cal. Verification.	Once per initial cal.	All analytes within ±20 % ±30% allowed for non-DOD	Correct source of problem. Repeat analysis. Recalibrate if needed. See Section 12.3.1
Tune	At the beginning of each 12 hour period in the analytical lot.	See Attch. A. DDT breakdown (less than 20%). Tailing for benzidine and pentachlorophenol (less than 2) are not evaluated unless requested per client.	Retune and recalibrate if needed.
Calibration Verification	At the beginning of each 12 hour period in the analytical lot and at the end of the run **for DOD.**	All analytes within ± 20% **For DOD:** Closing CCV ±50%	Evaluate the data. Correct source of problem. Repeat analysis if needed Recalibrate if needed **For DOD:** Re-run 2 successive CCVs See section 12.1.3-12.1.4
Method blank	One MB per extraction batch	Analytes below LOQ **For DOD: < ½ LOQ**	Evaluate the data/prep info. See section 12.4.1 Correct source of problem.
LCS/LCSD	One LCS per extraction batch; if insufficient volume for MS/MSD, then run LCSD	Performance based limits RPD<20	Repeat analysis. If recoveries or RPD is biased high and samples are non-detect, note in LIMS. If analytes are detected or recoveries are biased low, re-extract the prep batch if possible.
MS/MSD	One set per extraction batch. LCSD if insufficient volume for MS/MSD set.	Performance based RPD<20	If MS/MSD is biased high or low and LCS meets QC criteria, note in LIMS. If RPD is outside of criteria, note that the results in the parent sample are estimated for any affected analytes. See Sections 12.1.1, 12.1.2, 12.2.1, 12.2.2.
Surrogate Spike	Every Sample	Performance based	See Section 12.1.4 Correct source of problem. Repeat analysis if needed.
Internal standards	Every Sample	50% to 200% from mid Point of the calibration	Correct source of problem. Re-calibrate if needed.
Instrument blank	1 per analytical lot	Analytes below the LOQ	See section 12.4.2
Demonstration of capability	Initially per analyst per method and annually	Performance based	Repeat analysis or re-extract if needed.

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

SGS	SGS North America, Inc. - Alaska Division Standard Operating Procedure	
NOTE: This document contains CONFIDENTIAL business information and is not intended for distribution.		
S.O.P. Title: **Continuous Liquid-Liquid Extraction for Semi-Volatile Compounds**		**Revision Date:** March 2016
Method No: SW846 3520C		**SOP No**: 759r16
Page: 1 of 16		**Supersedes:** 759r15

Signatures below reflect periodic review of Standard Operating Procedures. If the procedure is found adequate with little or no editing necessary, this page is signed and dated. An Addendum may be issued for minor changes that need to be implemented immediately. If it is determined that major edits are required, a new revision will be released with a new signature page.

Technical Director	Date	Quality Assurance (QA) Manager, QA Staff or their Designee	Date
Stephen C. Ede	3/29/16	P Woods	3/29/2016

Original cover pages with wet signatures and the digitally signed electronic SOP versions are available in the Quality Assurance Office.
A limited number of controlled hard copies will be issued for the Section Method SOPs & Technical Director's offices.

This document will be converted into a PDF file with the QA Manager's, QA Staff's or QA Designee's electronic signature and posted on the network: \\usfs700\ANK_GroupData\Public\DOCUMENT\SOP\~Approved_SOPs~

This electronically signed PDF will be considered the controlled copy for staff. Any printouts or photocopies are invalid.

Each staff member responsible for this SOP will print & sign this coverpage upon successful review, retaining it as a record in their training folder.

I have reviewed and understand the method reference(s) and this version of the SOP.
I agree to use only this currently approved version of the SOP.

Signature: _____ Printed Name: _____ Date: _____

Morgan Morris
2017.03.07
09:44:20
-09'00'

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

Summary of Changes from Previous Revision:

- Addendum 1 and 2 have been incorporated into this revision
- Sections 9.10. and 9.19.13 are edited.
- Section 9.25 is edited.

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

Table of Contents

1.0. OBJECTIVE: 4
2.0. SCOPE AND APPLICATION: 4
3.0. DEVIATIONS FROM REFERENCE METHOD: 4
4.0. RESPONSIBILITIES: 4
5.0. INTERFERENCES: 5
6.0. SAMPLE HANDLING: 5
7.0 APPARATUS: 6
8.0. REAGENTS: 6
9.0. EXTRACTION: (Attachment B: Flow Chart) 7
10.0. CALIBRATION: 12
11.0. ANALYSIS: 12
12.0. QUALITY CONTROL: 12
13.0. CALCULATIONS, REVIEW AND REPORTING: 12
14.0. HEALTH AND SAFETY: 12
15.0. POLLUTION PREVENTION: 13
16.0. METHOD PERFORMANCE: 13
17.0. DETECTION LIMIT (DL) STUDY: 13
18.0. LIMIT OF DETECTION (LOD): 13
19.0. LIMIT OF QUANITATION (LOQ): 13
20.0. REFERENCES: 13
21.0. ATTACHMENTS: 14

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

1.0. OBJECTIVE:

This method is used to isolate organic compounds from aqueous samples. This method is applicable to the isolation and concentration of water soluble and slightly soluble organics in preparation for a variety of chromatographic procedures

2.0. SCOPE AND APPLICATION:

This SOP is suitable for subsequent analysis with method SW8270D, EPA625, PAH by 8270D-SIMS, 8270D Pest SIMS, 1625B Sulfolane Isotopic Dilution, Thiolane, 8015C, AK102/103, and, 8082A. A measured volume of sample, usually 1 liter, is placed into continuous liquid/liquid extractor, adjusted to a specific pH (see extraction summary page), and extracted with organic solvent that has a greater density then the sample, for 4-6 hours. The extracts are then concentrated and analyzed with gas chromatography or gas chromatography/mass spectroscopy.

3.0. DEVIATIONS FROM REFERENCE METHOD:

3.1. The continuous liquid to liquid extraction run time is at least 4 hrs and a maximum of 6 hrs. DRO/RRO spike compounds degrade after 4 hours. The reference method states that the extraction system may run for 18-24 hours. Method based performance (e.g. LCS recoveries, PT studies) supports the efficiency of procedure.

3.2. 8270D samples are extracted 2.5 hours at pH <2 and then for at least 1.5 hours at pH>11, for a combined time of 4 hours. Extraction should go no longer than 6 hours. Method 3520C specifies an extraction period of 18-24 hours at pH of <2 and at the second pH level of >11 an additional 18-24 hours extraction is required. Method based performance (e.g. LCS recoveries, PT samples) supports the efficiency of the procedure.

3.3. The continuous liquid to liquid extraction currently uses 250mL of methylene chloride to each extractor body. Method 3520C states to add 300-500mL of methylene chloride to each extractor body. Industry standards and best practices use smaller amounts to reduce chlorinated solvent waste.

3.4. The drying column used has a salt ball chamber with fritted glass disc, which is baked at 400°C for a minimum of 4 hours. The reference method uses a drying column with Pyrex® glass wool at the bottom and a PTFE stopcock.

3.5. The continuous liquid to liquid extraction apparatus, all related glassware, and the technique were custom made for the extraction process.

3.6. The concentration apparatus used is XcelVap by Horizon Technology using compressed nitrogen gas. The reference method lists the use of a Kuderna-Danish (K-D) apparatus for sample concentration using a heated water bath with concentric ring covers.

3.7. DRO/RRO samples, for both AK102/103 and 8015C, are collected in HCl-preserved bottles; therefore, associated extraction QC are adjusted to pH <2 with 4.0 mL of HCl.

4.0. RESPONSIBILITIES:

4.1 The QA Office maintains a master list of this SOP to ensure review on a timely basis. This system serves as an accounting of SOP distribution and ensures that distributed SOPs are current and complete. This includes destruction of controlled copies of expired and retired SOPs. The QA Office also maintains a

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

historical file of original cover pages with wet signatures and digitally signed electronic versions of this SOP; including the current revision and any versions archived within the past 5 years.

4.2 The electronic (Word Document) versions of this SOP, both current and any prior versions, are maintained on the computer network in a secure location as a "read only" file.

4.3 It is the responsibility of all personnel to follow this SOP as written, document and gain QA or Technical Director approval for deviations to the SOP, and submit needed SOP revisions to the QA Office.

4.4 This SOP is scheduled for review on an annual basis. Any required revisions will be incorporated into the SOP. The new revision of the SOP will be distributed by QA and the superseded version returned to the QA Office. If no revisions are required, the SOP cover page is signed and dated to document the review, and the updated cover page will be distributed.

4.5 A PDF version of each SOP (generated in Adobe or scanned) is digitally signed by a member of the QA Office as a security measure. The digitally signed PDF, used online, is considered to be a controlled copy of the SOP and is stored on the network.

\\usfs700\ank_groupdata\Public\DOCUMENT\SOP\~Approved_SOPs~

All staff have "read" access to these SOPs. Only QAQC has access to "write" on SOPs. Staff is directed to use the controlled electronic versions of SOPs. A limited number of controlled hardcopies are to be distributed by the QA Office.

5.0. INTERFERENCES:

5.1. Samples that contain high hydrocarbon content may emulsify or otherwise interfere with surrogate/spike recovery.

5.2. Organochlorine pesticides may dechlorinate, phthalate esters may exchange, and phenols may react to form tannates. These reactions increase with increasing pH, and decrease with shorter extraction time.

5.3. Samples containing a significant amount of solids may interfere with the extraction process.

6.0. SAMPLE HANDLING:

6.1. Sample Collection – Samples should be unaltered prior to extraction. Aqueous samples are stored at 0-6ºC until extraction.

6.2. Sample Size – 1L amber glass jars with Teflon-lined lids. Small volume DRO/RRO and PAH or samples with a history of high concentrations of the analyte of interest, may be submitted in 250-ml amber glass jars with Teflon-lined lids.

6.3. Sample Preservation – Water samples are stored at 0-6°C until extraction. Prior to extraction water sample collection should include preservation as follows:

Method	Preservative
8270D / EPA625/ Sulfolane/Thiolane	Cool 0-6°C
8270D-SIM	Cool 0-6°C,
8082A /EPA608	Cool 0-6°C,
8015C / AK102 / AK103	Cool 0-6°C, acidic pH (less than 2) by 1:3 HCl

Hexane extracts are refrigerated at 0-6ºC. Methylene chloride extracts are cooled to ≤ -10ºC.

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

6.4. Holding Times – Unpreserved water samples for all analysis except PCB must be extracted within 7 days of sample collection. There is a 1 year holding time for extraction of PCBs. Water samples collected for AK 102 and/or AK103 that have been acid preserved must be extracted within 14 days of sample collection. Extracts (except PCBs) must be analyzed within 40 days. PCB extracts have a cumulative 1 year hold time.

6.5. Criteria for Acceptance/Rejection of Samples – If samples have broken hold time, were not preserved properly, or were not stored at 0-6ºC, notify the Project Manager (PM) before proceeding with extraction.

7.0 APPARATUS:

7.1. 1500 ml-Glass extractor body with Teflon® stop-cocks

7.2. Coil condensers

7.3. Salt ball chambers (“salt balls”)

7.4. Jacketed concentrators (“bells”)

7.5. Teflon® chips (for use as boiling chips)

7.6. Pyrex glass concentrator tubes with a 1mL (ungraduated) tip

7.7. Concentrator Apparatus: XcelVap by Horizon Technologies (compressed nitrogen gas source), or equivalent.

7.8. Circulating glycol refrigeration unit (used in coil condenser)

7.9. Circulating heated glycol system (used in jacketed concentrators)

7.10. 1mL syringes: Hamilton gastight, calibration certified in house, as stated in SOP 104

7.11. Autosampler vials: Virtuoso, amber and clear, with Teflon®-lined crimp tops

7.12. Graduated cylinders class A.

7.13. pH paper: 0 -14 range (with $\leq$0.5 pH unit increments)

7.14. Disposable glass pipettes: 1, 5, and 10-mL

7.15. Disposable Pasteur pipettes, 7 and 9 inch

7.16. Permanent, solvent-resistant marker (Sharpie Industrial)

7.17. Teflon wash bottles, 500mL, labeled ‘methylene chloride’ or ‘D.I water’ accordingly: FILLED DAILY

7.18. Plastic and metal Keck clips

7.19. FisherBrand screw top vial, 17X60mm, 2 dram, w/rubber lined cap. (5mL vial)

8.0. REAGENTS:

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

8.1. Dichloromethane (CH_2Cl_2 or DCM): Fisher Optima (or equivalent) chromatographic grade.

8.2. nNonane: Acros 99% or equivalent (PAH analysis keeper)

8.3. De-ionized water (organic free)

8.4. Granular anhydrous sodium sulfate (Na_2SO_4): JT Baker or Fisher (or equivalent), received and opened dates must be recorded on the side of container. Heat at 400°F for ≥4 hours in a shallow tray, record in the Prep working reagents book. Label jars with ID number, date, and initials.

8.5. Sodium hydroxide solution (10N): Dissolve 40g NaOH in 100mL organic-free water. Record information in the Prep Working Reagents log book.

8.6. Hydrochloric acid solution 1:1 HCl: Add 500mL HCl to 500mL organic-free water. Record lot number information in the Prep Working Reagents log book. (Only applicable to DRO/RRO extraction)

8.7. Sulfuric acid solution 1:1- Add 500mL H_2SO_4 to 500mL organic-free water. Record lot number information in the Prep Working Reagents log book.

8.8. Hexane (C_6H_{14}): Fisher Optima (or equivalent) high purity Pesticide grade

9.0. EXTRACTION: *(Attachment B: Flow Chart)*

9.1. (#1) Approximately thirty minutes before extraction, turn the red knob (on the heater control box) "**on**."

9.2. (#2) Turn the yellow flow control levers under the extraction benches being used to"**extraction**."

9.3. (#3) Check to make sure all green A & B valves under the extraction benches are turned OFF. Turn the yellow flow control handles inside the pump cabinet to"**extraction".**

9.4. (#4) Flip the switch located on the end of the cabinet to "**fill"**.

9.5. (#5) Prepare all glassware, according to the SGS SOP#117 "Glassware Cleaning and Preparation."

9.6. Assemble stopcocks and add 250mL of methylene chloride to the bottom of each extractor body. Add one Teflon® chip to each jacketed concentrator and ½ inch of granular Na_2SO_4 to all salt chambers. Attach the bottom of the salt chamber to the jacketed concentrator using a Keck clip and the top of the salt chamber to the arm of the extractor body using another clip. Thread the two heated glycol hoses into the jacketed concentrators and tighten the hoses by hand only. The top hose goes to the top threaded stem and the bottom hose goes to the bottom threaded stem.

9.7. Pull the batch to be extracted from the reach in. Samples are sent in 1L or 250mL amber bottles. Set each jar to the right of the extractor body that will be used for the samples extraction. Scan the sample number into the ELN to build the batch. Ensure that all samples in a work order are together in the batch, unless the number of samples exceeds 20. Verify that samples are assembled on the bench in order by WO/sample number. Sample IDs should be transcribed onto the jacketed concentrators with a solvent resistant permanent marker.

9.8. All containers will be marked with a solvent resistant permanent marker at the bottom of the meniscus. Then all volumes must be measured to the marked point.

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

9.9. To prepare the method blank, LCS or LCS Duplicate, use 1000mL de-ionized water (organic free). Add the room temperature spike standard to the QC (Quality Control) samples - LCS, LCSD, MS, and MSD - using the designated syringe. Add the room temperature surrogate standard to all of the samples containers, including all QC samples. Some sample jars will come filled to the rim. In those situations, decant a portion of the sample into the extractor body, making room to introduce the spiking mixes into the sample in the jar. *Note: refer to Attachment A "Spiking Requirement Table" for method specific spiking requirements.*

9.9.1. Spiking solutions must be introduced into the sample in the original sample container.

9.10. Verify the sample ID on the container matches what is written on the jacketed concentrator ("bell") before pouring the entire spiked sample into the designated clean extractor body carefully so that the liquid does not go into the arm of the extractor body leading to salt chamber. If the sample volume is significantly greater than 1 liter (e.g., larger than 1-liter sample container) measure 1 liter of sample with a solvent rinsed graduated cylinder. If the volume of the sample to be extracted is significantly less than 1 liter, dilute to 1 liter with de-ionized water. After pouring the sample into the extractor body rinse the sample container with DI to remove any sediment, followed by 2 methylene chloride rinses , capping the jar and shaking to thoroughly coat the entire container and cap, decant each rinse into the extractor body. Then rinse the neck of the extractor body with methylene chloride.

9.11. **SIM PAH:** After pouring the spiked sample into the extractor body add 100µl of nonane using a 100 µl syringe.

9.12. Adjust the initial sample pH, if needed, and make a notation in "sample comments" in ELN logbook.

9.13. (#6) Turn chiller ON.

9.14. Cap the extractor body by lowering the coil condenser into the neck of the extractor body. Be sure that chiller is on, at approximately 2°C, and that cold glycol is circulating through the condensers.

9.15. (#7) Start circulating heated glycol through the jacketed concentrators by rotating the ***TOP (A)*** green valve (underneath the bench) horizontally, followed by opening the ***BOTTOM (B)*** green valve. Open these valves in this order, top A, then bottom B, reversing the order will cause hot glycol back pressure in the system & glassware. Before starting extraction, check the heater control box to ensure that the glycol temperature is at least 160°F.

9.16. (#8) Open the stop-cock to allow solvent to flow through the salt chamber and down into the jacketed concentrator. Be sure not to flood salt chamber, while maintaining a constant flow to jacketed concentrator. The methylene chloride level should not exceed the neck of jacketed concentrator or go below the Teflon® chips. Allow the continuous extraction system to cycle for a minimum of 4 hours and a maximum of 6 hours.

9.17. Approximately 10 minutes after extraction begins, check all joints on extraction apparatus. This is achieved by checking the stopcock for leaks, verifying the condenser is set securely into the top joint of the body, and all ground glass connections are together. i.e. condenser to body, body to salt ball, salt ball to jacketed concentrator.

9.18. As stated in SW846 3520C – 3, section 7.1. "It is recommended that if high analyte concentrations are anticipated, samples should be collected in smaller sample bottles and the whole sample used."

Note: If sample is multi-phasic, the supervisor and the Project Manager must be contacted to determine which phase should be analyzed. If there is more than ¼ inch of sediment in the bottom of the container, it is considered to be multi-phasic.

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

9.19. If more than one bench is to be set up, completely set up 1st bench (set up through section 9.14 of this SOP) before starting set up of the 2nd bench. When setting up 2nd bench, follow same steps as above.

9.20. **Extraction pH requirements:**

9.20.1. AK 102/103 – 8015, DRO/RRO: adjust to <2 with 4mL of 1:1 HCL

9.20.1.1. Some clients send PAH samples preserved with acid. These samples must be neutralized with 10^N NaOH, to pH 5-9.

9.20.2. 8270 Pst SIM & 8082 PCB: check and record that pH is 5 - 9 and adjust if necessary with 1:1 H_2SO_4 or 10^N NaOH, to 5 – 9.

9.20.3. 8270 SVOC: Adjust pH to <2 with 1.5mL 1:1 H_2SO_4. Extract 2.5 hours and add 10mL 10^N NaOH to bring the pH up to 11. Continue extracting for 1.5 additional hours; extraction should not exceed 6 hours.

9.20.3.1. TCLP leachates require ~ 15 mL of 10N NaOH due to the TCLP extraction fluid.

9.20.3.2. Sample pH will be checked after extraction at the bench to ensure the pH of 11 was achieved and maintained. Noncompliant pH changes will be noted in the prep log.

9.21. **For SW846 methods (i.e., 8270D-SIM, 8270D, 8082A, 8015C)**, each batch of twenty field samples or less requires a method blank (MB), a laboratory control sample (LCS), a matrix spike (MS), and a matrix spike duplicate (MSD). If insufficient sample is provided to perform a MS/MSD, then a laboratory control sample (LCSD) must be included.

9.21.1. Sulfolane requires a method blank (MB) and laboratory control samples (LCS) for every batch of twenty field samples or less. ***In addition:***

9.21.2. Sulfolane batches of 1-9 samples will include a field duplicate (DUP) sample. If insufficient sample is provided to perform a duplicate, then a laboratory control sample (LCSD) must be included.

9.21.3. Sulfolane batches of 10-20 samples will have a matrix spike(MS) and a matrix spike duplicate (MSD). If insufficient sample is provided to perform an MS/MSD, then a laboratory control sample (LCSD) must be included.

9.22. **For AK-series methods** (i.e., AK102/103), each batch of twenty samples or less requires a method blank (MB), a laboratory control sample (LCS) and a laboratory control sample duplicate (LCSD). The client may also request a matrix spike (MS) and matrix spike duplicate (MSD); in which case, they are prepared in addition to the LCS and LCSD. **Note:** ***ADEC requires AK102/103 batches to have both an LCS and an LCSD, even if the client provides sufficient sample for an MS/MSD.*** To prepare the method blank, LCS or LCS Duplicate, use 1000mL de-ionized water (organic free).

9.23. Measure the initial sample volume (section 9.8.) by filling the sample bottle to the meniscus mark with tap water. Pour the water into a graduated cylinder and record this volume as the initial sample volume in the extraction logbook.

9.23.1. Be sure to keep samples in the order that they are set up on the bench when moving the containers to measure sample volume. Verify the container IDs with those in the ELN – samples should appear in the same order in both places. If something doesn't match up, do a double check to ensure correct information is being recorded. (i.e. make sure a sample switch is not occurring.)

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

9.24. After the extraction is complete, close the stop-cock and allow the solvent to concentrate in jacketed concentrator to less than 10mL before turning off system.

9.25. To turn off extraction system:

1. Turn the heater power knob to off
2. Flip the switch on the end of cabinet to "**off**"
3. Turn the yellow flow control levers under the bench to "**drain**"
4. Turn the yellow lever in the pump cabinet to "**drain**"
5. Flip the switch on the end of cabinet to "**drain**" & loosen the top glycol hose attached to each concentrator to vent the system
6. Once the glycol has drained, turn the switch on the end of the cabinet to "**off**"
7. Rotate all green A & B valves to vertical
8. Turn the chiller "**off**". Allow samples to equilibrate to room temperature before removing jacketed concentrators.

9.26. Concentration:

9.26.1. Check the water level in the XcelVAp and adjust the temperature to 38ºC.

9.25.2 To collect the extraction solvent, unscrew both glycol hoses from the jacketed concentrator and remove the remove the "bell" & "salt ball" together. After rinsing the salt chamber three times with methylene chloride, gently knock the salt ball against a gloved hand hard enough to disturb the Na2SO4 and allow the DCM to drain into the concentrator. Remove the "salt ball" and pour the contents of the bell into a labeled concentrator tube. Rinse the bell three times with methylene chloride and pour the rinse directly into a labeled concentrator tube. Ensure the label on the concentrator tube is accurately transcribed (i.e. the sample ID matches the ID on the "bell"). After the extraction solvent has been transferred into the concentrator tube rinse the sides of the concentrator tube with methylene chloride. Repeat this process for all samples in batch.

9.26.2. Start the nitrogen flow at about 5 PSI and place the concentrator tubes containing the sample into the XcelVap. The XcelVap can be programmed to ramp the nitrogen flow pressure up as the sample volume goes down. The maximum flow must not exceed 22psi. The surface of the solvent should be moving gently, not splashing.

9.26.3. Monitor the samples closely, when the sample level is down to ~10mL, then thoroughly rinse the sides of the tube with methylene chloride. For samples that are analyzed in methylene chloride, continue concentrating until the sample level is in the tube nipple (~1mL). Rinse the slanted tube bottom with methylene chloride and concentrate to about 1mL.

9.26.4. Samples with a high concentration of oil or other heavy organic compounds, will not concentrate to 1mL. When the sample volume is obviously not reducing, or the concentrate is viscous and black, do not try to concentrate as low as it will go. If the volume is less than 5mL, bring it up to 5.0mL using the calibrated 5.0mL reference vial. Record the final dilution volume (i.e., 5.0mL) in the ELN and on the side of the vial. Extracts that are more than 5mL can be measured with a class A graduated cylinder. DO NOT adjust the volume by (blowing down with nitrogen gun or adding solvent) once the final volume has been recorded. Transfer 1mL of the extract to an auto sampler vial. Record the total final volume on the side of the vial using a black marker and put a

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

dot on the edge of the vial cap top. Contact the project manager and record the reason for the deviation in "comments" in the ELN.

9.26.5. Calibrate 1.0mL and 5.0mL reference vials daily by measuring methylene chloride using a gas tight syringe into each vial (i.e., a crimp top autosampler vial for the 1.0mL and a 21x70 septum lidded vial for the 5.0mL reference vial).

NOTE: *The following procedures must be used to prevent mixing sample ID during transfer from concentration tube to sample vial. This is the final critical step to insure the validity of the extract.*

9.26.6. To assure samples are not switched, confirm labeling on the concentrator tube and GC vial match. Rinse the slanted tube bottom with a few drops of methylene chloride and concentrate to ~3/4 of a mL. *No less than 0.5mL*. Transfer the sample from the tube to the labeled vial, (in a vial tray with the vials lined up to correspond with the tube position in the tube rack), using a 1mL glass pipette. Rinse the tube with a few drops of methylene chloride and add to the vial. The now empty concentrator tube is replaced in the tube rack in the same corresponding x-y position. If the sample volume is over 1.0mL by comparison with the reference vial use the nitrogen gun to reduce the volume to 1.0mL. If the sample volume is under 1.0mL, adjust to proper volume by adding methylene chloride using glass transfer pipettes. **Cap the vial and record the final volume**. (The final volume **must** be entered in ELN at the time the vial is capped.) When all samples have been transferred to vials, check the sample vial numbers with the empty tube numbers to assure that no errors have been made.

9.26.7. In the event that a sample vial needs to be relabeled, for example a poorly printed label or the sample placed in an incorrect vial. Make sure that the vial's barcode is unreadable, and the new sample ID is clearly written. This will require immediate peer review and a note placed in the ELN.

NOTE: *Use of the nitrogen* **g***un to reduce the sample volume in the vial creates an exothermic reaction that causes water condensation on & in the vial. Therefore it is to be used sparingly.*

9.26.8. Sufolane extracts: Minimize use of the nitrogen gun as this analysis is extremely sensitive to moisture.

9.26.9. SVOC & PAH extracts: must never go below 0.5mL because lighter compounds will be lost.

9.26.10. Never in any circumstance allow a sample to concentrate to dryness.

9.26.11. **For 8082 PCB** samples that are analyzed in hexane, a solvent exchange to hexane must be done.

9.26.11.1. Monitor the sample in the XcelVap closely and when the sample level is down to ~1mL, rinse the sides of the tube with about 15mL of hexane and continue concentrating the sample. When the volume reaches 0.5mL, (1cm from the bottom of the tube) add 10mL of hexane. Repeat the 10mL hexane rinse a total of two times, reducing the sample volume to 0.5mL after each hexane rinse. Transfer the final concentrate, (0.5mL), to a sample vial and bring to the proper volume by adding hexane with a pasteur pipette. The following are the rinse and concentrate volumes for the hexane exchange process:

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

9.26.11.2.

Hexane	Sample Volume
15mL	→ 0.5mL
10mL	→ 0.5mL
10mL	→ 1.0 mL

9.26.11.3. For 8082 PCB analysis, the sample is brought to 1.0mL with hexane and is ready for analysis.

9.27. Deliver extracts to instrumentation lab

9.27.1. For 8015, AK102/103, DRO/RRO, and PCB, deliver in clear glass auto sampler 1mL vials

9.27.2. For Sulfolane, 8270 SVOC, 8270 SIMS, PEST SIM, use amber glass auto sampler 1 mL vials

9.28. Make sure that any & all sample oddities & deviations are documented and all blank entries in the ELN are filled, including the XcelVap ID and temperature, and the lot numbers of all solvents, standards and materials used. Post the data into LIMS. Double check entries. Print the ELN preview page and send to the analyst with the sample extracts.

10.0. CALIBRATION:

N/A

11.0. ANALYSIS:

N/A

12.0. QUALITY CONTROL:

12.1. For each batch of up to twenty extracted. If there is not sufficient volume for an MS/MSD, a LCS duplicate sample is extracted. **All batches for AK102/103 require both LCS and LCSD.** These samples are used to evaluate extraction efficiency and ensure that the extraction process is not contributing to sample results. Sample spikes and sample spike duplicates (MS/MSD set) may be requested by the client to evaluate site specific effects on the extraction/analysis process.

12.2. All samples, method blanks, LCS/LCSD and MS/MSD are fortified with the surrogate solutions.

12.3. Samples can be added to an active batch (samples still in the extraction process), with less than 20 samples, to the full 20 sample batch size. Examples would be, RUSH samples or samples broken or spilled. The process end time must be the same for all samples in the batch, no less than 4 hours or more than 6 hours.

12.4. Any corrective action(s) needed to address a QC outlier or other technical challenges that are not listed in this SOP require the prior approval of the QA Office or Technical Department.

13.0. CALCULATIONS, REVIEW AND REPORTING:

Refer to the Peer Review SOP 101.

14.0. HEALTH AND SAFETY:

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

14.1. Samples shall be returned to the approved storage location until such time as it is determined that no further analysis will be required.

14.2. Once it has been established that no more analysis of a sample will be required, acid and alkaline preserved samples may be neutralized using the Elementary Neutralization Hood located in GC Prep, unless it is considered to be hazardous (i.e. mercury waste, cyanide waste). Refer to the current version of SOP 108 for further instruction.

14.3. All surplus reagent acids shall be neutralized on a daily basis using the Elementary Neutralization Hood located in GC Prep.

14.4. Small volumes of surplus volatile reagents may be allowed to evaporate in a hood at the end of the analytical session.

14.5. Proper Personal Protective Equipment (PPE) must be worn at all times. Proper PPE when handling samples include a lab coat, gloves and safety glasses. In addition, when handling any solutions with concentrated acid or base preservative, a face shield and apron must be worn.

15.0. POLLUTION PREVENTION:

15.1 SGS is committed to evaluate all areas of the lab with regard to current and potential pollution prevention. Pollution prevention is described as any technique that reduces or eliminates waste at the point of generation. Further discussion on pollution prevention programs in the laboratory can be found in *SGS Pollution Prevention Plan* (Form F053).

15.2 This custom made, automated system for continuous liquid-liquid extraction reduces solvent use.

15.3 SGS distills the methylene chloride not used for analysis and the recycled solvent which passes the purity test is used for AK102/103.

16.0. METHOD PERFORMANCE:

N/A

17.0. DETECTION LIMIT (DL) STUDY:

N/A

18.0. LIMIT OF DETECTION (LOD):

N/A

19.0. LIMIT OF QUANITATION (LOQ):

N/A

20.0. REFERENCES:

SW846, Revision 3, December 1996
Method 3520C, Revision 3, December 1996
Method 3500C, Revision 3, February 2007

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

21.0. ATTACHMENTS:

ATTACHMENT A: Spiking Requirements Table

Method	Surrogate	Volume	Spike	Volume	QC ID
8270D Semi-vol.	**8270**(100/200µg/mL acid & BN Cpds)	1.0mL			MB
	8270(100/200µg/mL acid & BN Cpds)	1.0mL	8270 spike (100µg/mL)	1.0mL	LCS
	8270(100/200µg/mL acid & BN Cpds)	1.0mL	8270 spike (100µg/mL)	1.0mL	MS/MSD
	8270(100/200µg/mL acid & BN Cpds)	1.0mL			PS
8082 PCB	Tetra/Deca (1µg/mL)	1.0mL			MB
	Tetra/Deca (1µg/mL)	1.0mL	Aroclor 1016/1260(1µg/mL)	1.0mL	LCS
	Tetra/Deca (1µg/mL)	1.0mL	Aroclor 1016/1260(1µg/mL)	1.0mL	MS/MSD
	Tetra/Deca (1µg/mL)	1.0mL			PS
8270D-PAH SIMS (also for Low Volume)	PAH (0.5µg/mL)	1.0mL			MB
	PAH (0.5µg/mL)	1.0mL	PAH Spike (0.5µg/mL)	1.0mL	LCS
	PAH (0.5µg/mL)	1.0mL	PAH Spike (0.5µg/mL)	1.0mL	MS/MSD
	PAH (0.5µg/mL)	1.0mL			PS
	All samples and QC spiked	**with**	**100µl nonane**		
Sulfolane	Sulfolane d_8 (80µg/mL) w/ 8270(100µg/mL acid & BN Cpds)	1.0mL			MB
	Sulfolane d_8 (80µg/mL) w/ 8270(100µg/mL acid & BN Cpds)	1.0mL	Sulfolane Spike (15µg/mL)	1.0mL	LCS
	Sulfolane d_8 (80µg/mL) w/ 8270(100µg/mL acid & BN Cpds)	1.0mL	Sulfolane Spike (15µg/mL)	1.0mL	MS/MSD
	Sulfolane d_8 (80µg/mL) w/ 8270(100µg/mL acid & BN Cpds)	1.0mL			PS
8270D-Pest SIMS	Pst (0.5µg/mL)	1.0mL			MB
	Pst (0.5µg/mL)	1.0mL	Pest spike (0.25µg/mL)	1.0mL	LCS/LCSD
	Pst (0.5µg/mL)	1.0mL	Pest spike (0.25µg/mL)	1.0mL	MS/MSD
	Pst(0.5µg/mL)	1.0mL			PS

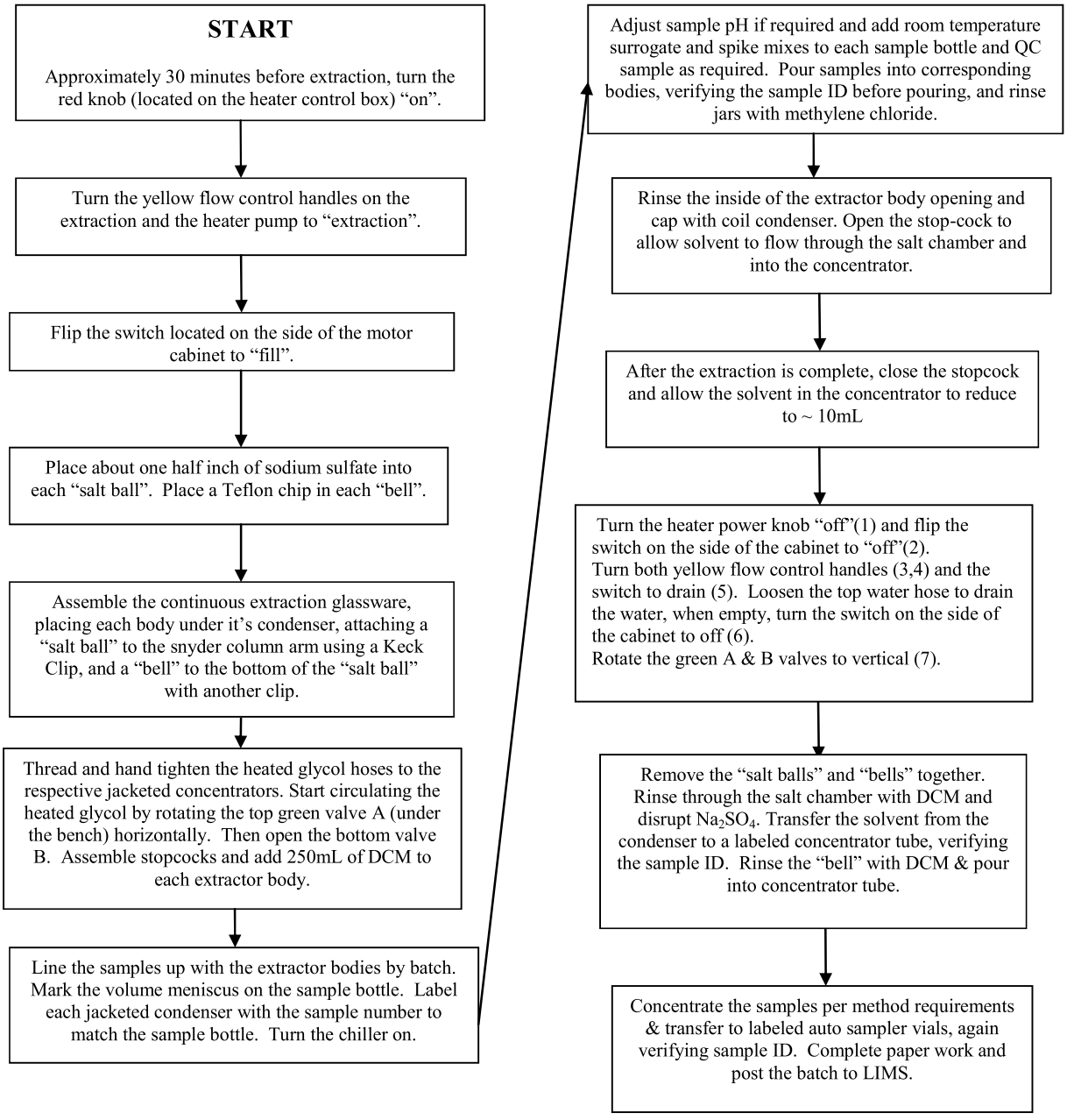
Method	Surrogate	Volume	Spike	Volume	QC ID
Thiolane	**8270**(100µg/mL acid & BN Cpds)	1.0 mL			MB
	8270(100µg/mL acid & BN Cpds)	1.0 mL	Thiolane Spike (15 µg/mL)	1.0 mL	LCS/LCSD
	8270(100µg/mL acid & BN Cpds)	1.0 mL	Thiolane Spike (15 µg/mL)	1.0 mL	MS/MSD
	8270(100µg/mL acid & BN Cpds)	1.0 mL			PS/DUP
AK102/103 DRO/RRO (also for Low Volume)	**5-Alpha & DTC (100µg/mL)**	1.0mL			MB
	5-Alpha & DTC (100µg/mL)	1.0mL	LSB / LSR (5000µg/mL)	1.0mL	LCS/LCSD
	5-Alpha & DTC (100µg/mL)	1.0mL	LSB / LSR (5000µg/mL)	1.0mL	MS/MSD
	5-Alpha & DTC (100µg/mL)	1.0mL			PS

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

Silica Gel AK 102/103 DRO/RRO	**5-Alpha & DTC (200µg/mL)**	1.0mL			MB
	5-Alpha & DTC (200µg/mL)	1.0mL	LSB / LSR (5000µg/mL)	2.0mL	LCS/LCSD
	5-Alpha & DTC (200µg/mL)	1.0mL	LSB / LSR (5000µg/mL)	2.0mL	MS/MSD
	5-Alpha & DTC (200µg/mL)	1.0mL			PS
8015C DRO/RRO	**5-Alpha & DTC (100µg/mL)**	1.0mL			MB
	5-Alpha & DTC (100µg/mL)	1.0mL	DRO by 8015 (5000µg/mL)	1.0mL	LCS/LCSD
	5-Alpha & DTC (100µg/mL)	1.0mL	DRO by 8015 (5000µg/mL)	1.0mL	MS/MSD
	5-Alpha & DTC (100µg/mL)	1.0mL	LSB / LSR (5000µg/mL)	1.0mL	LCS/LCSD
	5-Alpha & DTC (100µg/mL)	1.0mL	LSB / LSR (5000µg/mL)	1.0mL	MS/MSD
	5-Alpha & DTC (100µg/mL)	1.0mL			PS

Controlled copy distributed to Kelly Janukajtis with Brice Environmental Services.

Attachment B: Flow Chart



Controlled copy distributed to Kelly Carson at Brice Environmental.

ATTACHMENT B: Process for GC Prep-Soils

Before a Sonication batch has been started:

- Retrieve Spike and Surrogates
- Set out batch for spiking
- Create batch in LIMS
- Build batch in ELN
- Shake samples and loosen lids
- Spike Witnessing

After a Sonication batch has been started:

- Label TurboVap/Xcel Vap Tubes
- Print Vials
- Prepare next Sonication batch

After a Sonication batch has been blown down

- Concentrate batch
- Complete ELN documentation
- Review ELN for Posting

Special Attention Needed

- Watch TurboVaps/Xcel Vaps
    - Raise Pressure
    - Rinse tubes at ~2mL
    - Remove tubes at ~0.8mL
    - Record TurboVap/Xcel Vap Temperatures in ELN
- **Communicate as tasks are completed**
- **Document ELN at each step**
    - Do not fill out final volume in advance of concentration
        - Enter final volume as concentration is completed
    - Do not fill out Analyst initials until step has been completed
    - **Do add comments to samples and batches when analysis differs from normal**

Controlled copy distributed to Kelly Carson at Brice Environmental.

SGS	SGS North America, Inc. - Alaska Division Standard Operating Procedure
NOTE: This document contains CONFIDENTIAL business information and is not intended for distribution.	
S.O.P. Title: Purge and Trap Aqueous	**Revision Date**: July 2018
Method No: SW846 8000B & 5030B	**SOP No**: 764r12
Page: 1 of 8	**Supersedes:** 764r11

Signatures below reflect periodic review of Standard Operating Procedures. If the procedure is found adequate with little or no editing necessary, this page is signed and dated. An Addendum may be issued for minor changes that need to be implemented immediately. If it is determined that major edits are required, a new revision will be released with a new signature page.

Technical Director Date Quality Assurance (QA) Manager, QA Staff or their Designee Date

Stephen C. Ede 7/20/18 7/20/18

Original cover pages with wet signatures and the digitally signed electronic SOP versions are available in the Quality Assurance Office.
A limited number of controlled hard copies will be issued for the Section Method SOPs & Technical Director's offices.

This document will be converted into a PDF file with the QA Manager's, QA Staff's or QA Designee's electronic signature and posted on the network: \\usfs700\ANK_GroupData\Public\DOCUMENT\SOP\~Approved_SOPs~

This electronically signed PDF will be considered the controlled copy for staff. Any printouts or photocopies are invalid.

Each staff member responsible for this SOP will print & sign this coverpage upon successful review, retaining it as a record in their training folder.

I have reviewed and understand the method reference(s) and this version of the SOP.
I agree to use only this currently approved version of the SOP.

Signature: _____ Printed Name: _____ Date: _____

Document Control Number _____ Issued by _____ Date _____

Summary of Changes from Previous Revision:

- Minor spelling and grammar corrections
- 11.5 updated

Controlled copy distributed to Kelly Carson at Brice Environmental.

Table of Contents

1.0. OBJECTIVE: 4
2.0. SCOPE AND APPLICATION: 4
3.0. DEVIATIONS FROM REFERENCE METHOD: 4
4.0. RESPONSIBILITIES: 4
5.0. INTERFERENCES: 4
6.0. SAMPLE HANDLING: 5
7.0. APPARATUS: 5
8.0. REAGENTS: 5
9.0. EXTRACTION: 6
10.0. CALIBRATION: 6
11.0. ANALYSIS: 6
12.0. QUALITY CONTROL: 6
13.0. CALCULATIONS, REVIEW AND REPORTING: 7
14.0. HEALTH AND SAFETY: 7
15.0. POLLUTION PREVENTION: 7
16.0. METHOD PERFORMANCE: 7
17.0. DETECTION LIMIT (DL) STUDY: 7
18.0. LIMIT OF DETECTION (LOD): 7
19.0. LIMIT OF QUANTITATION (LOQ): 7
20.0. REFERENCES: 7
21.0. ATTACHMENTS: 8

Controlled copy distributed to Kelly Carson at Brice Environmental.

1.0. OBJECTIVE:

This SOP provides the guidance for purge and trap analysis for aqueous samples.

2.0. SCOPE AND APPLICATION:

This method is used to analyze water and water miscible samples, for volatile organic compounds by purge and trap prep gas chromatograph analysis methods by SW846. (Refer to method SOPs for analytical details.) An inert gas is bubbled through a water sample, reagent water, or methanol extract (for oil, sludge, and soils) contained in a specially designed purging chamber. Heated purging may be used to increase analyte transfer. The purging of the sample transfers purgeable compounds from the liquid to the vapor phase. The vapor is then swept to a porous polymer trap where they are collected. Once purging is complete, the trap is then rapidly heated and back flushed with the inert gas desorbing the analytes onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the compounds, which are then detected.

3.0. DEVIATIONS FROM REFERENCE METHOD:

This SOP contains no deviations from method 5030B.

4.0. RESPONSIBILITIES:

4.1 The QA Office maintains a master list of this SOP to ensure review on a timely basis. This system serves as an accounting of SOP distribution and ensures that distributed SOPs are current and complete. This includes destruction of controlled copies of expired and retired SOPs. The QA Office also maintains a historical file of original cover pages with wet signatures and digitally signed electronic versions of this SOP; including the current revision and any versions archived within the past 5 years.

4.2 The electronic (Word Document) versions of this SOP, both current and any prior versions, are maintained on the computer network in a secure location as a “read only” file.

4.3 It is the responsibility of all personnel to follow this SOP as written, document and gain QA or Technical Director approval for deviations to the SOP, and submit needed SOP revisions to the QA Office.

4.4 This SOP is scheduled for review on an annual basis. Any addendum will be incorporated into the SOP and a new revision of the SOP will be distributed by QA. The superseded version will be returned to the QA Office. If there are no addenda to incorporate or updates to make, the SOP is reviewed and given a new revision number. The cover page is signed and dated by the Technical Director and QA then distributed.

4.5 A PDF version of each SOP (generated in Adobe or scanned) is digitally signed by a member of the QA Office as a security measure. The digitally signed PDF, used online, is considered to be a controlled copy of the SOP and is stored on the network.

\\usfs700\ank_groupdata\Public\DOCUMENT\SOP\~Approved_SOPs~

All staff have “read” access to these SOPs. Only QAQC has access to “write” on SOPs. Staff is directed to use the controlled electronic versions of SOPs. A limited number of controlled hardcopies are to be distributed by the QA Office.

5.0. INTERFERENCES:

5.1. Samples can be contaminated by diffusion of volatiles (particularly methylene chloride and fluorocarbons) through the septum seal of the sample vial during shipment and storage.

Controlled copy distributed to Kelly Carson at Brice Environmental.

5.2. The laboratory where volatile analysis is performed should be completely free of solvents, which are part of the target analyte list.

5.3. The majority of sample contamination occurs at the instrument (purge gas, outgassing ahead of the trap etc.) The instrument must be demonstrated to be free from contamination under the conditions of analysis.

5.4. Contamination due to carryover can occur when high concentration samples and low concentration samples are analyzed sequentially. High concentration samples should be followed by a blank to check for carryover. The system may need to be baked out to eliminate contamination.

6.0. SAMPLE HANDLING:

6.1. Samples are tracked by the sample custodian. TCLP leachates are relinquished to the VOC Analyst by the EPTOX Analyst, along with the associated leachate blank(s) and a copy of the bench sheet for the batch that documents the leaching of the samples, blanks, and their batch assignments. A HSN QC number will be assigned to blanks and noted on the leach log. This number is required in order to track leach blanks from the preparation through the analytical process. LIMS Sample types specific to the different types of leach fluid blanks are available in the analytical queues to post leach blank data.

6.2. Holding Times: Volatile organic analysis of water and water miscible samples pre-preserved with HCl must be performed within 14 days after sample collection. Unpreserved water and water miscible samples, including unpreserved TCLP leachates and blanks must be analyzed within 7 days of the end of the leaching period (fourteen days if the leachate is preserved to pH<2 with 1:1 HCL:water).

6.3. Samples should be stored at 0-6^{o}C with minimal headspace in an area free of solvent fumes.

6.4. The size of any bubble caused by degassing upon cooling should not exceed 5-6 mm ^{2} if a bubble is present, check the vial's cap and septum to ensure a proper seal was made at time of sampling. If there is evidence of leaking the sample should be discarded.

7.0. APPARATUS:

7.1. See method specific SOP for instrumentation (e.g., 8021, 8260, 524, 602)

7.2. Microsyringes for spiking of sample

7.3. Class A volumetric flasks

8.0. REAGENTS:

8.1. Organic free water defined as water in which contamination is not observed at the LOQ value of the parameters of interest. (**Note:** For DOD, the water must be free of contaminants to < ½ LOQ.) Deionized (DI) water is dispensed from the volatiles RO system before using it for sample dilutions, standard preparation, trip blank preparation, and quality control sample preparation.

8.1.1. Acidic RO, (used to prepare samples and calibrations), is prepared by adding ~1mL of 50% HCL per one liter of reagent water to obtain a pH of ≤ 2.

8.2. Purge and Trap grade Methanol

Controlled copy distributed to Kelly Carson at Brice Environmental.

9.0. EXTRACTION:

N/A

10.0. CALIBRATION:

N/A

11.0. ANALYSIS:

11.1 Samples to be analyzed are obtained from the sample custodian.

11.2 Allow samples to come to room temperature prior to analysis.

11.3 Place samples into auto sampler tray. Record any observations of sample color, sediment or bubbles.

11.4 Internal standards or surrogates are added automatically.

11.5 Check sample pH on the remaining volume with narrow range paper after acquisition has finished. If the pH is greater than 2 it must be noted in sample comments in LIMS. Record pH check in the run log. The data is valid if the pH is greater than 2 and analyzed within 7 days.

11.6 Send remaining sample to post analysis

12.0. QUALITY CONTROL:

12.1. Water used for extraction is analyzed in each analytical batch to check for contamination. This check is the instrument blank, which can also serve as the tune (for GC/MS analysis) and a method blank for a water sample batch.

12.2. Each instrument with a purge and trap unit must have a valid calibration curve established, which is verified before use by the analysis of a second source standard. The curve is verified at the beginning of each analytical batch by the analysis of a mid-range calibration standard. Each analytical method contains acceptance criteria for the analysis of these two standards. An average of the response factors or calibration factors from the initial calibration curve is used for surrogate and target analyte calculations.

12.3. MB, LCS, MS and MSD must be associated with each preparation batch of 20 field samples or less. If sufficient field sample volume is not available to create an MS/MSD set, an LCSD sample is added to the batch. See method specific SOP for QC acceptance criteria.

12.4. Dilutions - If dilutions are necessary the amount of purged water must remain constant.

Example (10-fold dilution) - Use 4.5 mL of reagent water and 0.5 mL of sample for a final volume of 5.0 mL. The addition of any surrogates, internal standards, and matrix spike analytes (as applicable) are added after the dilution step.

12.5. Any corrective action(s) needed to address a QC outlier or other technical challenges that are not listed in this SOP require the prior approval of the QA Office or Technical Department.

Controlled copy distributed to Kelly Carson at Brice Environmental.

13.0. CALCULATIONS, REVIEW AND REPORTING:

See method specific SOP for information (e.g., 8021, 8260, 524, 602).

14.0. HEALTH AND SAFETY:

14.1. Samples shall be returned to the approved storage location until such time as it is determined that no further analysis will be required.

14.2. Once it has been established that no more analysis of a sample will be required, acid and alkaline preserved samples may be neutralized using the Elementary Neutralization Hood located in GC Prep, unless it is considered to be hazardous (i.e. mercury waste, cyanide waste). Refer to the current version of SOP 108 for further instruction.

14.3. All surplus reagent acids shall be neutralized on a daily basis using the Elementary Neutralization Hood located in GC Prep.

14.4. Small volumes of surplus volatile reagents may be allowed to evaporate in a hood at the end of the analytical session.

14.5. Proper Personal Protective Equipment (PPE) must be worn at all times. Proper PPE when handling samples include a lab coat, gloves and safety glasses. In addition, when handling concentrated acid or base preservative a face shield and apron must be worn.

15.0. POLLUTION PREVENTION:

SGS is committed to evaluate all areas of the lab with regard to current and potential pollution prevention. Pollution prevention is described as any technique that reduces or eliminates waste at the point of generation. Further discussion on pollution prevention programs in the laboratory can be found in *SGS Pollution Prevention Plan* (Form F053).

16.0. METHOD PERFORMANCE:

Method performance does not apply to this SOP.

17.0. DETECTION LIMIT (DL) STUDY:

N/A

18.0. LIMIT OF DETECTION (LOD):

N/A

19.0. LIMIT OF QUANTITATION (LOQ):

N/A

20.0. REFERENCES:

SW846 5030B Dec. 1996 Rev. 2, Pg. 1 Sec 2.0
SW846 5030B Dec. 1996 Rev. 2, Pg. 5 Sec. 6.1

Controlled copy distributed to Kelly Carson at Brice Environmental.

21.0. ATTACHMENTS:

N/A

Controlled copy distributed to Kelly Carson at Brice Environmental.

SGS	SGS North America, Inc. - Alaska Division Standard Operating Procedure
NOTE: This document contains CONFIDENTIAL business information and is not intended for distribution.	
S.O.P. Title: Purge and Trap Extraction, Non-aqueous	**Revision Date**: September 2017
Method No: SW846 5035A	**SOP No**: 767r10
Page: 1 of 9	**Supersedes**: 767r09

Signatures below reflect periodic review of Standard Operating Procedures. If the procedure is found adequate with little or no editing necessary, this page is signed and dated. An Addendum may be issued for minor changes that need to be implemented immediately. If it is determined that major edits are required, a new revision will be released with a new signature page.

Technical Director Date Quality Assurance (QA) Manager, QA Staff or their Designee Date

Stephen C. Ede 9/26/17 MMeus 9/26/17

Original cover pages with wet signatures and the digitally signed electronic SOP versions are available in the Quality Assurance Office.
A limited number of controlled hard copies will be issued for the Section Method SOPs & Technical Director's offices.

This document will be converted into a PDF file with the QA Manager's, QA Staff's or QA Designee's electronic signature and posted on the network: \\usfs700\ANK_GroupData\Public\DOCUMENT\SOP\~Approved_SOPs~

This electronically signed PDF will be considered the controlled copy for staff. Any printouts or photocopies are invalid.

Each staff member responsible for this SOP will print & sign this coverpage upon successful review, retaining it as a record in their training folder.

I have reviewed and understand the method reference(s) and this version of the SOP.
I agree to use only this currently approved version of the SOP.

Signature: _____ Printed Name: _____ Date: _____

Document Control Number _____ Issued by _____ Date _____

Controlled copy distributed to Kelly Carson at Brice Environmental.

Summary of Changes from Previous Revision:

- Changed reference of -10 to -20°C to -7 to -20°C.
- Adjusted section 6.4.3. to reflect current practices.
- Added additional apparatus being used.
- Added manufacturer of Methanol to section 8.1.
- Adjusted section 8.2. to reflect current practices.
- Adjusted section 9.1.2. to reflect current practices.
- Removed section 9.3.
- Updated attachment extraction QC.
- Added attachment B.

Controlled copy distributed to Kelly Carson at Brice Environmental.

Table of Contents

1.0. OBJECTIVE: 4
2.0. SCOPE AND APPLICATION: 4
3.0. DEVIATIONS FROM REFERENCE METHOD: 4
4.0. RESPONSIBILITIES: 4
5.0. INTERFERENCES: 4
6.0. SAMPLE HANDLING: 5
7.0. APPARATUS: 5
8.0. REAGENTS: 6
9.0. EXTRACTION: 6
10.0. CALIBRATION: 6
11.0. ANALYSIS: 6
12.0. QUALITY CONTROL: 7
13.0. CALCULATIONS, REVIEW AND REPORTING: 7
14.0. HEALTH AND SAFETY: 7
15.0. POLLUTION PREVENTION: 8
16.0. METHOD PERFORMANCE: 8
17.0. DETECTION LIMIT (DL) STUDY: 8
18.0. LIMIT OF DETECTION (LOD): 8
19.0. LIMIT OF QUANTITATION (LOQ): 8
20.0. REFERENCES: 8
21.0. ATTACHMENTS: 8

Controlled copy distributed to Kelly Carson at Brice Environmental.

1.0. OBJECTIVE:

This method is used to extract sediment/soil, solid waste and oil samples for volatile gas chromatograph methods by SW846 5035A.

2.0. SCOPE AND APPLICATION:

2.1 Soil and solid waste samples are typically preserved in the field with methanol. They may be sodium bisulfate preserved or collected and frozen for low level analysis. The preserved/extracted sample is then sent to the laboratory for analysis. At the time of writing this SOP, the State of Alaska Department of Environmental Conservation has not approved the use of sodium bisulfate preservation technique. SGS recommends the use of the low level freezing technique (i.e., 5 grams of soil in 5 ml DI water with stir bar). This SOP will cover the procedure for extracting samples with methanol at the laboratory.

2.2 A portion of sample is weighed, spiked and extracted with methanol. Due to the volatile nature of the components of interest this procedure must be done before the sample is used in any other analysis. Samples extracted by this technique at the laboratory may be considered invalid due to volatile loss before the sample arrives at the laboratory or during the transfer procedure. **Samples received at the laboratory for extraction will be flagged as biased low on the Sample Receipt Form**. Extraction efficiency for solid waste and oil samples may not be the same as for the LCS/LCSD that are extracted with them.

3.0. DEVIATIONS FROM REFERENCE METHOD:

Oil analysis quality control will consist of: An acceptable curve, Initial tune, Initial calibration blank, and a Continuing Calibration Verification.

4.0. RESPONSIBILITIES:

4.1 The QA Office maintains a master list of this SOP to ensure review on a timely basis. This system serves as an accounting of SOP distribution and ensures that distributed SOPs are current and complete. This includes destruction of controlled copies of expired and retired SOPs. The QA Office also maintains a historical file of original cover pages with wet signatures and digitally signed electronic versions of this SOP; including the current revision and any versions archived within the past 5 years.

4.2 The electronic (Word Document) versions of this SOP, both current and any prior versions, are maintained on the computer network in a secure location as a “read only” file.

4.3 It is the responsibility of all personnel to follow this SOP as written, document and gain QA or Technical Director approval for deviations to the SOP, and submit needed SOP revisions to the QA Office.

4.4 This SOP is scheduled for review on an annual basis. Any required revisions will be incorporated into the SOP. The new revision of the SOP will be distributed by QA and the superseded version returned to the QA Office. If no revisions are required, the SOP cover page is signed and dated to document the review, and the updated cover page will be distributed.

4.5 A PDF version of each SOP (generated in Adobe or scanned) is digitally signed by a member of the QA Office as a security measure. The digitally signed PDF, used online, is considered to be a controlled copy of the SOP and is stored on the network.

\\usfs700\ank_groupdata\Public\DOCUMENT\SOP\~Approved_SOPs~

All staff have “read” access to these SOPs. Only QAQC has access to “write” on SOPs. Staff is directed to use the controlled electronic versions of SOPs. A limited number of controlled hardcopies are to be distributed by the QA Office.

Controlled copy distributed to Kelly Carson at Brice Environmental.

5.0. INTERFERENCES:

Samples can be contaminated by diffusion of volatiles (particularly methylene chloride and fluorocarbons) through the septum seal of the sample vial during shipment and storage. Trip blanks which accompany the samples during shipment should be analyzed as a check of such contamination.

6.0. SAMPLE HANDLING:

6.1. Jars for field preserved methanol samples are weighed before they are sent in the client sample kit. These jars must be weighed again when the sample is received at the lab, prior to any analysis, to determine sample mass per SGS Weighing SOP#143. In the event that a non-tared jar is received, the sample jar may be emptied and weighed post analysis for an estimated jar weight; however, this technique is not recommended.

6.2. All samples for volatile analyses should be stored in a location free from volatile contaminants. Field extracted and in-house extracted soils are stored at 0-6° C in Sample Control's GC reach-in for methanol extracted soils to segregate them from all other samples. Encores and low level frozen vials are stored at -7 to -20° C in Sample Control's freezer to segregate them from other samples, etc.

6.3. Samples sent to the laboratory in Encore sampling containers (samples preserved by freezing), will be handled per section 8 of this SOP.

6.4. Holding Times:

6.4.1. Samples preserved/extracted in the laboratory: Volatile organic analysis of soils, oils and solid/sludge samples must be performed within 14 days after sample collection. The extraction/preservation should occur as soon as possible after sample receipt.

6.4.2. Encore sample containers: Encore samples have a hold time of 48 hours at 0-6 ºC. If the samples are frozen (-7° to -20°C) before shipment to the lab, the hold time is extended to 14 days before preservation. All analysis must be completed with 14 days from sampling.

6.4.3. Samples preserved/extracted in the field (methanol and sodium bisulfate): Analysis for soil samples must be performed within 14 days (depending on analysis method). Check backlog for the holding time status. Best results are obtained by allowing the preserved sample to stand under the methanol for at least 24 hours.

7.0. APPARATUS:

7.1. Balance - Analytical, capable of accurately weighing 0.01 g.

7.2. Glass vials – 17-mL, 40mL, and 4-oz with Teflon-lined caps.

7.3. Disposable Pasteur pipettes.

7.4. Small squeeze bulb.

7.5. Refrigerator for extract storage located in Volatile Department.

7.6. Class A volumetric flasks: 25mL, 50mL, 100mL, and 500mL and gas tight syringes: 5, 10, 50, 100, 250, 500µL, 1, 2.5, 5, and 10mL.

Controlled copy distributed to Kelly Carson at Brice Environmental.

8.0. REAGENTS:

8.1. Methanol – Purge and Trap grade, Fisher Chemical High Quality Solvent – Methanol.

8.2. BFB MeOH for field preserved samples: This solution is prepared in the laboratory at a concentration of 2.5 µg/mL BFB in MeOH. Fill a 2,000 mL flask more than halfway with methanol. Using a 1.0 mL syringe, add 1.0 mL Restek Car #30082 4-Bromofluorobenzene Standard (initial concentration 10,000 µg/mL), and fill to the mark with additional methanol. The flask is then carefully inverted three times, and placed into a 4 L storage container. The flask is filled a second time to mark with methanol, and added into the 4 L container. Before the BFB MeOH may be used, a test vial must be prepared and analyzed. To prepare the test, inject 1.0 mL of the BFB MeOH into a 50 mL flask filled up to the neck with reagent water, then fill to the mark with additional reagent water. That solution is then poured into a 40mL amber vial and given to the analyst for evaluation. Once analyzed, the analyst will approve that lot of BFB MeOH by completing the "Approved by" section of the label on the 4L container.

9.0. EXTRACTION:

9.1 Refer to SOP#143 for weighing procedures. Prepare containers for extraction of quality control samples.

9.1.1. Remove the cap, place the jar (4-oz) on the balance, shut the balance door and tare the balance.

9.1.2. Weigh out 50g of sample for preservation/extraction. Add 25mL of 2.5µg/mL BFB methanol as quickly as possible, and cap vial quickly. The methanol extract is then stored at 0-6°C for 24hrs before analysis.

9.2. All samples should be refrigerated a minimum of 24 hours after methanol addition.

9.3. Samples should be allowed to come to room temperature prior to analysis.

9.4. OILS/ORGANIC LIQUID WASTE EXTRACTION

9.4.1. Weigh 1.0 g (± 0.1g) of the sample, (matrix 3 oil) into a screw capped septa sealed vial. Record the weight to two decimal places. Immediately add 5.0 ml BFB methanol.

9.4.2. If the sample dissolves in methanol it is ready for analysis. Excessive sample handling will result in loss of volatile compounds.

9.4.3. Samples that are not miscible in methanol must be stored at 0-6° C for 24 hours before analysis.

9.4.4. Record anything unusual about the sample or any apparent odors.

9.4.5. For additional dilutions the standard used dilution is: 100µl/50mL, post as 5X.

10.0. CALIBRATION:

N/A

11.0. ANALYSIS:

See method specific SOP. (8021, 8260, BTEX, 601,602)

Controlled copy distributed to Kelly Carson at Brice Environmental.

12.0. QUALITY CONTROL:

12.1. For soil samples, a separate aliquot will be provided for percent solids determinations per SOP#115.

12.2. Each soil batch will have a MB, LCS, and MS/MSD. A LCSD may be used if insufficient sample is available for MS/MSD.

12.3. Any corrective action(s) needed to address a QC outlier or other technical challenges that are not listed in this SOP require the prior approval of the QA Office or Technical Department.

13.0. CALCULATIONS, REVIEW AND REPORTING:

13.1. Moisture Adjustment for Methanol Preserved Soils:

% Moisture = 100 – % Solid EQUATION 1

Final Volume = ((Mass of sample * % Moisture) / 1000 + Volume of MeOH EQUATION 2

13.2. Dilution Factor: Soil

(wet wt, g)(% Solid) = Dry weight, g EQUATION 3

$$\text{High level D.F.} = (5\text{ mL MEOH} / \text{Dry weight, g}) * \frac{5\text{ mL water}}{\text{Amount injected, mL}} \quad \text{EQUATION 4}$$

* Note for low level soil methods 8260:

Low level D.F. = (5 g water / Dry weight of sample, g) EQUATION 5

13.3. Dilution Factor: oil

(Weight of oil, g) / Density of oil, g/mL = Volume of oil, mL (if required) EQUATION 6

Oil DF = 5 mL of MEOH / volume of oil, mL * 5 mL water / Amount injected, mL
or Oil DF = 5 mL MEOH / mass of oil, g * 5 mL water / Amount injected, mL EQUATION 7

14.0. HEALTH AND SAFETY:

14.1. Samples shall be returned to the approved storage location until such time as it is determined that no further analysis will be required.

14.2. Once it has been established that no more analysis of a sample will be required, acid and alkaline preserved samples may be neutralized using the Elementary Neutralization Hood located in GC Prep, unless it is considered to be hazardous (i.e. mercury waste, cyanide waste). Refer to the current version of SOP 108 for further instruction.

14.3. All surplus reagent acids shall be neutralized on a daily basis using the Elementary Neutralization Hood located in GC Prep.

14.4. Small volumes of surplus volatile reagents may be allowed to evaporate in a hood at the end of the analytical session.

Controlled copy distributed to Kelly Carson at Brice Environmental.

14.5. Proper Personal Protective Equipment (PPE) must be worn at all times. Proper PPE when handling samples include a lab coat, gloves and safety glasses. In addition, when handling any samples or solutions with any acid or base preservative a face shield and apron must be worn.

15.0. POLLUTION PREVENTION:

SGS is committed to evaluate all areas of the lab with regard to current and potential pollution prevention. Pollution prevention is described as any technique that reduces or eliminates waste at the point of generation. Further discussion on pollution prevention programs in the laboratory can be found in *SGS Pollution Prevention Plan* (Form F053).

16.0. METHOD PERFORMANCE:

Method performance does not apply to this SOP.

17.0. DETECTION LIMIT (DL) STUDY:

N/A

18.0. LIMIT OF DETECTION (LOD):

N/A

19.0. LIMIT OF QUANTITATION (LOQ):

N/A

20.0. REFERENCES:

SW846 8000B (Dec. 1996)
SW846 5035A (July 2002)

21.0. ATTACHMENTS:

ATTACHMENT A: EXTRACTION Q.C.

BTEX/GRO Soil QC setup	Standard added	MeOH (µL)	Final Volume
IB/MB		2mL	100mL
NAS	100µL NAS		100mL
CCV2/CCV	100µL CCV2/CCV		100mL
LCS/LCSD BTEX/GRO	50µL CCV2/CCV	2mL	100mL
MS/MSD soil BTEX/GRO	50µL CCV2/CCV	2mL sample	100mL

BTEX/GRO Water QC setup	Standard added	MeOH (µL)	Final Volume
IB/MB		2mL	100mL
NAS	100µL NAS		100mL
CCV2/CCV	100µL CCV2/CCV		100mL
MS/MSD water	100µL CCV2/CCV	All Sample	100mL

Controlled copy distributed to Kelly Carson at Brice Environmental.

8260 Water samples QC setup	Internal Standard / Surrogate	Primary CCV/ Early Gas	MeOH (µL)	Final Volume
IB / MB	Added by system			100mL
CCV / LCSD	Added by system	60µL	160µL	100mL
Matrix Spike	Added by system	60µL	160µL	100mL
Matrix spike Dup	Added by system	60µL	160µL	100mL
ICV	Added by system	60µL second source	160µL	100mL

8260 Soil samples QC setup	Internal Standard / Surrogate	Primary CCV/ Early Gas	MeOH (mL)	Final Volume
IB / MB	Added by system		2mL	100mL
CCV / LCS	Added by system	60µL each mix	1.8mL	100mL
Matrix Spike	Added by system	60µL each mix	2mL sample	100mL
Matrix Spike Dup	Added by system	60µL each mix	2mL sample	100mL
ICV	Added by system	60µL second source	1.8mL	100mL

ATTACHMENT B: VOLUMES TO USE FOR VARIOUS DILUTIONS

	OIL (500µL)	**TCLP** (500µL)	**SOIL** (1000µL)	**H20** (50,000µL)
5X	100µL	100µL	200µL	10mL
10X	50µL	50µL	100µL	5mL
20X	25µL	25µL	50µL	2.5mL
50X	10µL	10µL	20µL	1mL
100X	5µL	5µL	10µL	500µL
200X	2.5µL	2.5µL	5µL	250µL
500X	1µL	1µL	2µL	100µL

This page intentionally blank

Controlled copy distributed to Kelly Carson at Brice Environmental.

SGS	SGS North America, Inc. - Alaska Division Standard Operating Procedure
NOTE: This document contains CONFIDENTIAL business information and is not intended for distribution.	
S.O.P. Title: Purgeable Organic Compounds Analysis by GC/MS	**Revision Date**: September 2017
Method No: 8260C and 624	**SOP No**: 783r03
Page: 1 of 21	**Supersedes**: 783r02

Signatures below reflect periodic review of Standard Operating Procedures. If the procedure is found adequate with little or no editing necessary, this page is signed and dated. An Addendum may be issued for minor changes that need to be implemented immediately. If it is determined that major edits are required, a new revision will be released with a new signature page.

Technical Director Date Quality Assurance (QA) Manager, QA Staff or their Designee Date

Stephen C. Ede 9/26/17 [signature] 9/26/17

Original cover pages with wet signatures and the digitally signed electronic SOP versions are available in the Quality Assurance Office.
A limited number of controlled hard copies will be issued for the Section Method SOPs & Technical Director's offices.

This document will be converted into a PDF file with the QA Manager's, QA Staff's or QA Designee's electronic signature and posted on the network: \\usfs700\ANK_GroupData\Public\DOCUMENT\SOP\~Approved_SOPs~

This electronically signed PDF will be considered the controlled copy for staff. Any printouts or photocopies are invalid.

Each staff member responsible for this SOP will print & sign this coverpage upon successful review, retaining it as a record in their training folder.

I have reviewed and understand the method reference(s) and this version of the SOP.
I agree to use only this currently approved version of the SOP.

Signature: _____ Printed Name: _____ Date: _____

Add#1 added 5/23/18

Add#2 added 6/27/18

Controlled copy distributed to Kelly Carson at Brice Environmental

SGS	SGS North America, Inc. - Alaska Division Standard Operating Procedure
NOTE: This document contains CONFIDENTIAL business information and is not intended for distribution.	
S.O.P. Title: Purgeable Organic Compounds Analysis by GC/MS	**Revision Date**: June 2018
Method No: 8260C and 624	**SOP No**: 783r03 Add #2
Page: 1 of 1	**Supersedes**: 783r03

Signatures below reflect approval for the following changes to the current SOP. These changes will be incorporated into the SOP during the next review. This addendum will be incorporated into the electronic SOP (i.e., PDF file).

Technical Director	Date	Quality Assurance (QA) Manager, QA Staff or their Designee	Date
Stephen C. Ede	6/27/18	[signature]	6/27/18

I have reviewed and understand the method reference(s) and this version of the SOP.
I agree to use only this currently approved version of the SOP.

Signature: _____ Printed Name: _____ Date: _____

The above referenced SOP should be modified as follows:

Section 12.1 should be changed:

From:

At the beginning of each 12-hour period the GC\MS must be tune must be checked to meet BFB specifications see Table 1. The instrument blank or CCV is used to evaluate the tune. The primary method for BFB tuning is to use the software's autotune feature which takes the apex, the scan prior, and the scan following averages them, and performs a background subtraction. The secondary method of tune (manual) evaluation is to pick the apex, the scan prior, or the scan following and have the software evaluate BFB for that scan.

To:

At the beginning of each 12-hour period **for non-SIM methods,** the GC\MS ~~must be~~ tune must be checked to meet BFB specifications (see Table 1). The instrument blank or CCV is used to evaluate the tune. The primary method for BFB tuning is to use the software's autotune feature which takes the apex, the scan prior, and the scan following averages them, and performs a background subtraction. The secondary method of tune (manual) evaluation is to pick the apex, the scan prior, or the scan following and have the software evaluate BFB for that scan.

Add section 12.15

Surrogates – Surrogates are injected into every QC sample and client sample by the Centurion except for BFB in soil samples. BFB is a soil field surrogate added at the time of sampling. See Attachment A for acceptance criteria and corrective action for outliers.

Controlled copy distributed to Kelly Carson at Brice Environmental.

SGS	SGS North America, Inc. - Alaska Division Standard Operating Procedure
NOTE: This document contains CONFIDENTIAL business information and is not intended for distribution.	
S.O.P. Title: Purgeable Organic Compounds Analysis by GC/MS	**Revision Date**: May 2016
Method No: 8260C and 624	**SOP No**: 783r03 Add#1
Page: 1 of 2	**Supersedes**: 783r03

Signatures below reflect approval for the following changes to the current SOP. These changes will be incorporated into the SOP during the next review. This addendum will be incorporated into the electronic SOP (i.e., PDF file).

Technical Director	Date	Quality Assurance (QA) Manager, QA Staff or their Designee	Date
Stephen C. Ede	5/22/18		5/22/18

I have reviewed and understand the method reference(s) and this version of the SOP.
I agree to use only this currently approved version of the SOP.

Signature: _____ Printed Name: _____ Date: _____

The above referenced SOP should be modified as follows:

S.O.P. Title should be changed:

From:

Purgeable Organic Compounds Analysis by GC/MS

To:

Purgeable Organic Compounds Analysis by GC/MS **and GC/MS-SIM**

Section 2.5 should be changed:

From:

An autosampler is used to move a 5-mL or 25-mL aliquot of a sample into a specially designed purging tube. An inert gas, helium is bubbled through the tube at 40°C. This transfers purgeable compounds as a vapor phase. The vapor passes through a sorbent trap. Once purging is complete, the trap is then heated and back flushed with inert gas desorbing onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the compounds, which are then detected with a mass spectrometer.

To:

An autosampler is used to move a 5-mL or 25-mL aliquot of a sample into a specially designed purging tube. An inert gas, **such as nitrogen**, is bubbled through the tube at 40°C **(or 60°C for 8260C-SIM)**. This transfers purgeable compounds as a vapor phase. The vapor passes through a sorbent trap. Once purging is complete, the trap is then heated and back flushed with inert gas desorbing onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the compounds, which are then detected with a mass spectrometer.

Controlled copy distributed to Kelly Carson at Brice Environmental.

Add section 7.11

7.11 Analytical traps – 'K' type trap for 8260C, 'J' type trap for 8260C-SIM.

Add the following tables to section 10.1.2:

EDB/1,4-dioxane
Waters Table:

Conc. (µg/L)	EDB CCV Std. (µL)	Methanol (µL in 100mL)
.005	2	398
.01	4	396
.02	8	392
.05	20	380
.1	40	360
.2	80	320
.4	160	240
1.0	400	0

Transfer to two 40mL vial. The IS and surrogate are added automatically by the system.

EDB/1,4-dioxane
Soils Table:

Conc. (µg/L)	EDB CCV Std. (µL)	Methanol (mL in 100mL)
.005	2	1.998
.01	4	1.996
.02	8	1.992
.05	20	1.980
.1	40	1.960
.2	80	1.920
.4	160	1.840
1.0	400	1.6

Transfer to two 40mL vial. The IS and surrogate are added automatically by the system.

Controlled copy distributed to Kelly Carson at Brice Environmental.

Summary of Changes from Previous Revision:

- Changed 8260-modified compound list to reflect current practice.
- Changed comment in section 2.5. to reflect correct temperature.
- Changed section 3.1. to reflect current practices.
- Change section 7.3. reference of 5mL purge to 5mL/25mL purge.
- Changed name of gas chromatograph to current one being used.
- Changed name of software being used to current.
- Added the different flask and syringes being used.
- Changed all pH strip references of ≤ 0.5 to 0.5 - 5.5.
- Changed preparation of acidified water to current practices.
- Changed Methanol manufacturer to current one being used.
- Changed steps to make different sources of CCV and Early Gas to reflect current practices.
- Indicated section 8.8. was for Soil, and section 8.9. was for water.
- Changed instrument examples to current examples.
- Adjusted section 10.5.2., section 10.5.3., and 10.7.
- Changed section 11.6. temperature reference to current practice.
- Removed section 11.8.
- Changed section 12.2. to reflect current practice.
- Adjusted section 12.3. and section 12.6.5.
- Changed comment in Attachment A about average RF acceptance criteria and MS/MSD corrective action.

Controlled copy distributed to Kelly Carson at Brice Environmental.

Table of Contents

1.0. OBJECTIVE: 4
2.0. SCOPE AND APPLICATION: 4
3.0. DEVIATIONS FROM REFERENCE METHOD: 5
4.0. RESPONSIBILITIES: 6
5.0. INTERFERENCES: 6
6.0. SAMPLE HANDLING: 7
7.0. APPARATUS: 7
8.0. REAGENTS: 8
9.0. EXTRACTION: 9
10.0. CALIBRATION: 10
11.0. ANALYSIS: 13
12.0. QUALITY CONTROL: 14
13.0. CALCULATIONS, REVIEW AND REPORTING: 17
14.0. HEALTH AND SAFETY: 18
15.0. POLLUTION PREVENTION: 19
16.0. METHOD PERFORMANCE: 19
17.0. DETECTION LIMIT (DL) STUDY: 19
18.0. LIMIT OF DETECTION (LOD): 19
19.0. LIMIT OF QUANTITATION (LOQ): 19
20.0. REFERENCES: 19
21.0. ATTACHMENTS: 19

1.0. OBJECTIVE:

This document outlines a technique and control parameters for identifying and determining the concentrations of volatile organic compounds in various sample matrices. The instrument used for analysis is a GCMS (gas chromatograph/mass spectrometer).

2.0. SCOPE AND APPLICATION:

2.1. Method 8260C is used to determine volatile organic compounds in a variety of waste matrices. This method is applicable to nearly all types of samples, regardless of water content, including ground water, aqueous sludge, waste solvents, oily wastes, mousses, tars, fibrous waste, polymeric emulsions, filter cakes, spent carbons, spent catalysts, soils, and sediments.

2.2. The following analytes can be determined by this method. It is possible to add analytes to this list on a project-by-project basis upon client request; however, special arrangements may be required.

Analyte	CAS Number	Analyte	CAS Number
Chloromethane	74-87-3	Vinyl chloride	75-01-4
Bromomethane	74-83-9	Chloroethane	75-00-3
1,1-Dichloroethane	75-34-3	Carbon Disulfide	75-15-0
Methylene chloride	75-09-2	*trans*-1,2-Dichloroethene	156-60-5
1,2 - Dichloroethane	107-06-2	*cis*-1,2-Dichloroethene	156-59-2
Chloroform	67-66-3	1,1,1-Trichloroethane	71-55-6
1,1-Dichloroethene	75-35-4	Benzene	71-43-2
2-Butanone	78-93-3	1,2-Dichloropropane	78-87-5
Carbon tetrachloride	56-23-5	Methyl-tert-butyl ether	1634-04-4
Trichloroethene	79-01-6	*cis*-1,3-Dichloropropene	10061-01-5
Bromodichloromethane	75-27-4	1,1,2-Trichloroethane	79-00-5
trans-1,3-dichloropropene	10061-02-6	Bromoform	75-25-2
Dibromochloromethane	124-48-1	MIBK	108-10-1
2-Hexanone	591-78-6	Tetrachloroethene	127-18-4
Toluene	108-88-3	Ethylbenzene	100-41-4
Chlorobenzene	108-90-7	*o*-Xylene	95-47-6
p&m-Xylene	108-38-3, 106-42-3	1,1,2,2-Tetrachloroethane	79-34-5
Styrene	100-42-5	1,3-Dichlorobenzene	541-73-1
1,2-Dichlorobenzene	95-50-1	1,4-Dichlorobenzene	106-46-7
Bromochloromethane	74-97-5	1,3-Dichloropropane	142-28-9
Dichlorodifluoromethane	75-71-8	Dibromomethane	74-95-3
2,2'-Dichloropropane	591-20-7	Trichlorofluoromethane	75-69-4
1,2,3-Trichlorobenzene	87-61-6	1,1-Dichloropropene	563-58-6
Isopropylbenzene	98-82-8	1,1,1,2-Tetrachloroethane	630-20-6
1,2,3-Trichloropropane	96-18-4	Bromobenzene	108-68-1
2-Chlorotoluene	95-49-8	*n*-Propylbenzene	103-65-1
1,3,5-Trimethylbenzene	108-67-8	4-Chlorotoluene	106-43-4
1,2,4-Trimethylbenzene	95-63-6	*tert*-Butylbenzene	98-06-6
1,2-Dibromo-3-chloropropane	96-12-8	*sec*-Butylbenzene	135-98-8
Hexachlorobutadiene	87-68-3	1,2,4-Trichlorobenzene	120-82-1
n-Butylbenzene	104-51-8	Naphthalene	91-20-3
1-Chlorohexane	544-10-5	Acetone	67-64-1
Vinyl acetate	158-05-04	Freon 113	76-13-1

Controlled copy distributed to Kelly Carson at Brice Environmental.

2.3. Method 624 is used determine volatile organic compounds in a water matrix. The following analytes can be determined, and are routinely analyzed, by this method. It is possible to add analytes to this list upon client request.

Analyte	CAS Number	Analyte	CAS Number
Chloromethane	74-87-3	Vinyl chloride	75-01-4
Bromomethane	74-83-9	Chloroethane	75-00-3
1,1-Dichloroethane	75-34-3	*cis*-1,2-Dichloroethene	156-59-2
Methylene chloride	75-09-2	*trans*-1,2-Dichloroethene	156-60-5
1,2 - Dichloroethane	107-06-2	1,1,1-Trichloroethane	71-55-6
Chloroform	67-66-3	Benzene	71-43-2
1,1-Dichloroethene	75-35-4	1,2-Dichloropropane	78-87-5
Carbon tetrachloride	56-23-5	*cis*-1,3-Dichloropropene	10061-01-5
Trichloroethene	79-01-6	1,1,2-Trichloroethane	79-00-5
Bromodichloromethane	75-27-4	Bromoform	75-25-2
trans-1,3-dichloropropene	10061-02-6	Tetrachloroethene	127-18-4
Dibromochloromethane	124-48-1	Ethylbenzene	100-41-4
Toluene	108-88-3	*o*-Xylene	95-47-6
Chlorobenzene	108-90-7	1,1,2,2-Tetrachloroethane	79-34-5
p&m-Xylene	108-38-3, 106-42-3	1,3-Dichlorobenzene	541-73-1
Styrene	100-42-5	1,4-Dichlorobenzene	106-46-7
1,2-Dichlorobenzene	95-50-1	Trichlorofluoromethane	75-69-4
Total Xylenes			

2.4. The following compounds (8260-Modified) can be run when special project arrangements are made in advance. If requested, these compounds will be reported as method "8260M":

Analyte	CAS Number
Cyclohexane	110-82-7
n-Hexane	110-54-3

2.5. An autosampler is used to move a 5-mL or 25-mL aliquot of a sample into a specially designed purging tube. An inert gas, helium is bubbled through the tube at 40°C. This transfers purgeable compounds as a vapor phase. The vapor passes through a sorbent trap. Once purging is complete, the trap is then heated and back flushed with inert gas desorbing onto a gas chromatographic column. The gas chromatograph is temperature programmed to separate the compounds, which are then detected with a mass spectrometer.

3.0. DEVIATIONS FROM REFERENCE METHOD:

3.1. 8260: Surrogates are spiked by the instrument, into all calibration levels, blanks, and all analysis at 30µg/L. For soils, BFB is spiked into all calibration level, blanks, and all analysis at 80µg/L.

3.2. 8260: The CCV, LCS, LCSD, MS, & MSD will be prepared using the primary standards.

3.3. A second source ICV is run to verify each calibration acceptance criteria per the DOD QSM. The recovery for all 8260 compounds should be ±20%. Compounds included in the 8260-modified list should be ±50%.

3.4. 624: The trap material and temperatures. Note: There have been substantial improvements to instrumentation and trap packing material since Method 624 was revised.

3.5. 624: Internal standards and surrogates are as listed in this document in section 8.8.

3.6. 624 QC from published method sections (8.1.–8.7.) will be replaced by these SOP sections (8.5. - 8.12.) and section 9.0

3.7. BFB Key Ion Abundance Criteria for MS Tuning will be as listed in section 12.1 of this SOP and will replace section 10 of method 624.

4.0. RESPONSIBILITIES:

4.1. The QA Office maintains a master list of this SOP to ensure review on a timely basis. This system serves as an accounting of SOP distribution and ensures that distributed SOPs are current and complete. This includes destruction of controlled copies of expired and retired SOPs. The QA Office also maintains a historical file of original cover pages with wet signatures and digitally signed electronic versions of this SOP; including the current revision and any versions archived within the past 5 years.

4.2. The electronic (Word Document) versions of this SOP, both current and any prior versions, are maintained on the computer network in a secure location as a "read only" file.

4.3. It is the responsibility of all personnel to follow this SOP as written, document and gain QA or Technical Director approval for deviations to the SOP, and submit needed SOP revisions to the QA Office.

4.4. This SOP is scheduled for review on an annual basis. Any required revisions will be incorporated into the SOP. The new revision of the SOP will be distributed by QA and the superseded version returned to the QA Office. If no revisions are required, the SOP cover page is signed and dated to document the review, and the updated cover page will be distributed.

4.5. A PDF version of each SOP (generated in Adobe or scanned) is digitally signed by a member of the QA Office as a security measure. The digitally signed PDF, used online, is considered to be a controlled copy of the SOP and is stored on the network.

\\usfs700\ank_groupdata\Public\DOCUMENT\SOP\~Approved_SOPs~

All staff have "read" access to these SOPs. Only QAQC has access to "write" on SOPs. Staff is directed to use the controlled electronic versions of SOPs. A limited number of controlled hardcopies are to be distributed by the QA Office.

5.0. INTERFERENCES:

There are three primary sources of contamination:

5.1. Impurities in the purge gas and organic compounds out-gassing from the plumbing ahead of the trap account for the majority of contamination problems. The analytical system must be demonstrated to be free from contamination under the conditions of analysis by running laboratory reagent blanks each day. The use of non-Teflon plastic tubing, non-Teflon threads sealant, or flow controllers with rubber components in the purge and trap system should be avoided.

5.2. Samples can be contaminated by diffusion of volatile organics through the septum seal into the sample during shipment and storage. A field reagent blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

5.3. Contamination by carry-over can occur whenever high level and low-level samples are analyzed sequentially. To reduce carry-over, the purging device and sample syringe must be rinsed with reagent water between sample analyses. Unusually concentrated samples should be followed by analysis of reagent water to check for cross contamination. Since the trap and other parts of the system are also subject to contamination, baking and purging of the entire system may be required.

5.4. Some liquid samples foam up with agitation. This causes contamination in the lines going from the sparge tube. Antifoam is used to inhibit foam production.

6.0. SAMPLE HANDLING:

6.1. Proper Handling: The samples must be iced or refrigerated at 0 – 6ºC from the time of collection until analysis. Frozen soil in 40ml purge vials and Encore samples must be kept at less than or equal to -10°C until analysis or, in the case of Encores, extraction with methanol.

6.2. Holding Time: All properly preserved water, soil, oils, and sludge samples must be analyzed within 14 days of collection. Water samples not preserved to a pH of less than two must be analyzed within 7 days of collection.

6.3. Storage Procedures: Sample bottles must remain hermetically sealed and stored in a location free from any solvents and isolated from all standards and standard solutions.

6.4. Preservation: Water samples are collected in vials containing 0.5mL of 50% HCl as a preservative. This adjusts the pH of the sample to less than 2. Sodium thiosulfate or ascorbic acid must be added prior to acidification if source is chlorinated. Soil samples should be preserved with methanol for medium-high concentration samples or, for low concentration samples, sodium bisulfate or DI water before freezing (refer to SGS SOP#767). In the case of the latter, a methanol preserved sample volume must also be collected in the event concentrations above the calibration range are encountered in the analysis of the sodium bisulfate or frozen aliquot.

6.5. When prepping samples for volatile analysis the only type of gloves that can be used is neoprene. Latex and nitrile gloves will result in carbon disulfide contamination.

7.0. APPARATUS:

7.1. Sample Vials (aqueous samples) – 40mL capacity equipped with a screw cap with a Teflon-faced silicone septum.

7.2. Sample jars (solid samples) - glass jars equipped with a Teflon-lined screw cap lid.

7.3. The Closed System Autosampler, Centurion has vial trays designed to hold 40mL vials. The Centurion holds 100 vials. The system automatically transfers a 5mL/25mL aliquot of sample to a purge vial for purging. The gaseous headspace between the water column and the inlet should be a total volume of less then 15mL. The purge gas must pass through the water column as finely divided bubbles with a diameter of less than 3mm at the origin. The purge gas must be introduced no more than 5mm from the base of the water column.

7.4. Purge and Sample Concentrator Module - The hydrocarbon trap must be at least 25cm long and have an inside diameter of at least 0.105in. The desorber must be capable of rapidly heating the trap.

7.5. Gas Chromatograph - An analytical system complete with a temperature programmable gas chromatograph suitable for on-column injection and all required accessories including syringes, analytical columns, gases, and detector. (Agilent Technologies 7890B/7890A)

7.6. Mass Spectrometer - Capable of scanning from 35 - 300amu every 1 seconds or less, using 70 volts (nominal) electron energy in the electron impact mode and producing a mass spectrum that meets all the criteria in Table 1 when 5-50ng gets to the detector by purging 4-Bromofluorobenzene (BFB) as part of the instrument blank. If 3uL of 50ng/uL SURR solution is added to the samples, that equals 15ng of 4-BFB to the detector assuming a 10:1 injector split.

7.7. Software: MSD Chemstation and Mass Hunter are used for data analysis.

7.8. Class A volumetric flasks: 25mL, 50mL, 100mL, and 500mL and gas tight syringes: 5, 10, 50, 100, 250, 500µL, 1, 2.5, 5, and 10mL.

7.9. Narrow range pH test strips: pH 0.5-5.5

Controlled copy distributed to Kelly Carson at Brice Environmental.

7.10. For instrument specific operating parameters see the instrument maintenance manual.

8.0. REAGENTS:

Note: All in-house standards have an expiration date of one year from production; providing it does not surpass the vendor's expiration date*

8.1. Reagent water – organic free RO water in which the analytes of interest are not observed at ½ the LOQ values.

8.1.1. Acidic RO, (used to prepare samples and calibrations), is prepared by adding ~4mL of 1:1 HCL to 4 liters of reagent water to obtain a pH of ≤ 2.

8.2. Hydrochloric acid (1:1) - Add 50mL of concentrated HCl to 50mL of reagent water.

8.3. Methanol – Purge and Trap grade, Fisher Chemical High Quality Solvent – Methanol

8.4. 20% Sodium Bisulfate solution – Add 100g of sodium bisulfate (Fisher Scientific part # 5240-500) to 500mL of reagent water.

8.5. Calibration and quality control standards for 8260: Certified solutions are purchased from two venders, to be used as calibration and second source standards. The vendors will be chosen from the "ISO Guide 34" list when possible.

8.5.1. Primary 8260 Early Gas Solution: Using a gas tight syringe transfer 1.25 mL each Restek (2000µg/L) vinyl acetate standard, Supelco (2000µg/L) volatile organic compound, and NSI (2000µg/L) 1,3-butadiene into a 50mL volumetric flask filled up to the neck with methanol. Bring to volume with methanol and invert three times. This yields 50/50µg/mL solution.

8.5.2. Primary 8260 CCV Solution: Using a gas tight syringe transfer 1.25mL Restek (2000µg/L) 502.2 Cal 2000 mega-mix, 0.75m/L of Restek (5000µg/L) custom SGS-8 primary standard, and 0.75mL of ECS (10,000µg/L) ketone mixture into a 50mL volumetric flask filled up to the neck with methanol. Bring to volume with methanol and invert three times. This yields a 50/75/150µg/mL solution.

8.5.3. Second Source 8260, Early Gas Solution: Using a gas tight syringe transfer 1.25 mL each Ultra (2000µg/L) voc gas mixture, NSI (2000µg/L) vinyl acetate, and Restek (2000µg/L) 1,3-butadiene standard into a 50mL volumetric flask filled up to the neck with methanol. Bring to volume with methanol and invert three times. This yields 50/50µg/mL solution.

8.5.4. Second Source 8260 CCV Solution: Using a gas tight syringe transfer 1.25mL Supelco (2000µg/L) SS 502/524 volatile organics calibration mix, 0.75m/L of Restek (5000µg/L) custom SGS-8 secondary standard, and 1.25mL of Restek (5,000µg/L) VOA calibration mix #1 into a 50mL volumetric flask filled up to the neck with methanol. Bring to volume with methanol and invert three times. This yields a 50/75/150µg/mL solution.

8.6. Spike solution (SPK) – Use the appropriate Primary Standard to spike samples (MS and MSD) when required.

8.7. Surrogate solution (SUR) - Certified solution purchased from Supelco #49112-U at a concentration of 10,000µg/mL (toluene-D_8, 4-bromofluorobenzene, and 1,2-dichloroethene-D_4).

8.7.1. Prepared by dilution. Place approximately 80mL of methanol in a 100mL class A volumetric flask. Inject 0.5mL of the surrogate solution into the methanol. Bring to volume with methanol. Invert three times. This yields a 50µg/mL surrogate solution.

Controlled copy distributed to Kelly Carson at Brice Environmental.

8.8. Internal Standard Solution (INT) for Soil - certified solutions purchased from Restek Custom Internal Standard Mix at a concentration of 10,000µg/mL (fluorobenzene, 1-chloro-3-fluorobenzene, and 1,2-dichlorobenzene-D_4).

8.8.1. Prepared by dilution. Place approximately 40mL of methanol in a 50mL class A volumetric flask. Inject 250µL of the internal standard solution into the methanol. Bring to volume with methanol. Invert three times. This yields a 50µg/mL internal standard solution.

8.8.2. A combined internal standard / surrogate solution for manual injection is prepared by diluting 0.5mL of Surrogate solution (8.10) and 0.5mL Internal Standard mix (8.11) into 100mL of methanol. This mix is 50µg/mL and is used 3.0µl per 5.0mL sample.

8.9. Combined Internal Standard and Surrogate mix for Water, Closed System Centurions.

8.9.1. Prepared by dilution using the purchased standards Restek Custom Internal Standard Mix 555809 (10,000ug/mL) and Supelco 8260 surrogate mix 20557902 (10,000mg/mL). Place approximately 80mL of methanol in a 100mL class A volumetric flask. Inject 1.5mL of Restek Custom Internal Standard Mix and 1.5mL of Supelco surrogate mix into the methanol. Bring to volume with methanol. Invert three times. This yields a 150µg/mL solution for the 25 mL purge.

8.9.2. To prepare the Internal Standard and Surrogate mixes for the Centurion, place approximately 15mL of methanol in a 25mL, class A, volumetric flask. Dilute the 150µg/mL solution prepared above (8.9.1) by diluting 5.0mL of the 150µg/mL solution to 25mL with methanol. Invert three times. This yields a 30µg/mL solution that is used for the 5 mL purge.

8.10. Purchased standards should not be used past manufacturer's expiration date. Standards prepared from stock solutions are valid for one year from creation, manufacturer's expiration date, or when signs of degradation are observed.

8.10.1. Transfer each stock standard solution into its own Teflon-sealed screw cap bottle and store in the freezer protected from light with minimal head space. Label and date bottle in accordance with the Laboratory Standards Labeling SOP #112.

8.12. BFB MeOH for field preserved samples: This solution is prepared in the laboratory at a concentration of 2.5 µg/mL BFB in MeOH. Fill a 2,000 mL flask more than halfway with methanol. Using a 1.0 mL syringe, add 1.0 mL Restek Car #30082 4-Bromofluorobenzene Standard (initial concentration 10,000 µg/mL), and fill to the mark with additional methanol. The flask is then carefully inverted three times, and placed into a 4 L storage container. The flask is filled a second time to mark with methanol, and added into the 4 L container. Before the BFB MeOH may be used, a test vial must be prepared and analyzed. To prepare the test, inject 1.0 mL of the BFB MeOH into a 50 mL flask filled up to the neck with reagent water, then fill to the mark with additional reagent water. That solution is then poured into a 40mL amber vial and given to the analyst for evaluation. Once analyzed, the analyst will approve that lot of BFB MeOH by completing the "Approved by" section of the label on the 4L container.

8.13. Antifoam: liquid polymer without volatile compound interferences, used to reduce surface tension.

9.0. EXTRACTION:

Please refer to SGS SOPs 764 and 767.

Controlled copy distributed to Kelly Carson at Brice Environmental.

10.0. CALIBRATION:

10.1. Before recalibrating, each instrument shall be tuned using PFTBA. Compare abundance of ion 69 to ratios of ions 131 & 219, and peak widths of each ion to previous tune print outs. If out of control values are observed, perform MS autotune and then retune manually. When acceptable results are gained, the tune (along with parameters) will be printed and filed in instrument specific binders.

10.1.1. Calibration Setup – Calibration standards are prepared from the primary solutions in the previous section.

10.1.2. The 8260-Modified list of compounds (refer to section 2.) methyl-tert-butyl ether and carbon disulfide are calibrated at 1.5 times the "normal" concentration of 0.4 – 70µg/mL. Calibrated at 2 times the "normal" concentration are: p&m xylene. Calibrated at 3 times the "normal" concentration are: acetone, 2-butanone, 4-methyl-2-pentanone, and 2-hexanone.

Waters Table:
For 5mL purge

Prepared in acidic DI water

Conc. (µg/L)	CCV Std. and Early Gas Std. (µL in 100mL)	Methanol (µL in 100mL)
0.075	0.15	400
0.4	0.8	398
1.0	2.0	396
3	6.0	388
10	20	360
30	60	280
50	100	200
70	140	120
200	400	0

Transfer to two 40mL vial. The IS and Surrogate are added automatically (30µg/L) by the system.

Soils Table:
For 5mL purge

Prepared in DI water

Conc. (µg/L)	CCV Std. and Early Gas Std. (µL of each)	Methanol (mL in 100mL)
0.4	0.8	1.998
1.0	2.0	1.996
4.0	8.0	1.984
8.0	16	1.968
30	60	1.88
50	100	1.8
70	140	1.72
200	400	1.2

Transfer to two 40mL vial. The IS and surrogate are added automatically (30µg/L) by the system.

Controlled copy distributed to Kelly Carson at Brice Environmental.

Low Level Soils Table:
For methanol 25mL purge

Prepared in DI water

Conc. (µg/L)	CCV Std. and Early Gas Std. (µL of each)	Methanol (mL in 100mL)
0.02	0.2 (in 500mL)	10 (in 500mL)
0.08	0.8 (in 500mL)	10 (in 500mL)
0.4	0.8	1.998
1.0	2.0	1.996
4.0	8.0	1.984
8.0	16	1.968
30	60	1.88
50	100	1.8
100	200	1.6

Transfer to two 40mL vial. The IS and surrogate are added automatically (30µg/L) by the system.

Low Level Soils Table
For 5mL in-vial purging

Conc. (µg/L)	CCV/Early Gas Std. (µL/ea)	Final vol. (mL)	MeOH (µL)
0.4µg/L	0.8	100	279
1.0µg/L	2	100	278
3.0µg/L	6	100	268
10µg/L	1	5	12
30µg/L	3	5	8
50µg/L	5	5	4
70µg/L	7	5	0

A 5mL aliquot is then added to a 40mL vial containing blank sand and fitted with a stir-bar. The IS and Surrogate are added automatically (30µg/L) by the system.

10.2. Calibration Processing Steps:

10.2.1. Load the current calibration for the instrument of interest. (VRA, VQA, etc.)

10.2.2. Save the method to the date run. (VSA2008-0512.M)

10.2.3. Load the data file. Load the 30 point for 8260.

10.2.4. Quant the 30 point.

10.2.5. Init. Cal. – update levels – retention times

10.2.6. Init. Cal. – Clear all calibration responses.

10.2.7. Init. Cal. – update levels – responses

10.2.8. Init. Cal. – Global Update – set curve fit – average response

10.2.9. Save Method

Controlled copy distributed to Kelly Carson at Brice Environmental.

10.2.10. Quant 30 point.

10.2.11. Con. Cal. – Save ISTD responses

10.2.12. Q Edit 30 point. All values should be 30.00, 45.00, or 90.00 respectively. Save Method.

10.2.13. If all values do not meet the exact value, repeat the process, after saving the method.

10.2.14. Save the method.

10.2.15. Quant each of the other points of the curve, Q Edit, Save, Update responses in Init. Cal., Save Method.

10.2.16. Review each analyte to meet QC criteria per section 10.5.

10.3. To evaluate the calibration, a response factor report is prepared. The report calculates the average response factor for each analyte and the relative standard deviation between response factors for the different concentrations.

10.3.1. Each of the most common analytes in the calibration verification standard should meet the minimum response factors as noted in Attachment B.

10.3.2. If the minimum response factors are not met the system should be evaluated and corrective action should be taken before samples are analyzed.

10.3.3. All target compounds of interest must be evaluated using a 15% variability criterion. Use percent difference when performing the average response factor model calibration.

10.4. System performance check compounds (SPCC) -8260C does not have SPCCs.

10.5. The criteria used for curve fit is as follows:

10.5.1. Average Response Factor (RRF): (Preferred), Analytes with an RSD less than or equal to 15% for their average response factor are quantitated using the average factor. A minimum of 5 points are required. If the RSD is greater than 15% then one of the following options will be used.

10.5.2. Linear (1st order) least squares regression: This option requires a minimum r^2 value of 0.990 (or a r value of 0.995). A minimum of 5 points are required. As per method 8000C, forcing through zero is not permitted.

10.5.2.1. When calculating the calibration curves using the linear regression model, a minimum quantitation check on the viability of the lowest calibration point should be performed by re-fitting the response from the low concentration calibration standard back into the curve. It is not necessary to re-analyze a low concentration standard, rather the data system can recalculate the concentrations as if it were an unknown sample. The recalculated concentration of the low calibration point should be within ±30% of the standard's true concentration.

10.5.2.2. Analytes which do not meet the minimum quantitation calibration refitting criteria should be considered "out of control" and corrective action such as redefining the lower limit of quantitation and/ or reporting those "out of control" target analytes as estimated when concentration is at of near the lowest calibration point may be appropriate.

10.5.3. Quadratic non-linear (2nd order) regression: This option requires a minimum r^2 value of 0.990 (or an r value of 0.995). A minimum of 6 points are required. As per method 8000C, forcing through zero is not permitted.

Controlled copy distributed to Kelly Carson at Brice Environmental.

10.5.4. The use of weighted least squares regression may be used. The deciding factor in the use of these techniques will be the residuals for the calibration points (which fit best matches the points). The residual is the difference between the known concentration of the calibration point and the calculated value based on the calibration curve. The analyst should strive to reduce the residual error at each point in the calibration to less than 20%.

10.6. Relative retention times (RRT) for all calibration points must agree within 0.06 RRT units from the mid point of the calibration curve. RRT= RT Analyte (minutes)/RT Internal Standard (minutes).

10.7. After a calibration is complete, initial calibration verification (ICV) is run using a Second Source Solution (sections 8.5.3. and 8.5.4). Goals are achieved if all analytes are ± 20% of the calculated true value of the solution. **Note: For 8260-Modified compounds (refer to section 2.0.), ICV criteria are ± 50%.**

11.0. ANALYSIS:

11.1. Initial screening of samples is done by visually inspecting the appearance of the sample. The LIMS queue backlog is checked for the required analysis and special QA/QC requirements.

11.1.1. Liquid samples that demonstrate a tendency to foam with agitation are treated with antifoam to inhibit the formation of foam in the sparge tube. A blank sample, with antifoam added, is processed with any samples analyzed with the addition of antifoam.

11.2. For water samples – After allowing the sample to come to ambient temperature place the 40mL vial on the Centurion autosampler. The Centurion will remove a 5mL aliquot from the vial and before transferring will inject IS/Surr mix to yield a final concentration of 30µg/L. After the analysis, the pH of the sample is taken using narrow range pH indicator strips (pH 0.5 - 5.5) from the sample remaining in the vial, and recorded on runlog.

11.3. All TCLP leachates and 100% liquid TCLP samples must come to ambient temperature before analysis. These samples are analyzed at a 50X dilution or per client request. This meets the regulatory TCLP limits. 100% liquid TCLP samples must be filtered prior to analysis using a syringe filter. Matrix "6" samples that are not TCLP analyses are diluted 50X before analysis. Matrix "6" samples that are not TCLP analyses may or may not be filtered prior to analyses per client request. Matrix "6" TCLP samples are filtered and analyzed at a 50X dilution.

11.4. For methanol preserved soil samples – Preparation of this matrix requires dilution prior to analysis. After allowing the sample to come to ambient temperature a 1.0mL aliquot of the methanol extract is diluted to 50mL. Transfer solution to a 40mL vial and place on the autosampler for analysis. The Centurion will remove a 5mL or 25mL aliquot from the vial and before transferring will inject IS and surrogate to yield a final concentration of 30µg/L.

11.5. Frozen (thawed soil/DI water) and sodium bisulfate preserved soil samples are set-up on the closed system instrument as received from the field. Refer to SOPs # 764, & 767 (methods 5030C and 5035A) for purge and trap extraction.

11.6. Soil samples not extracted in the field will be treated as field extracts. {Refer to SOP # 764, & # 767 (methods 5030C & 5035A) for extraction.} Weigh out approximately 50g of sample and add 25mL of BFB-methanol into a pre-weighed 4.0 oz. jar. Both the initial weight and final weight will be stored in LIMS or recorded in the AK101/ 8260C logbook (refer to SOP#143 for weighing procedures). The extracted samples must be iced or refrigerated at 0 - 6°C for 24 hours before analysis can be performed.

Controlled copy distributed to Kelly Carson at Brice Environmental.

11.7. Qualitative Analysis. The qualitative identification of compounds in a sample is based on retention time and comparison of mass spectrum with characteristic ions in a reference spectrum. The reference spectrum must be generated using the same conditions as the calibration. The characteristic ions from the reference mass spectrum are typically the three ions of greatest intensity, or any ions over 30% relative intensity if less than three such ions occur in the reference spectrum. Positive identification of target compounds is confirmed when the following criteria are met:

11.7.1. The compound elutes within the retention time window set during calibration.

11.7.2. The relative intensities of the characteristic ions agree within 30% from the reference spectrum.

11.7.3. Identification is hampered when individual analytes are not resolved chromatographically and produce mass spectra containing ions contributed by more than one compound. The identification criteria may be met, but each compound spectrum will contain extraneous ions. Analyst judgment is imperative while deciding to assign or eliminate peaks that are target analytes.

11.7.4. For samples containing impurities not associated with the calibration standards, a library search may be performed for the purpose of tentative identification. For guidance regarding Tentatively Identified Compounds (TICs), refer to SGS SOP 500.

11.7.5. Quantitation of calibrated compounds: Once a compound has been identified, quantitation is based on the integrated abundance of the primary characteristic ion. The internal standard used is the one closest in retention to that of the compound. The average RRF or calibration equation from the most recent initial calibration is used for the calculation.

11.7.6. Batches that are run in tandem with 2 concentrators must be screened by the analyst to identify samples that may present cross contamination due to the concentration of analytes in that sample. Those samples must be documented in the run log for both concentrators as well as all samples that could be affected. This must be completed before any samples are reported from either “side” of the run. Samples so identified must be evaluated by the analyst for carryover contamination before reporting. The Peer Reviewer will insure that the noted samples have been evaluated for cross contamination.

11.7.6.1. When evaluating this type of data, check run times to determine the order of analysis. The standard alternation of concentrators can be changed when one instrument has down time and the other does not (e.g. failed QC for one of the two instruments).

12.0. QUALITY CONTROL:

12.1. At the beginning of each 12-hour period the GC\MS must be tune must be checked to meet BFB specifications see Table 1. The instrument blank or CCV is used to evaluate the tune. The primary method for BFB tuning is to use the software’s autotune feature which takes the apex, the scan prior, and the scan following averages them, and performs a background subtraction. The secondary method of tune (manual) evaluation is to pick the apex, the scan prior, or the scan following and have the software evaluate BFB for that scan.

Controlled copy distributed to Kelly Carson at Brice Environmental.

Table 1
BFB Key Ion Abundance Criteria for MS Tuning

Mass	Ion Abundance Criteria
50	15 to 40% of m/z 95
75	30 to 60% of m/z95
95	base peak, 100% relative abundance
96	5 to 9% of m/z 95
173	less than 2% of m/z 174
174	>50% of m/z 95
175	5 to 9% of m/z 174
176	95% to 101% of m/z 174
177	5 to 9% of m/z 176

Note that autotune is routinely used and the manual procedure is used in a minority of circumstances.

When manually performing the BFB tune, follow these steps to subtract the background:

A. Choose the area to be scanned, using the left mouse button.
B. Double click inside the chosen area.
C. Double click outside the peak area.
D. Choose the "subtract" option under the "TUNER" macro box.

12.2. Before processing any samples the analyst analyzes an instrument blank. The instrument blank can serve as the tune blank and shows that interferences from the analytical system and reagents are under control. If any analytes are detected above the LOQ in the blank, and are detected in the associated samples above the LOQ for non-DOD and ½ the LOQ for DOD, then those compounds must be reanalyzed. If the analytes detected in the blank are not detected in the samples above the LOQ or ½ LOQ, reanalysis is recommended, but not necessary.

12.3. One method blank is run per batch. This shows that interference from glassware and reagents is under control.

12.4. **The ICV is prepared using the second source standards.**

12.5. Oil Quality Control:

An acceptable curve, Initial tune, initial blank and continuing calibration verification.

DAILY QC SETUP

Water samples QC setup	Internal Standard / Surrogate	Primary Source 8260	Primary Source Early Gases	MeOH (µL)	Final Volume
IB / MB	Added by system				100mL
CCV / LCSD	Added by system	60µL	60µL	160µL	100mL
Matrix Spike	Added by system	60µL	60µL	160µL	100mL
Matrix spike Dup	Added by system	60µL	60µL	160µL	100mL

Controlled copy distributed to Kelly Carson at Brice Environmental.

Soil samples QC setup	Internal Standard / Surrogate	Primary Gas/Early Gas	MeOH (mL)	Final Volume
IB / MB	Added by system		2mL	100mL
CCV / LCS	Added by system	60µL each mix	1.8mL	100mL
Matrix Spike	Added by system	60µL each mix	2mL sample	100mL
Matrix Spike Dup	Added by system	60µL each mix	2mL sample	100mL

12.6. OILS/ORGANIC LIQUID WASTE EXTRACTION:

12.6.1. Weigh 1.0 g (± 0.1g) of the sample, (matrix 3 oil) into a screw capped septa sealed vial. Record the weight to two decimal places. Immediately add 5.0 ml BFB methanol.

12.6.2. If the sample dissolves in methanol it is ready for analysis. Excessive sample handling will result in loss of volatile compounds.

12.6.3. Samples that are not miscible in methanol must be stored at 0-6º C for 24 hours before analysis.

12.6.4. Record anything unusual about the sample or any apparent odors.

12.6.5. For additional dilutions the standard used dilution is 100µg/L/50mL post as 5X.

12.7. The experience of the analyst performing GC\MS analysis is invaluable to the success of the methods. Each day that analyses are performed, the daily calibration standard should be evaluated to determine if the chromatographic system is operating properly. Questions that should be asked are: Do the peaks look normal? Is the response obtained comparable to the response from previous calibrations? Careful examination of the standard chromatogram can indicate whether the column is still usable, the injector is leaking, etc. If any changes are made to the system (e.g. column changed), recalibration of the system should take place. **Note:** For manual integration guidance, please refer to SOP#144.

12.8. The calibration verification is run at the beginning of each 12-hour period in the analytical lot after the tune check. The calibration verification standard (CCV) is used to check the validity of the initial calibration. The percent drift for a CCV and all other analytes (calculated as the percent difference between the true and recovered CCV concentrations) must be less than +/- 20%. If the CCV recovery is low, all data for that analyte will not be reported and will be reanalyzed the following day. In the event of a high bias, every attempt will be made to reanalyze the samples with recoveries for the affected analyte in an additional analytical run. If this is not possible due to hold time expiration or insufficient sample volume the results may be posted as estimated. (Refer to SOP#136 for Data Flagging.)

12.8.1. Internal Standard Retention Time- The retention times for the internal standards in the CCV must be evaluated. If the retention time for any internal standard changes by more than 10 seconds from that of the midpoint standard level of the most recent calibration sequence then the chromatographic system must be inspected for malfunctions and corrections must be made. When the corrections are made, reanalysis of samples analyzed while the system was malfunctioning is required.

12.8.2. **All methods for DOD samples:** In the event of a recovery failure for analytes of interest in continuing or closing CCV samples, the Analyst may immediately (within 1 hr of the failing CCV and before any other samples have acquired) rerun 2 successive CCVs. If both meet QC criteria for all analytes of interest, then the samples already analyzed may be reported and the run sequence may be continued. Samples following the two passing CCVs are also valid. **All CCVs must be reported in LIMS.** Refer to SOP#101 for nomenclature (e.g., CCCV, CVC, CVCA, etc.)

Controlled copy distributed to Kelly Carson at Brice Environmental.

12.9. The minimum response factors listed in Table 4 must be met. Internal Standard area counts must not change by more than a factor of two (-50 % to +100%) from the mid-point standard in the most recent initial calibration. Internal standard retention time of the CCV must not change by more than 10 seconds from the mid-point standard in the initial calibration. If the criteria are not met, investigate the problem. Reanalyze the standard or analyze a new calibration curve.

12.10. Laboratory Control Sample (LCS) - Each analyte should be within lab generated control limits. When analytes fall outside of control limits refer to Peer Review SOP#101 for sample comments. If problem persists corrective action should be taken to return the instrument to proper control.

12.11. Matrix spikes / Matrix Spike Duplicate (MS / MSD) - Spike two sample aliquots with the primary solution. The analytes should be within the LCS lab generated control limits for each analyte, and the relative percent difference (RPD) between the spikes must be less than or equal to 20%. MS recoveries are not used to control the acceptability of a batch. A footnote is to be generated discussing any outliers. If there is insufficient sample volume to perform an MS/MSD an LCSD must be analyzed as part of the extraction batch.

12.12. Initial Demonstration of Proficiency. – Once per Analyst. Four replicate standards are analyzed and evaluated for recovery and RPD per EPA 8000C section 8.0.

12.13. Refrigerator/storage blanks are used to monitor for potential cross contamination in temporary and long-term storage units. (Refer to SOP#104 for details.) These storage blanks will be logged into LIMS and treated on a RUSH basis. Those analyzed by 8260C will be evaluated to ½ LOQ. Anything in excess will be rerun to confirm.

12.14. Section 16 outlines QC criteria and corrective actions. Any corrective action required to address a QC outlier or technical problem which not listed in this SOP requires the prior approval of the QA Manager or Technical Director.

13.0. CALCULATIONS, REVIEW AND REPORTING:

13.1. **% Solid** = $\frac{\text{(g. of dry sample + pan) - (pan weight) x 100}}{\text{(g. of wet sample)}}$

Example $\frac{(3.034 \text{ gm}) - (1.567) \text{ X } 100}{(5.034)} = 29.14\%$

13.2. **Moisture Adjustment for Methanol Preserved Soil :**

% Moisture = 100 - % Solid

Final Volume = (Mass of sample * % Moisture) / 100 + MeOH Volume

13.3. **Dilution factor for soils**:

[wet weight (g.)] $\left[\frac{\text{\% solid}}{100}\right]$ = True weight (g.)

$\frac{\text{5 mL methanol}}{\text{True weight}}$ X $\frac{\text{5 mL water}}{\text{mL of samples}}$ = Dilution Factor

Example(5 gm sample) $\left(\frac{92\% \text{ solids}}{100}\right)$ = 4.6 gm true weight

$\frac{(5 \text{ mL MEOH})}{(4.6 \text{ gm true weight})}$ X $\frac{(5 \text{ mL water})}{(0.100 \text{ mL sample})}$ = 58.69 dilution factor

Controlled copy distributed to Kelly Carson at Brice Environmental.

13.4. **Dilution factor for oil/sludges**:

$$\frac{\text{5 mL methanol}}{\text{wt (g) of sample}} \times \frac{\text{5 mL water}}{\text{0.050 mL MeOH ext.}} = \text{Dilution factor}$$

Example for a 1 gm sample, injected at 50 µL

$$\frac{\text{5 mL}}{\text{1.0 gm}} \times \frac{\text{5 mL}}{\text{.050 mL}} = \text{500 dilution factor}$$

Note: All oil samples for TCLP must be density corrected.

13.5. **Dilution factor for oil/sludges w / Density correction**.

$$\text{Example} \frac{\text{2.1360 gm of sample}}{\text{0.956 gm/mL}} = \text{2.2343 mL}$$

Example for a 2.1360 gm sample, injected at 50 µL

$$\frac{\text{5 mL}}{\text{2.2343 mL}} \times \frac{\text{5 mL}}{\text{0.050 mL}} = \text{223.78 dilution factor}$$

13.6. **Estimated concentration for noncalibrated compounds**

$$\frac{\text{(Area of Sample from Total Ion Chromatogram)}}{\text{(Area of IS from Total Ion Chromatogram)}} \times \frac{\text{(Conc Internal Standard(ug/mL))}}{\text{(Response Factor=1.00)}} \times \text{(Dilution Factor)} = \text{Conc ug/L}$$

13.7. **Example calculation for compound concentration**

$$RF = \frac{As \times Cis}{Ais \times Cs}$$ RF is generated from calibration

$$Cs = \frac{As \times Cis}{RF \times Ais}$$ Cs is generated daily

Cis = Concentration of internal standard.
Ais = Area of Internal Standard
Cs = Concentration of Analyte
As = Area of Analyte

14.0. HEALTH AND SAFETY:

14.1. Samples shall be returned to the approved storage location until such time as it is determined that no further analysis will be required.

14.2. Once it has been established that no more analysis of a sample will be required, acid and alkaline preserved samples may be neutralized using the Elementary Neutralization Hood located in GC Prep, unless it is considered to be hazardous (i.e. mercury waste, cyanide waste). Refer to the current version of SOP#108 for further instruction.

14.3. All surplus reagent acids shall be neutralized on a daily basis using the Elementary Neutralization Hood located in GC Prep.

14.4. Small volumes of surplus volatile reagents may be allowed to evaporate in a hood at the end of the analytical session.

14.5. Proper Personal Protective Equipment (PPE) must be worn at all times. Proper PPE when handling samples include a lab coat, gloves and safety glasses. In addition, when handling any samples or solutions with any acid or base preservative a face shield and apron must be worn.

Controlled copy distributed to Kelly Carson at Brice Environmental.

15.0. POLLUTION PREVENTION:

SGS is committed to evaluate all areas of the lab with regard to current and potential pollution prevention. Pollution prevention is described as any technique that reduces or eliminates waste at the point of generation. Further discussion on pollution prevention programs in the laboratory can be found in *SGS Pollution Prevention Plan* (Form F053).

16.0. METHOD PERFORMANCE:

There are no method performance measures to report at this time.

17.0. DETECTION LIMIT (DL) STUDY:

DL studies are performed when a significant change in instrument response is observed, when a new instrument is purchased for analysis. The DL is intended to demonstrate the capability of this method as it is implemented at SGS. An update to the DL does not necessitate an update to this document. Further guidance on performing a DL study can be found in SOP 116.

18.0. LIMIT OF DETECTION (LOD):

The LOD is defined per SOP 116; LOD verification shall be performed quarterly according to the schedule set by the QA Office.

19.0. LIMIT OF QUANTITATION (LOQ):

19.1. The LOQ is defined per SOP 116; LOQ verification shall be performed quarterly according to the schedule set by the QA Office.

20.0. REFERENCES:

SW846 8000C and 8260C SW846 5030C and 5035A (August 2006)

EPA624 (October 1984)

DOD QSM, current version

21.0. ATTACHMENTS:

Attachment A: Corrective Action Table
Attachment B: Recommended Minimum Relative Response Factor Criteria for initial and continuing calibration verification

Controlled copy distributed to Kelly Carson at Brice Environmental.

Attachment A: CORRECTIVE ACTION TABLE

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial Calibration for all analytes (ICAL)	Periodic	Average RF analytes ≤15% Linear/non-linear analytes $r^2 \geq 0.99$ or $r \geq 0.995$	Troubleshoot Repeat calibration.
Second Source Cal. Verification. (ICV)	Once per initial cal.	All analytes within 20 % true value. 8260-Modified analytes (section 2.0.) ± 50 % true value	Repeat analysis once. If criteria is still out, Troubleshoot, Repeat Calibration
Calibration Verification (CCV)	At the beginning of each 12 Hour period, and the end of the run for DOD samples only	SPCC average RF ≥ section 10.4. RPD for all analytes ≤ 20 **For DOD** samples: Closing CCV +/- 50%	**For non-DOD samples:** 1. Repeat analysis once. 2. If QC criteria not met, then recalibrate and reanalyze. **For DOD samples:** 1. Immediately (within 1 hr and before any other samples have acquired) run two successive CCVs. If both meet QC criteria, then samples already analyzed may be reported and the run may continue.
Method blank	One MB per extraction batch	< LOQ for analytes of interest. For DOD clients, <½ the LOQ.	If associated sample result > 10X the blank contamination, note in LIMS and apply "B" flag to all affected results. If associated sample result < 10X the blank contamination, re-analyze and or re-extract. Note in LIMS and apply "B" flag to all results.
LCS LCSD	One per extraction batch	LCS: Based on laboratory control limits, RPD ≤ 20% LCSD: Used only for sample duplicate RPD. Based on laboratory control limits, RPD ≤ 20%	Repeat analysis once. If target analytes are outside control, high, and not detected in sample, report the data with qualification. If target analytes are outside control, low, repeat analysis.
MS/MSD(Recovery) MS/MSD(RPD)	1 set per batch of 20samples or less	Recovery based on LCS criteria. RPD ±20%	Review / report data. MS recoveries not used for batch control.
Surrogates	Every Sample	Water and soil criteria dependent on in-house control limits.	If analyte is not detected, report. Rerun samples with positive results.
Tune Standard: Prior to Calibration And at the beginning of each 12-hour analytical period.		Method specific see SOP Section 11.1. and table 1	Rerun the tune If condition continues, Retune instrument and recalibrate.
Internal Standard	Every sample post extraction.	From 50% to 200% of midpoint calibration values. One client requires 50 – 130%	Troubleshoot Repeat analysis.
12 hour clock	Each analytical period	Passing Tune, IB, and CCV and the beginning of each analytical run.	Samples outside of the 12 hour clock cannot be reported.

Controlled copy distributed to Kelly Carson at Brice Environmental.

Attachment B: RECOMMENDEDED MINIUMUM RELATIVE RESPONSE FACTOR

Volatile Compounds	Minimum Response Factor (RF)	Typical Response Factor (RF)
Dichlorodifluoromethane	0.100	0.327
Chloromethane	0.100	0.537
Vinyl chloride	0.100	0.451
Bromomethane	0.100	0.255
Chloroethane	0.100	0.254
Trichlorofluoromethane	0.100	0.426
1,1-Dichloroethene	0.100	0.313
1,1,2-Trichloro-1,2,2-trifluoroethane	0.100	0.302
Acetone	0.100	0.151
Carbon disulfide	0.100	1.163
Methyl Acetate	0.100	0.302
Methylene chloride	0.100	0.380
trans-1,2-Dichloroethene	0.100	0.351
cis-1,2-Dichloroethene	0.100	0.376
Methyl tert-Butyl Ether	0.100	0.847
1,1-Dichloroethane	0.200	0.655
2-Butanone	0.100	0.216
Chloroform	0.200	0.557
1,1,1-Trichloroethane	0.100	0.442
Cyclohexane	0.100	0.579
Carbon tetrachloride	0.100	0.353
Benzene	0.500	1.368
1,2-Dichloroethane	0.100	0.443
Trichloroethene	0.200	0.338
Methylcyclohexane	0.100	0.501

Volatile Compounds	Minimum Response Factor (RF)	Typical Response Factor (RF)
1,2-Dichloropropane	0.100	0.382
Bromodichloromethane	0.200	0.424
cis-1,3-Dichloropropene	0.200	0.537
trans-1,3-Dichloropropene	0.100	0.515
4-Methyl-2-pentanone	0.100	0.363
Toluene	0.400	1.577
1,1,2-Trichloroethane	0.100	0.518
Tetrachloroethene	0.200	0.606
2-Hexanone	0.100	0.536
Dibromochloromethane	0.100	0.652
1,2-Dibromoethane	0.100	0.634
Chlorobenzene	0.500	1.733
Ethylbenzene	0.100	2.827
meta-/para-Xylene	0.100	1.080
ortho-Xylene	0.300	1.073
Styrene	0.300	1.916
Bromoform	0.100	0.413
Isopropylbenzene	0.100	2.271
1,1,2,2-Tetrachloroethane	0.300	0.782
1,3-Dichlorobenzene	0.600	1.408
1,4-Dichlorobenzene	0.500	1.427
1,2-Dichlorobenzene	0.400	1.332
1,2-Dibromo-3-chloropropane	0.050	0.129
1,2,4-Trichlorobenzene	0.200	0.806

Reference: Table 4 8260C Revision 3 (August 2006)

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program
Laboratory Approval Program

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.465.5390
Fax: 907.269.7649
cs.lab.cert@alaska.gov

February 1, 2018

Charles Homestead
SGS North America
200 W Potter Drive
Anchorage, AK 99518

RE: Contaminated Sites Laboratory Approval **17-021**

Dear Mr. Homestead,

Thank you for submitting an application to the Alaska Department of Environmental Conservation's Contaminated Sites Laboratory Approval Program (CS-LAP), on November 17, 2017. Based on your lab's National Environmental Laboratory Accreditation Program (NELAP) approval through the Florida Department of Health (DoH) and Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) approval through the American Association for Laboratory Accreditation (A2LA), SGS North America, located at the above address, is granted ***Approved*** status to perform the analyses listed in the attached *Scope of Approval*, for Alaska contaminated sites projects, including underground storage tanks and leaking underground storage tank sites (UST/LUST), under the July 1, 2017 amendments to 18 AAC 78. This approval expires on ***December 31, 2019***.

Be aware that **any** changes in your NELAP or DoD-ELAP approval status must be reported to the CS program within 3 business days. Failure to do so will result in revocation of **all** CS-LAP approvals for a period of one year. Notification should be in writing sent to cs.lab.cert@alaska.gov. We recommend also contacting the CS-LAP by telephone to verify that the message was received.

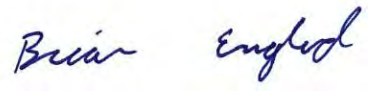
To report any changes in your lab's contact information (i.e. lab director, business name, location, etc.), please complete the form found at http://dec.alaska.gov/spar/csp/LabApproval/ApplyForApproval.htm and submit to cs.submittals@alaska.gov.

To apply for renewal of your approval, please complete the application found at http://dec.alaska.gov/spar/csp/LabApproval/ApplyForApproval.htm and submit to cs.submittals@alaska.gov. The required documentation must be submitted for renewal no later than 30 days before your date of expiration.

Please remember to include the laboratory's ID number, listed above, on all correspondence concerning the laboratory.

If you have any questions, please contact the CS-LAP at (907) 465-5390, or by email at cs.lab.cert@alaska.gov. Labs are also highly encouraged to join the CS-LAP listserv by going to http://list.state.ak.us/mailman/listinfo/cs.lab.approval.

Respectfully,



Brian Englund
Alaska CS Lab Approval Officer

Attachment: Scope of Approval

Scope of Approval – X indicates approved methods

Hazardous Substance	CAS Number	Analysis Method	Sample Matrix			Accrediting Body
			Soil	Water	Air	
Acenaphthene	83-32-9	8270D	**X**	**X**	---	A2LA
Acenaphthene	83-32-9	8270D-SIM	**X**	**X**	---	A2LA
Acenaphthylene	208-96-8	8270D	**X**	**X**	---	A2LA
Acenaphthylene	208-96-8	8270D-SIM	**X**	**X**	---	A2LA
Acetone	67-64-1	8260C	**X**	**X**	---	A2LA
Aldrin	309-00-2	8270D-SIM	**X**	**X**	---	A2LA
Anthracene	120-12-7	8270D	**X**	**X**	---	A2LA
Anthracene	120-12-7	8270D-SIM	**X**	**X**	---	A2LA
Antimony (metallic)	7440-36-0	6020A	**X**	**X**	---	A2LA
Arsenic, Inorganic	7440-38-2	6020A	**X**	**X**	---	A2LA
Barium	7440-39-3	6020A	**X**	**X**	---	A2LA
Benz[a]anthracene	56-55-3	8270D	**X**	**X**	---	A2LA
Benz[a]anthracene	56-55-3	8270D-SIM	**X**	**X**	---	A2LA
Benzene	71-43-2	8021B	**X**	**X**	---	A2LA
Benzene	71-43-2	8260C	**X**	**X**	---	A2LA
Benzo[a]pyrene	50-32-8	8270D	**X**	**X**	---	A2LA
Benzo[a]pyrene	50-32-8	8270D-SIM	**X**	**X**	---	A2LA
Benzo[b]fluoranthene	205-99-2	8270D	**X**	**X**	---	A2LA
Benzo[b]fluoranthene	205-99-2	8270D-SIM	**X**	**X**	---	A2LA
Benzo[g,h,i]perylene	191-24-2	8270D	**X**	**X**	---	A2LA
Benzo[g,h,i]perylene	191-24-2	8270D-SIM	**X**	**X**	---	A2LA
Benzo[k]fluoranthene	207-08-9	8270D	**X**	**X**	---	A2LA
Benzo[k]fluoranthene	207-08-9	8270D-SIM	**X**	**X**	---	A2LA
Benzoic Acid	65-85-0	8270D	**X**	**X**	---	A2LA
Benzyl Alcohol	100-51-6	8270D	**X**	**X**	---	A2LA
Beryllium and compounds	7440-41-7	6020A	**X**	**X**	---	A2LA
Bis(2-chloroethyl)ether	111-44-4	8270D	**X**	**X**	---	A2LA

Scope of Approval – X indicates approved methods

Hazardous Substance	CAS Number	Analysis Method	Sample Matrix			Accrediting Body
			Soil	Water	Air	
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	8270D	**X**	**X**	---	A2LA
Bromobenzene	108-86-1	8260C	**X**	**X**	---	A2LA
Bromodichloromethane	75-27-4	8260C	**X**	**X**	---	A2LA
Bromoform	75-25-2	8260C	**X**	**X**	---	A2LA
Bromomethane	74-83-9	8260C	**X**	**X**	---	A2LA
Butyl Benzyl Phthalate	85-68-7	8270D	**X**	**X**	---	A2LA
Butylbenzene, n-	104-51-8	8260C	**X**	**X**	---	A2LA
Butylbenzene, sec-	135-98-8	8260C	**X**	**X**	---	A2LA
Butylbenzene, tert-	98-06-6	8260C	**X**	**X**	---	A2LA
Cadmium	7440-43-9	6020A	**X**	**X**	---	A2LA
Carbon Disulfide	75-15-0	8260C	**X**	**X**	---	A2LA
Carbon Tetrachloride	56-23-5	8260C	**X**	**X**	---	A2LA
Chlordane, Total	12789-03-6	8270D-SIM	**X**	**X**	---	A2LA
Chlordane, Total	12789-03-6	8270D-SIM	**X**	**X**	---	A2LA
Chlordane, α-	5103-71-9	8270D-SIM	**X**	**X**	---	A2LA
Chlordane, γ-	5103-74-2	8270D-SIM	**X**	**X**	---	A2LA
Chlorobenzene	108-90-7	8260C	**X**	**X**	---	A2LA
Chloroform	67-66-3	8260C	**X**	**X**	---	A2LA
Chloromethane	74-87-3	8260C	**X**	**X**	---	A2LA
Chloronaphthalene, Beta-	91-58-7	8270D	**X**	**X**	---	A2LA
Chlorophenol, 2-	95-57-8	8270D	**X**	**X**	---	A2LA
Chromium (Total)	7440-47-3	6020A	**X**	**X**	---	A2LA
Chrysene	218-01-9	8270D	**X**	**X**	---	A2LA
Chrysene	218-01-9	8270D-SIM	**X**	**X**	---	A2LA
Copper	7440-50-8	6020A	**X**	**X**	---	A2LA
Cresol, o- (2-Methylphenol)	95-48-7	8270D	**X**	**X**	---	A2LA
Cumene (Isopropylbenzene)	98-82-8	8260C	**X**	**X**	---	A2LA

Scope of Approval – X indicates approved methods

Hazardous Substance	CAS Number	Analysis Method	Sample Matrix			Accrediting Body
			Soil	Water	Air	
DDD, 4,4'-	72-54-8	8270D-SIM	**X**	**X**	---	A2LA
DDE, 4,4'-	72-55-9	8270D-SIM	**X**	**X**	---	A2LA
DDT, 4,4'-	50-29-3	8270D-SIM	**X**	**X**	---	A2LA
Dibenz[a,h]anthracene	53-70-3	8270D	**X**	**X**	---	A2LA
Dibenz[a,h]anthracene	53-70-3	8270D-SIM	**X**	**X**	---	A2LA
Dibenzofuran	132-64-9	8270D	**X**	**X**	---	A2LA
Dibromochloromethane	124-48-1	8260C	**X**	**X**	---	A2LA
Dibromoethane, 1,2- (Ethylene Dibromide)	106-93-4	8260C	**X**	**X**	---	A2LA
Dibromomethane (Methylene Bromide)	74-95-3	8260C	**X**	**X**	---	A2LA
Dibutyl Phthalate	84-74-2	8270D	**X**	**X**	---	A2LA
Dichlorobenzene, 1,2-	95-50-1	8260C	**X**	**X**	---	A2LA
Dichlorobenzene, 1,2-	95-50-1	8270D	**X**	**X**	---	A2LA
Dichlorobenzene, 1,3-	541-73-1	8260C	**X**	**X**	---	A2LA
Dichlorobenzene, 1,3-	541-73-1	8270D	**X**	**X**	---	A2LA
Dichlorobenzene, 1,4-	106-46-7	8260C	**X**	**X**	---	A2LA
Dichlorobenzene, 1,4-	106-46-7	8270D	**X**	**X**	---	A2LA
Dichlorobenzidine, 3,3'-	91-94-1	8270D	**X**	**X**	---	A2LA
Dichlorodifluoromethane	75-71-8	8260C	**X**	**X**	---	A2LA
Dichloroethane, 1,1-	75-34-3	8260C	**X**	**X**	---	A2LA
Dichloroethane, 1,2-	107-06-2	8260C	**X**	**X**	---	A2LA
Dichloroethylene, 1,1-	75-35-4	8260C	**X**	**X**	---	A2LA
Dichloroethylene, 1,2-cis-	156-59-2	8260C	**X**	**X**	---	A2LA
Dichloroethylene, 1,2-trans-	156-60-5	8260C	**X**	**X**	---	A2LA
Dichlorophenol, 2,4-	120-83-2	8270D	**X**	**X**	---	A2LA
Dichloropropane, 1,2-	78-87-5	8260C	**X**	**X**	---	A2LA
Dichloropropene, 1,3- (cis + trans)	542-75-6	8260C	**X**	**X**	---	A2LA
Dieldrin	60-57-1	8270D-SIM	**X**	**X**	---	A2LA

Scope of Approval – X indicates approved methods

Hazardous Substance	CAS Number	Analysis Method	Sample Matrix			Accrediting Body
			Soil	Water	Air	
Diethyl Phthalate	84-66-2	8270D	**X**	**X**	---	A2LA
Dimethylphenol, 2,4-	105-67-9	8270D	**X**	**X**	---	A2LA
Dimethylphthalate	131-11-3	8270D	**X**	**X**	---	A2LA
Dinitrophenol, 2,4-	51-28-5	8270D	**X**	**X**	---	A2LA
Dinitrotoluene, 2,4-	121-14-2	8270D	**X**	**X**	---	A2LA
Dinitrotoluene, 2,6-	606-20-2	8270D	**X**	**X**	---	A2LA
Endosulfan I	959-98-8	8270D-SIM	**X**	**X**	---	A2LA
Endosulfan II	33213-65-9	8270D-SIM	**X**	**X**	---	A2LA
Endosulfan sulfate	1031-07-8	8270D-SIM	**X**	**X**	---	A2LA
Endrin	72-20-8	8270D-SIM	**X**	**X**	---	A2LA
Ethylbenzene	100-41-4	8021B	**X**	**X**	---	A2LA
Ethylbenzene	100-41-4	8260C	**X**	**X**	---	A2LA
Fluoranthene	206-44-0	8270D	**X**	**X**	---	A2LA
Fluoranthene	206-44-0	8270D-SIM	**X**	**X**	---	A2LA
Fluorene	86-73-7	8270D	**X**	**X**	---	A2LA
Fluorene	86-73-7	8270D-SIM	**X**	**X**	---	A2LA
Heptachlor	76-44-8	8270D-SIM	**X**	**X**	---	A2LA
Heptachlor Epoxide	1024-57-3	8270D-SIM	**X**	**X**	---	A2LA
Hexachlorobenzene	118-74-1	8270D	**X**	**X**	---	A2LA
Hexachlorobutadiene	87-68-3	8260C	**X**	**X**	---	A2LA
Hexachlorobutadiene	87-68-3	8270D	**X**	**X**	---	A2LA
Hexachlorocyclohexane, Alpha- (α-BHC)	319-84-6	8270D-SIM	**X**	**X**	---	A2LA
Hexachlorocyclohexane, Beta- (β-BHC)	319-85-7	8270D-SIM	**X**	**X**	---	A2LA
Hexachlorocyclohexane, Delta- (δ-BHC)	319-86-8	8270D-SIM	**X**	**X**	---	A2LA
Hexachlorocyclohexane, Gamma- (Lindane)	58-89-9	8270D-SIM	**X**	**X**	---	A2LA
Hexachlorocyclopentadiene	77-47-4	8270D	**X**	**X**	---	A2LA
Hexachloroethane	67-72-1	8270D	**X**	**X**	---	A2LA

Scope of Approval – X indicates approved methods

Hazardous Substance	CAS Number	Analysis Method	Sample Matrix			Accrediting Body
			Soil	Water	Air	
Hexanone, 2-	591-78-6	8260C	**X**	**X**	---	A2LA
Indeno[1,2,3-cd]pyrene	193-39-5	8270D	**X**	**X**	---	A2LA
Indeno[1,2,3-cd]pyrene	193-39-5	8270D-SIM	**X**	**X**	---	A2LA
Isophorone	78-59-1	8270D	**X**	**X**	---	A2LA
Lead, Total	7439-92-1	6020A	**X**	**X**	---	A2LA
Mercury (elemental)	7439-97-6	6020A	**X**	**X**	---	A2LA
Mercury (elemental)	7439-97-6	7470A	---	**X**	---	A2LA
Mercury (elemental)	7439-97-6	7471B	**X**	---	---	A2LA
Methoxychlor	72-43-5	8270D-SIM	**X**	**X**	---	A2LA
Methyl Ethyl Ketone (2-Butanone)	78-93-3	8260C	**X**	**X**	---	A2LA
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	8260C	**X**	**X**	---	A2LA
Methyl tert-Butyl Ether (MTBE)	1634-04-4	8260C	**X**	**X**	---	A2LA
Methylene Chloride	75-09-2	8260C	**X**	**X**	---	A2LA
Methylnaphthalene, 1-	90-12-0	8270D	**X**	**X**	---	A2LA
Methylnaphthalene, 1-	90-12-0	8270D-SIM	**X**	**X**	---	A2LA
Methylnaphthalene, 2-	91-57-6	8270D	**X**	**X**	---	A2LA
Methylnaphthalene, 2-	91-57-6	8270D-SIM	**X**	**X**	---	A2LA
Naphthalene	91-20-3	8260C	**X**	**X**	---	A2LA
Naphthalene	91-20-3	8270D	**X**	**X**	---	A2LA
Naphthalene	91-20-3	8270D-SIM	**X**	**X**	---	A2LA
Nickel, Total	7440-02-0	6020A	**X**	**X**	---	A2LA
Nitrobenzene	98-95-3	8270D	**X**	**X**	---	A2LA
Nitrosodimethylamine, N-	62-75-9	8270D	**X**	**X**	---	A2LA
Nitroso-di-N-propylamine, N-	621-64-7	8270D	**X**	**X**	---	A2LA
Nitrosodiphenylamine, N-	86-30-6	8270D	**X**	**X**	---	A2LA
Octyl Phthalate, di-N-	117-84-0	8270D	**X**	**X**	---	A2LA

Scope of Approval – X indicates approved methods

Hazardous Substance	CAS Number	Analysis Method	Sample Matrix			Accrediting Body
			Soil	Water	Air	
PCB - Aroclor-1016	12674-11-2	8082A	**X**	**X**	---	A2LA
PCB - Aroclor-1221	11104-28-2	8082A	**X**	**X**	---	A2LA
PCB - Aroclor-1232	11141-16-5	8082A	**X**	**X**	---	A2LA
PCB - Aroclor-1242	53469-21-9	8082A	**X**	**X**	---	A2LA
PCB - Aroclor-1248	12672-29-6	8082A	**X**	**X**	---	A2LA
PCB - Aroclor-1254	11097-69-1	8082A	**X**	**X**	---	A2LA
PCB - Aroclor-1260	11096-82-5	8082A	**X**	**X**	---	A2LA
Pentachlorophenol	87-86-5	8270D	**X**	**X**	---	A2LA
Phenanthrene	85-01-8	8270D	**X**	**X**	---	A2LA
Phenanthrene	85-01-8	8270D-SIM	**X**	**X**	---	A2LA
Phenol	108-95-2	8270D	**X**	**X**	---	A2LA
Propyl benzene	103-65-1	8260C	**X**	**X**	---	A2LA
Pyrene	129-00-0	8270D	**X**	**X**	---	A2LA
Pyrene	129-00-0	8270D-SIM	**X**	**X**	---	A2LA
Selenium	7782-49-2	6020A	**X**	**X**	---	A2LA
Silver	7440-22-4	6020A	**X**	**X**	---	A2LA
Styrene	100-42-5	8260C	**X**	**X**	---	A2LA
Tetrachloroethane, 1,1,1,2-	630-20-6	8260C	**X**	**X**	---	A2LA
Tetrachloroethane, 1,1,2,2-	79-34-5	8260C	**X**	**X**	---	A2LA
Tetrachloroethylene	127-18-4	8260C	**X**	**X**	---	A2LA
Thallium, Total	7440-28-0	6020A	**X**	**X**	---	A2LA
Toluene	108-88-3	8021B	**X**	**X**	---	A2LA
Toluene	108-88-3	8260C	**X**	**X**	---	A2LA
Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	76-13-1	8260C	**X**	**X**	---	A2LA
Trichlorobenzene, 1,2,3-	87-61-6	8260C	**X**	**X**	---	A2LA
Trichlorobenzene, 1,2,4-	120-82-1	8260C	**X**	**X**	---	A2LA

Scope of Approval – X indicates approved methods

Hazardous Substance	CAS Number	Analysis Method	Sample Matrix			Accrediting Body
			Soil	Water	Air	
Trichlorobenzene, 1,2,4-	120-82-1	8270D	**X**	**X**	---	A2LA
Trichloroethane, 1,1,1-	71-55-6	8260C	**X**	**X**	---	A2LA
Trichloroethane, 1,1,2-	79-00-5	8260C	**X**	**X**	---	A2LA
Trichloroethylene	79-01-6	8260C	**X**	**X**	---	A2LA
Trichlorofluoromethane	75-69-4	8260C	**X**	**X**	---	A2LA
Trichlorophenol, 2,4,5-	95-95-4	8270D	**X**	**X**	---	A2LA
Trichlorophenol, 2,4,6-	88-06-2	8270D	**X**	**X**	---	A2LA
Trichloropropane, 1,2,3-	96-18-4	8260C	**X**	**X**	---	A2LA
Trimethylbenzene, 1,2,4-	95-63-6	8260C	**X**	**X**	---	A2LA
Trimethylbenzene, 1,2,4-	95-63-6	8260C	**X**	**X**	---	A2LA
Vanadium, Total	7440-62-2	6020A	**X**	**X**	---	A2LA
Vinyl Acetate	108-05-4	8260C	**X**	**X**	---	A2LA
Vinyl Chloride	75-01-4	8260C	**X**	**X**	---	A2LA
Xylene, m+p -	-	8021B	**X**	**X**	---	A2LA
Xylene, m+p -	-	8260C	**X**	**X**	---	A2LA
Xylene, o-	95-47-6	8021B	**X**	**X**	---	A2LA
Xylene, o-	95-47-6	8260C	**X**	**X**	---	A2LA
Xylene, Total	1330-20-7	8021B	**X**	**X**	---	A2LA
Xylene, Total	1330-20-7	8260C	**X**	**X**	---	A2LA
Zinc, Total	7440-66-6	6020A	**X**	**X**	---	A2LA
Total Organic Carbon	N/A	9060	**X**	**X**	---	A2LA
Gasoline Range Organics (C6 – C10)	N/A	AK 101	**X**	**X**	---	A2LA
Diesel Range Organics (C10 – C25)	N/A	AK 102	**X**	**X**	---	A2LA
Residual Range Organics (C25 – C36)	N/A	AK 103	**X**	**X**	---	A2LA

Controlled copy distributed to Kelly Carson at Brice Environmental.

SGS North America Inc. – Alaska Division

SGS NORTH AMERICA INC. - QUALITY MANUAL

Written in accordance with the requirements of ISO/IEC 17025:2005 – General Requirements For The Competence Of Calibration and Testing Laboratories

REVISION: 8.6

ISSUED BY: Mary C McDonald

Mary C McDonald, QA Manager

AUTHORIZED BY:

Charles Homestead, General Manager

Stephen C. Ede

Stephen Ede, Technical Director

William Wesley, Production Manager

FOR USE AT: SGS North America Inc. – Alaska Division
Environment, Health & Safety
200 W. Potter Drive
Anchorage, AK 99518

DATE: November 13,2017

This document contains confidential business information and is not intended for distribution.

This electronically signed PDF will be considered the controlled copy for staff.

Table of Contents

1. Introduction 8

1.1. Application 8

2. Normative References 9

2.1. Reference Standards 9

2.1.1. Quality System 9

2.1.2. Other Standards 9

2.1.3. Other Quality System Manuals 10

3. Terms & Definitions 10

4. Management Requirements 11

4.1. Organization 11

4.1.1. Legal Entity 11

4.1.2. Laboratory Responsibility 11

4.1.3. Scope of Management System 11

4.1.4. Conflict of Interest 12

4.1.5. Laboratory Responsibilities 12

4.1.5.1. Management and Technical Personnel 12

4.1.5.2. Undue Pressure 13

4.1.5.3. Customer Confidentiality 13

4.1.5.4. Operational Integrity 13

4.1.5.4.1. Corporate Integrity 14

4.1.5.4.2. Data Integrity 14

4.1.5.4.3. Conflict of Interest 14

4.1.5.5. Organization Charts 15

4.1.5.6. Responsibility and Authority 15

4.1.5.7. Laboratory Supervision ..... Error! Bookmark not defined.

4.1.5.8. Technical Management 15

4.1.5.9. Quality Assurance Manager 16

4.1.5.10. Managerial Substitution 17

4.1.5.11. Place of Staff in Organization Objectives 18

4.1.6. Responsibility for Communication 18

4.2. Quality System 18
4.2.1. Policies and Procedures 18
4.2.2. Quality Manual 19
4.2.2.1. Quality Policy Statement 19
4.2.3. Top Management Roles & Responsibilities 20
4.3. Document Control 20
4.3.1. Policies and Procedures 20
4.3.2. Approval and Issue 21
4.3.3. Master List 21
4.3.4. Availability 21
4.3.5. Obsolete Documents 21
4.3.6. Identification 22
4.3.7. Document Changes 22
4.3.8. Altered or New Text 22
4.3.9. Hand-written Amendments 22
4.3.10. Computerized Amendments 22
4.4. Review of Requests, Tenders, and Contracts 23
4.4.1. Policies and Procedures 23
4.4.2. Records of Review 23
4.4.3. Notification of Customer 23
4.4.4. Contract Amendments 23
4.5. Subcontracting of Tests 24
4.5.1. Competency 24
4.5.2. Customer Notification 24
4.5.3. Responsibility 24
4.5.4. Results 25
4.6. Purchasing Services and Supplies 25
4.6.1. Policies and Procedures 25
4.6.2. Verification 25
4.6.3. Purchasing Documents 25
4.6.4. Approved Suppliers 26
4.7. Service to Customer 26

4.7.1. Cooperation with Customers 26
4.7.2. Feedback 26
4.8. Complaints 26
4.8.1. Policies and Procedures 26
4.8.2. Records 27
4.9. Control of Nonconforming Testing 27
4.9.1. Policies and Procedures 27
4.10. Improvement 27
4.10.1. Policies and Procedures 27
4.11. Corrective Action 27
4.11.1. Policies and Procedures 27
4.12. Preventive Action 28
4.12.1. Action Identification 28
4.12.2. Action Plans 29
4.13. Control of Records 29
4.13.1. Procedures 29
4.13.2. Record Integrity 30
4.13.3. Technical Records 30
4.13.4. Record Information 30
4.13.5. Recording 30
4.13.6. Corrections to Records 31
4.13.7. Corrections to Electronic Records 31
4.14. Internal Audits 31
4.14.1. Requirements 31
4.15. Management Review 31
4.15.1. Objectives 31
4.15.2. Contents 33
4.15.3. Actions Taken 33
4.15.4. Records 332
5. Technical Requirements 33
5.1. General 33
5.2. Personnel 33

5.2.1. Qualifications 33
5.2.2. Trainees & Training 34
5.2.3. Employees 34
5.2.4. Job Descriptions 35
5.2.5. Authorized Personnel 36
5.2.6. Records 36
5.3. Accommodation and Environmental Conditions 36
5.3.1. Technical Requirements 36
5.3.2. Facility 36
5.3.3. Monitoring 37
5.3.4. Incompatible Activities 37
5.3.5. Access 37
5.3.6. Housekeeping 37
5.4. Test Methods and Method Validation 37
5.4.1. Methods and Procedures 37
5.4.2. Equipment Instructions 38
5.4.3. Method Deviations 38
5.4.4. Method Selection 38
5.4.5. Non-Customer Specified Method Selection 38
5.4.6. Inappropriate Methods 38
5.4.7. Published Reference Methods 38
5.4.8. Laboratory Developed Methods 38
5.4.9. Non-Standard Methods 39
5.4.10. Method Validation 39
5.4.11. Range and Accuracy 39
5.4.12. Measurement Uncertainty 39
5.4.13. Reasonable Estimates 39
5.4.14. Calibrations 39
5.4.15. Calculations and Data Transfers 39
5.4.16. Computers or Automated Equipment 40
5.4.17. Protection of Data 40
5.5. Equipment 40

5.5.1. Operation 40
5.5.2. Records 41
5.5.3. Procedures 42
5.5.4. Out-of-Service 42
5.5.5. Calibration Status 43
5.5.6. Return to Service 43
5.5.7. Adjustments 43
5.6. Measurement Traceability 43
5.6.1. Calibration Program 43
5.6.2. Traceability to International System of Units 44
5.6.3. Traceability 44
5.6.4. Reference Standards 44
5.6.5. Reference Materials 44
5.7. Sampling 46
5.7.1. Procedures and Plan 46
5.7.2. Deviations 47
5.7.3. Records 47
5.8. Handling of Test Items 47
5.8.1. Procedures 47
5.8.2. Identification 48
5.8.3. Deficiencies 48
5.8.4. Facilities 48
5.8.5. Environmental Conditions 48
5.8.6. Handling Instructions 48
5.9. Assuring the Quality of Test Results 49
5.9.1. Quality Control 49
5.9.2. Quality Control Data 49
5.9.3. Quality Control Data Analyzed 494
5.10. Reporting the Results 50
5.10.1. Test Reports 50
5.10.2. Test Result Interpretation 50
5.10.3. Opinions and Interpretations 51

5.10.4. Amendments....51
5.10.5. Simplified Reporting....51
6. SUMMARY OF CHANGES FROM PREVIOUS REVISION....51
7. REFERENCES....52

1. Introduction

This Quality Manual outlines the Quality System of the Alaska Division of SGS North America Inc (hereafter referred to as SGS Alaska or SGS). As the principal manual, used in conjunction with a set of standard operating procedures (SOPs), it describes the laboratory's commitment to Quality Management.

SGS aims to provide a safe and healthy working condition to all employees, visitors, and contractors through:

- Protecting the environment and the communities where we work and live, by the prevention of pollution and minimization of our impact
- Complying with all applicable HSE (Health, Safety, Environmental) national and local regulations and laws
- Continuously improve the HSE working conditions and environment towards out “Zero incident” target
- Increasing all SGS employees HSE awareness and safe behavior

This Manual describes the approach of SGS with regard to Quality Management through:

- Continuous upgrading of SGS services;
- Permanent Quality Management to prevent and/or eliminate nonconformities;
- Allocating the necessary resources to maintain and continually improve the organization;
- Conducting reviews of all elements of the system;
- Producing accurate, precise and complete legally defensible data; and
- Communicating to the staff the importance of meeting customer and regulatory requirements.

1.1. Application

- The policies in this Manual apply to all levels of the organization of SGS Alaska at the Anchorage laboratory (200 W. Potter Drive) and the Fairbanks receiving facility (3180 Peger Road). Corporate Policies and Procedures related to Human Resources, Finance and Accounting, Management Information Systems and General Administration are covered in separate documents.
- Implementation of the Quality System is achieved by means of this Quality Manual and documented procedures that are developed and followed by SGS Alaska.
- This Manual and supporting procedures are revised as necessary, to meet changing requirements and needs. The QA Office maintains a master file of this manual to insure review on a annual basis. The filing system serves as an accounting of the distribution of the manual. The accounting includes destruction of controlled copies of expired manuals. The QA Office also maintains a historical file of original and electronic versions of this manual; including the current revision and any versions archived within the past 5 years. Any changes to the Manual may be made only by authorization of the QA Office.
- This Manual is readily available to all SGS staff and is available to all SGS clients upon their request.

This document contains confidential business information and is not intended for distribution.

This electronically signed PDF will be considered the controlled copy for staff.

2. Normative References

2.1. Reference Standards

2.1.1. Quality System

The Quality System of SGS has been designed in accordance with A2LA accreditation for ISO/IEC 17025:2005, the 2009 National Environmental Laboratory Accreditation Conference (NELAC) Chapter 5 standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DOD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (latest version). SGS will follow the established advertising policy to control the use of the A2LA symbol.

Reference:

A2LA Document P101 (www.a2la.org)

SGS SOP 140 (Review of Requests for Quotes, Proposals and Contracts)

2.1.2. Other Standards

A large amount of the analytical work performed by the laboratory is completed to support the regulatory requirements of our clients. This work may be performed to satisfy the provisions in one or more of the following regulatory areas:

- **Clean Water Act (CWA):** Under the CWA, an organization that discharges wastewater into a river system is subject to regulation under the *National Pollution Discharge Elimination System (NPDES)*, as well as the *Alaska Pollution Discharge Elimination System (APDES)*. Various analytical methods are approved or mandated by this act.
- **Resource Conservation and Recovery Act (RCRA):** Under RCRA, any organization that wishes to dispose of solid waste must determine if it is potentially hazardous or exhibits toxic characteristics. Specific methods exist for making such a determination. Also, any organization that is operating a hazardous waste storage facility must have in place a groundwater protection plan. The analyses performed to support this type of plan may use the methods outlined in SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, as published by the Environmental Protection Agency (EPA) of the United States in support of the RCRA program.
- **Safe Drinking Water Act (SDWA):** Under the SDWA, the analysis of drinking water must be analyzed by specific established methodologies. The *Alaska Department of Environmental Conservation Drinking Water (ADEC DW)* programs regulate both Microbiology and Chemistry.
- **Alaska Department of Environmental Conservation Contaminated Sites Program (ADEC CS):** This program mandates the use of specific methods and preservation techniques for contaminated sites and underground storage tanks within Alaska.
- In addition, many projects the laboratory is involved with have oversight by the Air Force Center for Engineering and Environment (AFCEE), Brooks AFB (AFIOH/SCD), the Naval Facilities Engineering Service Command (NFESC), or the US Army Corps of Engineers (USACE). These agencies have jointly developed the Department of Defense (DOD) Quality System Manual (QSM). The DoD QSM is a guidance document which defines specific data quality objectives and other special considerations required in all aspects of data collection. The QSM is built upon ISO 17025 and NELAC standards, with the addition of clarifications and appendices from the DOD EM/DQ (Environmental Monitoring/Data Quality) Workgroup, composed of members from all DOD branches. Throughout this document and the associated SOPs, the term “DOD” will be used generically to refer to AFCEE, Navy and/or Army Corps of Engineers.

Note: It is critical to the success of any project that the laboratory is aware of which regulatory program(s) is(are) involved and if any special considerations have been imposed by either the regulatory agency or client. DOD QSM criteria (using the latest approved version) can be applied in those instances when the laboratory is notified in advance, has the opportunity to review project specific data quality objectives, and had the opportunity to negotiate variance requests (if applicable). Otherwise, all work performed by SGS will be analyzed using the most appropriate methodology (including Standard Methods for the Analysis of Water and Wastewater (SM), EPA, SW846 or methods developed/modified by the laboratory) in accordance with this laboratory QAP. Whenever feasible, SGS will adopt the most recently approved method. Clients should confirm current capabilities with SGS Business Development or their assigned Project Manager and may verify the laboratories current scope(s) of certification or accreditation at the accrediting body's website:

ISO 17025/DOD ELAP scope of accreditation:

http://www.a2la.org/scopepdf/2944-01.pdf?CFID=834475&CFTOKEN=5a009576ef32e090-76FE8574-1851-9E57-47EC77967DA1C036&jsessionid=8430513eebc78f2180af801c6a7b7d871144

ADEC Contaminated Sites scope of certification:

**http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx

ADEC Drinking Water Chemistry scope of certification:

https://dec.alaska.gov/applications/eh/EHLabStatus/Home/Index

ADEC Drinking Water Microbiology scope of certification:

http://dec.alaska.gov/applications/eh/ehlabstatus/microreport/index

2.1.3. Other Quality System Manuals

This is the only Quality Manual used by SGS Alaska.

3. Terms & Definitions

- "Supplier" and "Vendor" are synonymous and refer to the external source used to acquire purchased products and/or services by the organization.
- Throughout the text of this Quality Manual whenever the term "product" occurs, it can also mean service.
- "Analyst" refers to any member of the staff who prepares or analyzes samples and may refer to any individual who peer reviews data.
- "Customer" can refer to the customer (internal or external), accrediting body, or regulatory authority.
- "General Manager" is used to describe the top level of management at which decisions regarding the lab are made.
- "Production Manager" is used to describe the position at which the overall responsibility for production (a.k.a. Operations) occurs.
- "Quality Assurance (QA) Manager" is used to describe the position at which the overall responsibility for the Quality System occurs.
- "QA/QC Officer" is used to describe staff who assist the QA Manager to implement, maintain and improve the laboratory's quality system.

- "Supervisor" is used to describe the position at which the overall responsibility for approving work schedules, overtime, and allocating labor resources occurs.
- The management team includes the General Manager, Production Manager, Technical Director, and QA Manager.

4. Management Requirements

4.1. Organization

4.1.1. Legal Entity

SGS Alaska is appropriately registered for legal process. All (original) business licenses are held by the SGS legal department.

Reference:

SGS North America Inc. Alaska Business License

4.1.2. Laboratory Responsibility

The mandate of SGS Alaska is to deliver the highest quality analysis and reporting of waters (including drinking water, wastewater, surface water, groundwater, etc.), soils and other materials in a timely manner in accordance with the needs of the customer, regulatory authorities and accrediting bodies, including (but not limited to):

- ADEC
- A2LA

The certifications and approvals include on-site evaluations of the laboratory by each agency to ensure that equipment, personnel, and laboratory techniques are in conformance with the EPA and program guidelines. Regulators generally schedule audits at two or three year intervals. More frequent audits may occur when a new method is implemented; a new instrument technology is acquired, as a requirement of a project-specific work plan; or as part of a client's service procurement procedure.

Reference:

ISO/IEC 17025:2005, General Requirements for the Competence of Testing and Calibration Laboratories

DoD Quality Systems Manual for Environmental Laboratories (latest version)

2009 National Environmental Laboratory Accreditation Conference (NELAC)

18 AAC 70 (ADEC Water Quality Standards)

18 AAC 75 (ADEC Oil and other Hazardous Substances)

18 AAC 78 (ADEC Underground Storage Tanks)

18 AAC 80 (ADEC Drinking Water)

4.1.3. Scope of Management System

The laboratory management system covers work carried out at SGS Alaska (i.e., the fixed laboratory in Anchorage and the receiving facility in Fairbanks).

4.1.4. Conflict of Interest

SGS Alaska is a member of the SGS group – the world's leading inspection, testing, certification and verification company with more than 90,000 employees in a network of more than 2000 offices around the world.

The core services offered by SGS Global can be divided into these categories:

- **Inspection and Verification Services**. SGS inspects and verifies the quantity, weight and quality of traded goods. Inspection typically takes place at the manufacturer's/supplier's premises or at time of loading or at destination during discharge/off-loading.
- **Testing Services**. SGS tests product quality and performance against various health, safety and regulatory standards. SGS operates state of the art laboratories on or close to customers' premises.
- **Certification Services**. SGS certifies that products, systems or services meet the requirements of standards set by governments, standardization bodies (e.g. ISO 9000) or by SGS customers. SGS also develops and certifies its own standards.

SGS Alaska offers testing services and is governed by management (as outlined in the organizational chart) which ensures that both real and potential conflicts of interest are prevented. The responsibilities of key personnel (i.e., management and supervisors) are outlined in the job descriptions, which are maintained by senior management.

All SGS employees are expected to avoid any situation where there is or could be a conflict between their own personal interests and the interests of the organization. It is equally important to avoid the appearance of a conflict of interest. These principles are covered in the SGS Code of Integrity which is reviewed with all staff upon hire and annually.

Reference:

SGS Organization Charts (Alaska Division and NAM Region)

SGS Code of Integrity

SGS North America Employee Handbook

4.1.5. Laboratory Responsibilities

4.1.5.1. Management and Technical Personnel

The goal of SGS Alaska is to provide quality determinations in a timely manner. This can only be realized by fostering excellence in its staff, through training, and provision of a workplace that is safe, adequately sized, results-oriented, and operates with due regard for the quality management system in place.

SGS Alaska has managerial and technical personnel who, irrespective of other duties, have the authority and resources needed to carry out their duties, including the implementation, maintenance, and improvement of the management system, to identify the occurrence of departures from the quality system, and to initiate actions to prevent or minimize such departures.

In order to function smoothly and generate data of the required quality all personnel must:

- Understand SGS's Code of Integrity, Quality Policy, and Company Policy on Health, Safety and Environment.
- Understand the necessity for quality control

- Accept their level of responsibility for quality control
- Obtain the skill to perform assigned analyses

Job descriptions for management and technical personnel are maintained by Senior Management and include the above as functions of the respective positions.

Reference:

Sections: 4.10. (Improvement), 4.11. (Corrective Action) and 4.12. (Preventive Action) of this document

4.1.5.2. Undue Pressure

SGS Alaska adheres to the Human Resource Management policies laid down by both SGS and the Government of the United States of America, which helps ensure that management and personnel are free from internal and external commercial, financial and other pressures that might adversely affect the quality of their work. Copies of this documentation are retained in the Human Resources office.

Reference*:*

SGS North America Employee Handbook

4.1.5.3. Customer Confidentiality

SGS is committed to protecting the privacy and information of its customers. A copy of our General Conditions of Services is made available to all customers, and governs their relationship with SGS. All data generated by SGS is to be held in the strictest confidence, and care must be taken to ensure that data is reported and discussed only with the client or an authorized representative. Details of any analysis should never be discussed with anyone outside of the laboratory unless such discussion has been specifically approved by management and/or client.

Reference:

SGS Code of Integrity

SGS General Conditions of Service

4.1.5.4. Operational Integrity

Integrity is at the core of the business of the SGS Group, it is the common thread through all activities. A Code of Integrity has been established to lay down rules of behavior in all dealings for the SGS Group (including SGS North America Inc. – Alaska Division) and to provide guidance in day-to-day business. In addition, laboratory procedures have been developed to further support the corporate code.

SGS maintains published documents, including the "Code of Integrity," which outline the professional demeanor expected from every employee. All employees are required to sign and keep on file these forms, which documents each employee's acceptance and understanding of these requirements. A copy of the signed form is also kept in each employee's personnel file. Initial and annual ethics training is provided by the General Manager. Initial training regarding manual integration is provided for applicable staff; both Analysts and data reviewers.

As outlined in the SGS North America Employee Handbook, disciplinary measures may include a verbal warning, written warning, unpaid suspension, and/or termination; however, there is no guarantee of, or expectation that, progressive disciplinary measures will be followed. Each case is evaluated on its own merits and potential punishment for improper, unethical or illegal actions may not be limited to suspension or termination of employment.

Failure to report suspected improper, unethical or illegal actions is considered a serious offense and may also result in disciplinary action. Prompt reporting of any suspected infractions will not result in disciplinary action. It is SGS's policy, therefore, to require staff to report any matters of concern. Channels for reporting include the direct supervisor, General Manager, Technical Director, QA Manager and the corporate Compliance Officer. All reports must be documented and thoroughly investigated by management.

Reference:

SGS Code of Integrity

SGS SOP 144 (Manual Integration)

DOD QSM (latest version)

EPA Inspector General Letter (dated September 5, 2001)

4.1.5.4.1. Corporate Integrity

All SGS services are to be provided in a professional, independent and impartial manner, honestly and in full compliance with Group approved methods, practices and policies. SGS does not surrender to any pressure from clients in one are of business in order to obtain a favorable treatment in another area.

Reference:

SGS Code of Integrity

4.1.5.4.2. Data Integrity

All SGS employees receive data integrity training as part of their initial Orientation & General Training program and annual refresher training is provided. In addition, analysts and reviewers for methods which may involve manual integration are given initial and annual training.

Reference:

SGS Code of Integrity

DOD QSM (latest version)

SGS SOP 144 (Manual Integration)

4.1.5.4.3. Conflict of Interest

A conflict of interest is any situation where the interests of the SGS Group overlap with personal employee interests or with those of close relatives or persons with whom the employee is in close personal or business contact. The mere appearance of impropriety is to be avoided because it creates the impression of a lack of impartiality.

Employees who find themselves in conflict are obligated to promptly discuss such situations with their Supervisor so that prompt and swift resolution which is amenable to all parties can be achieved. When a conflict of interest does manifest, the Supervisor will promptly resolve the situation in concert with the client so that an informed decision can be made before pursuing a course of action. All approaches to solving conflicts of interest will be transparent to all parties involved. Objectivity will remain at the forefront in all decisions.

Reference:

SGS Code of Integrity

4.1.5.5. Organization Charts

The Organization Chart for SGS Alaska is updated regularly, under the direction of the Human Resources department and is accessible through the SGS intranet (\\usfs700\ank_groupdata\Public\DOCUMENT\RFP). Information on the structure of SGS globally, can be found on the SGS website (www.sgs.net).

The laboratory organization includes three teams:

- Operations (i.e., analytical, sample receiving/login and sample control staff)
- Operational Support (i.e., accounting, IT and data management staff)
- Client Services (i.e., project management and QA/QC staff)

The management team includes the General Manager, Production Manager, Technical Director, and Quality Service Manager.

Reference:

SGS Organization Chart (Alaska Division)

4.1.5.6. Responsibility and Authority

SGS Alaska operates under the direction of the General Manager, who is responsible for developing and maintaining the organizational structure, the description of the responsibilities of senior personnel, providing scientific leadership, project planning, equipment maintenance and requisition, laboratory supplies, laboratory production, ensuring overall timely delivery of project results and overall responsibility for the Quality System within the laboratory. The General Manager is responsible for balancing the demands of the internal and external customer groups. Some authority is delegated to appropriate individuals depending upon their specific areas of responsibility and expertise.

Reference:

SGS Organization Chart (Alaska Division)

SGS SOP 126 (Procurement, Receipt of Supplies and Processing Vendor Invoices)

SGS SOP 140 (RFP/Proposal Review)

4.1.5.7. Production Manager

The Production Manager provides adequate supervision of all staff as outlined in the SGS Organization Chart, and is directly responsible for the supervision of the operations and sample control staff. Including oversight responsibility of daily activities to ensure the generation of timely data that meets industry accepted practices and project-specific requirements. Oversees documentation practices supporting the tests performed, instrument maintenance, and decision making processes affecting the data.

Reference:

SGS Organization Chart (Alaska Division)

4.1.5.8. Technical Management

The Technical Director is ultimately responsible for the technical operation of all departments. The Technical Director reviews all analytical procedures utilized by Analysts and is directly responsible for the accuracy of test results, acquisition of new instruments, method development and modification, laboratory quality control, and is ultimately responsible for the implementation and training of staff in the techniques

detailed in SOPs and elements of the laboratory QAP. This position advises clients in proper techniques, methods necessary to properly fulfill the requirements of regulatory agencies, and address routine questions from clients or analytical staff regarding the validity or reliability of specific analytical data. Performs the periodic review of the generated data packages.

The Technical Director has a minimum of a Bachelors Degree in Chemistry or other Natural Science discipline and a minimum of 2 years of analytical chemistry laboratory experience.

Note: Per the DOD QSM (latest version), a Technical Director who is absent for a period of time exceeding 15 consecutive calendar days shall designate another full-time staff member meeting their qualifications to temporarily perform the functions. If the absence exceeds 35 consecutive calendar days, the primary accrediting authority must be notified in writing.

Reference:

SGS Organization Chart (Alaska Division)

4.1.5.9. Quality Assurance Manager

The Quality Assurance (QA) Manager has the authority and responsibility for ensuring the quality system is implemented and followed at all times, with direct access to the highest level of management at which decisions are made. The QA Manager reports to the General Manager, but works independently and is able to evaluate data objectively, free of managerial influence. A working knowledge of general statistical concepts is required to provide a basis for reviewing data to determine method performance.

The QA Manager is responsible for following:

- Develop and update the overall QA Plan for the laboratory.
- Serve as the focal point for QA/QC and be responsible for the oversight of QC data.
- Aid in the documenting and addressing corrective actions and/or client concerns, as well as to track the long-term effectiveness of corrective actions.
- Oversee proficiency sample testing and evaluation.
- Assist Analysts and administrative staff in preparing and updating SOPs.
- Distribute current SOPs to appropriate personnel via the document control program.
- Issue monthly reports to the corporate Technical and local Management Team (including the General Manager and Technical Director) outlining QA/QC activities and initiatives.
- Establish effective and efficient internal and external communication channels.
- Maintain current, and explore new, certification or approval programs.
- Facilitate internal and external audit programs, including lab responses and corrective actions.
- Assist Business Development by reviewing Data Quality Objectives (DQOs) during the quote review and, if applicable, outlining variance requests.

The QA Manager is assisted by the QA/QC Officer(s) and several key staff which comprise the Quality Team. Each person on the Quality Team has oversight responsibility for a specific function of the QA/QC systems (e.g., SOPs, PT samples, DL studies, internal audits, certification/accreditation applications and renewal, corrective actions, training, etc.). Each member of the Quality Team reports to the QA Manager and QA Officer, who oversee progress and deadlines for the QA/QC system. Consequently, where the

QA Manager is referenced throughout this document, their designee may carry out the duties under their direct supervision.

4.1.5.10. Operational Support

- The Office Manager over sees the accounts payable, accounts receivable and data management
- The Informational Technician maintains all servers and computers along with the Oracle data base. All hardware and software maintenance for the desk/lap tops. Oversees daily backup of data.

Reference:

SGS Organization Chart (Alaska Division)

4.1.5.11. Client Service Team

- Consists of Project Managers who serve as the liaison between the laboratory and its clientele
- Business Development reviews requests for proposal(RFP) and creating quotes.

Reference:

SGS Organization Chart (Alaska Division)

Reference:

SGS Organization Chart (Alaska Division)

SGS Monthly QA Reports

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 103 (Performance Test Program)

SGS SOP 105 (Corrective Actions)

SGS SOP 111 (Document Control)

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

SGS SOP 116 (DL/LOD/LOQ)

SGS SOP 140 (RFP/Proposal Review)

SGS SOP 145 (Control Charts & Control Limits)

4.1.5.12. Managerial Substitution

When a member of the Management staff of the laboratory is away from the laboratory, their core duties would be delegated as follows:

- Technical Director:
  - Technical Direction – Production Manager

- General Manager:
  - Administrative Duties (e.g., hiring/firing) – Production Manager
  - Finance (e.g., budgeting, capital expenditures) – Production Manager
  - Client Services – Technical Manager
  - Contracts – SGS Legal
  - Facilities (e.g., HVAC) – Production Manager
- Production Manager:
  - Manage Backlog and Approve Rush Requests – Section Leads
  - Day to Day Technical Decisions – Section Leads
- QA Manager:
  - QA Calls – Technical Director
  - SOPs, DL/LOD/LOQ Studies, PE Studies, etc – QA/QC Officers

4.1.5.13. Place of Staff in Organization Objectives

Laboratory staff are made aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the management system through regularly scheduled status meetings. Each analytical section has a representative attend status meetings and serve as a liaison for their operational section (e.g., Sample Preparation, Waters, Microbiology, Metals, Volatiles and Semivolatiles).

Reference:

SGS Organization Charts (Alaska Division)

SGS SOP 007 (Laboratory Communications)

4.1.6. Responsibility for Communication

Appropriate communication procedures have been established and implemented by top management. Regularly scheduled status meetings have been established,

Reference:

SGS SOP 007 (Laboratory Communications)

4.2. Quality System

4.2.1. Policies and Procedures

SGS Alaska Quality Assurance Program is directed by the QA Manager who is responsible for its effectiveness and efficiency. Achievement of these objectives with respect to quality is the responsibility of all personnel. The management system established to implement the Quality Assurance Policy satisfies the requirements of ISO/IEC 17025:2005 (General Requirements for the Competence of Testing and Calibration Laboratories).

Understanding of the management system is demonstrated by all laboratory staff through a quiz, which is based on the principles of the Management System in place. It is taken by all lab staff at the end of their

Quality Management System training. When changes are made to the QAP that modify a procedure, and/or policy to an extent that the staff would be reasonably expected to be affected by the change, a new quiz will be given to all staff and records of the test maintained. (Note: Where a written quiz is not practical and/or appropriate, an alternate method of verification may be implemented, (e.g. observation and documentation of the successful performance of tasks specific to the quality management system, etc.).

Implementation of the management system is demonstrated through data processing and record keeping.

Reference:

SGS Form FT-017 (QAP Training Quiz)

4.2.2. Quality Manual

The QA Manager is responsible for developing, implementing and updating the Quality Manual (otherwise referred to as the Quality Assurance Plan). The Quality Manual documents top management commitment to the development and implementation of the management system (see section 4.1.2), documents top management's commitment to continually improving its effectiveness (see section 4.15); documents the importance of meeting customer requirements as well as statutory and regulatory requirements (see section 4.1.2); documents a quality policy statement authorized by top management, and supporting quality objectives (see section 4.2.3); includes or makes reference to all procedures within a defined document structure (see section 4.3); defines the roles and responsibilities of technical management and the quality manager (see section 4.1.5.8 and 4.1.5.9); and outlines the structure of documentation used in the management system (see section 4.3).

4.2.2.1. Quality Policy Statement

Sound management practices and commitment to good professional practice and quality of service are important responsibilities in the conduct of our business.

As an employer, SGS Alaska will work to deliver the following:

- High quality analysis of waters, soils and other materials in a timely manner.
- A program of scheduled quality activity that ensures the requirements of the management system are documented and includes the following:
  - Service that is fit-for-purpose, which includes quality and responsiveness.
  - Prevention rather than correction.
  - The use of internationally recognized methods wherever possible.
  - An effective and documented training program.
  - A comprehensive validation program, including accuracy and short & long-term precision; Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantification (LOQ); linearity, and estimation of uncertainty of measurement.
  - Participation in proficiency evaluation studies (where available).
  - Competent, trained personnel assigned to carry out duties in a timely manner and in accordance with the mandate of the Management System, while ensuring that the work is done safely and with due regard to the environment.
- Compliance with ISO/IEC 17025:2005 – General requirements for the competence of testing and calibration laboratories and with all applicable legal and regulatory legislation requirements and the DOD QSM standards as defined in applicable accreditation scopes.

- Regular review, audit and internal quality control procedures to continually improve the effectiveness of the management system.
- Communication of the objectives of the management system to ensure understanding by all personnel.

Reference:

SGS Certifications and Accreditations

SGS SOP 007 (Laboratory Communications)

SGS SOP 102 (Training and Certification)

SGS SOP 103 (Performance Test Program)

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

SGS SOP 116 (DL/LOD/LOQ)

SGS SOP 141 (Uncertainty)

SGS SOP 145 (Control Charts & Control Limits)

4.2.3. Top Management Roles & Responsibilities

Top management is committed to the development and implementation of the management system and to continually improving its effectiveness through the provision of resources to support and develop the system. This includes (but is not limited to) a Management Team which meets regularly to review the lab operations – including the management system – and identify areas of needed improvement.

Reference:

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

4.3. Document Control

4.3.1. Policies and Procedures

SGS Alaska controls all documents that form part of its quality system through defined procedures. Locations are designated for all controlled documents to ensure access by the appropriate people. Both the forms used to gather information and the actual recorded information are controlled with the objective that the personnel developing the method, performing and approving the analysis can be identified if required. All controlled documentation is property of SGS and must be left behind at the termination of employment.

The analytical procedures and associated quality control criteria for the tests performed by SGS are outlined in the laboratory's written SOPs. Additionally, SOPs are prepared for administrative or operational activities that affect data collection activities or sample integrity. Each SOP contains sufficient detail to ensure that specific procedures can be clearly followed and duplicated. The SOPs are issued as controlled documents by the Quality Assurance Office to ensure that only the most recent revisions are in circulation and are distributed to all pertinent staff.

Reference*:*

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.2. Approval and Issue

Analytical SOPs are scheduled for review on an annual basis by the primary user, at which time the SOP may be updated to incorporate the most recent promulgated/approved source method and/or technological advancements. The SOP is generally only updated if scheduled review indicates corrections and additions to the document are necessary; otherwise, the cover page will be signed to indicate that the document remains current and correct. Minor changes may be made to the document at any time through a controlled "Addendum" with approval of the Technical Director and/or QA Manager (or designee).

Internally generated documents are reviewed by appropriate staff members and, upon approval, are control by the QA Manager (or designee). All SOPs, logbooks, and internal forms handled in this manner and electronic, read-only versions are kept on the network.

Reference:

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.3. Master List

A master list of all internal SOPs (current revision and archived SOP numbers) is maintained by the QA Office; a copy of the master list of current SOP revisions is available to all staff on the Network:

\\usfs700\ank_groupdata\Public\DOCUMENT\SOP\~Approved_SOPs~

Note: SGS Alaska does not control all external documents (e.g. regulations). Rather, the lab maintains web links to documents that are made available by the issuing authority and staff access the on-line version/most up-to-date version at all times

Reference:

SGS SOP Tracking

4.3.4. Availability

All quality documentation (including instructions, standards, manuals, and reference methods) is available where required through the (write-protected) SGS network and in hard copy. All staff have access to the network.

Reference:

SGS Intranet

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.5. Obsolete Documents

It is the responsibility of the QA Office to ensure that all obsolete documentation, (resulting from a document change/update), is removed from the point of use folder and is archived electronically on the SGS network, which is not accessible to anyone outside of the QA Office (or designee).

Electronic documentation that is retained for any reason is marked as archived and/or stored in the appropriate archived documents folder on the SGS Network.

Reference:

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.6. Identification

All quality documentation is identified by a date of issue and/or revision number; page numbering (where appropriate), total number of pages or a mark to signify the end of the document (where appropriate), and the issuing and/or authorizing authority(ies) (where appropriate).

Reference:

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.7. Document Changes

Changes to quality documentation are reviewed and approved by the same function that performed the original review (or designee). Designees have the appropriate access to all pertinent information, as established through the job description.

Reference:

SGS Organization Chart (Alaska Division)

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.8. Altered or New Text

Altered or new text within a SOP is listed under "Summary of Changes from Previous Revision" and the document is assigned a new revision number. All documents are issued beginning with version number 1. Subsequent revisions are in whole number increments (i.e. 1 is modified to 2, etc.) Re-issue of a previously altered document will only contain the revision history of the most recent amendments. (Obsolete copies are stored as per section 4.3.5.)

Reference:

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.3.9. Hand-written Amendments

The SGS Alaska QA Manager (or designee) is the only person that may authorize hand-written amendments to any controlled document. The amendment shall be made in a permanent form and the change must be signed and dated by the QA Manager (or designee). Hand edits on controlled documents are limited to correcting minor errors and must be extended to all controlled versions of the document (i.e., electronic and hardcopy).

Reference:

SGS SOP 003 (Error Correction Procedures)

SGS SOP 006 (Preparation of Standard Operating Procedures)

4.3.10. Computerized Amendments

The QA Manager (or designee) is the only authorized person with modification rights to all controlled documents issued under the quality system and held on the SGS network. Notification to all affected

personnel is made immediately following the change via supervisor and/or e-mail or through the re-issuing of the document.

Reference:

SGS SOP 006 (Preparation of Standard Operating Procedures)

SGS SOP 111 (Document Control)

4.4. Review of Requests, Tenders, and Contracts

4.4.1. Policies and Procedures

SGS issues quotations on a regular basis. All laboratory tenders and/or contracts are released in accordance with the requirements of SGS SOP 140. The laboratory (generally under the direction of the General Manager or designee) verifies that the laboratory has the capability and resources to meet the requirements and to confirm the appropriate method selection.

Reference:

SGS SOP 140 (RFP/Proposal Review)

4.4.2. Records of Review

Records of review and pertinent discussions with the customer (including, but not limited to) subcontracted work and significant changes are retained as part of the quote file.

Reference:

SGS SOP 007 (Laboratory Communications)

SGS SOP 125 (Archiving of Raw Data and Work Order Files)

SGS SOP 140 (RFP/Proposal Review)

4.4.3. Notification of Customer

Records of notification of any deviations from the contract are maintained in the client folder(s), specific to the request, tender, or contact.

Reference:

SGS SOP 007 (Laboratory Communications)

SGS SOP 140 (RFP/Proposal Review)

4.4.4. Contract Amendments

Contract amendments are subject to the same policies and procedures, outlined above, and amendments are communicated to all (affected) personnel.

Reference:

SGS SOP 007 (Laboratory Communications)

SGS SOP 140 (RFP/Proposal Review)

4.5. Subcontracting of Tests

4.5.1. Competency

SGS Alaska provides an abundant number of tests for clients; however, occasionally it is requested that we perform certain analyses for which we do not have the capabilities. In such cases, as a service to our clients, SGS may arrange for such analyses to be conducted at a subcontract laboratory. SGS does not intentionally solicit work it does not perform, but this service is offered when such a test is relatively small component to the overall scope of a project or at the request of the client. Tests performed at SGS may also be subcontracted to another laboratory during periods of high sample volume or instrument down times, when an alternate instrument or method is either not available or unable to satisfy data quality objectives, in order to meet client needs.

Selection of a subcontract laboratory is based on the specific project requirements (e.g., ADEC DW, ADEC CS, DOD-ELAP, USDA foreign soil importation permit). The subcontract lab must be certified by the appropriate regulatory agency. SGS will require subcontracted laboratories to demonstrate that they meet DOD-ELAP requirements where applicable. Records of all subcontract labs used are maintained by Reference Lab Coordinator and are stored on the SGS Network. If an appropriately accredited lab cannot be utilized, it will be the responsibility of the client to make the final determination on which facility to use.

Where a subcontracted lab has been used, a copy of the subcontract lab report will be issued directly to the client to ensure clarity on which lab performed the work.

Reference:

SGS SOP 132 (Reference Lab (Subcontracting))

4.5.2. Customer Notification

The SGS Business Development or Project Manager will advise the client of the need for subcontracting work. This should be done in writing (preferably when the quote is issued) and client approval (in writing) should be secured before the work begins.

The Production Manager will notify the assigned Project Manager in the event that in-house work must be rescheduled for subcontracting in the event of capacity or instrumentation issues. In such an event, the Project Manager will contact the client for approval to subcontract the work. Copies of customer approval and/or notification – written and/or verbal – are retained as part of the Chain of Custody (CoC) record.

Reference:

SGS SOP 122 (Login and Package Review)

SGS SOP 132 (Reference Laboratories (Subcontracting))

SGS SOP 140 (Review of Requests for Quotes, Proposals and Contracts)

4.5.3. Responsibility

SGS Alaska is responsible for the contracted work, unless the customer or regulatory authority specifies the subcontractor to use. Records of customer or regulatory authority specifications are retained in the quote file.

Reference:

SGS SOP 132 (Reference Laboratories (Subcontracting))

SGS SOP 140 (Review of Requests for Quotes, Proposals and Contracts)

4.5.4. Results

SGS Alaska requires subcontract results to be reported in writing or electronically.

4.6. Purchasing Services and Supplies

4.6.1. Policies and Procedures

Procurement of supplies and services for SGS NAM (including the environmental division) is governed by strict purchasing policies, laid down by the SGS Corporation. All purchases require approval from Management (or designee), to ensure that the supplies or equipment purchased are of adequate quality to sustain confidence in the work. Selection of a supplier is done in accordance with the policies of the SGS Procurement Division. Where possible (or required by the lab) preference is given to suppliers with ISO certification or accreditation and the use of materials that are traceable to international standards. However, the purchasing department may have contracts that were established on an overall service basis, which may or may not include certification or accreditation. Records of suppliers used are maintained by the Purchasing department.

When at all possible, all references materials will be obtained from a vendor with ISO Guide 34 approval.

Reference:

SGS SOP 104 (Equipment Monitoring)

SGS SOP 126 (Procurement, Receipt of Supplies and Processing Vendor Invoices)

4.6.2. Verification

All purchased supplies that affect the quality are utilized only when verified compliant with specifications. Upon receipt of all purchased items for the laboratory, part numbers are checked against the Purchase Order; expiration dates, (if applicable), are verified to ensure a suitable period of usage; all materials that are traceable to a national standard are checked to insure they have a certificate of analysis/production information. In the event that any of the pre-requisites are not supplied, the lab contact notifies the purchasing department and the supplier is contacted for immediate replacement and/or submission of all required documentation. Where necessary, the following information is retained: date received and/or date opened.

4.6.3. Purchasing Documents

All routinely ordered items (e.g., reagents, standards, consumables) are pre-approved through the Lean Purchasing program. These items have been reviewed for technical content, as well as trigger levels and order quantities, and are tracked in a database: \\usfs700\scans\NewScans\cw_scan\data\users\CDS\~Purchasing

Non-routine items will be reviewed and approved by the Production Manager before orders are submitted to the General Manager (or designee) for finalization.

Reference:

SGS SOP 112 (Standards Labeling & Traceability)

SGS SOP 126 (Procurement, Receipt of Supplies and Processing Vendor Invoices)

4.6.4. Approved Suppliers

SGS Alaska procures goods and services from reputable organizations with which they have a historical relationship, or which have been investigated and approved for use. Records of approved suppliers are maintained by the Procurement department.

Reference:

SGS SOP 126 (Procurement, Receipt of Supplies and Processing Vendor Invoices)

4.7. Service to Customer

4.7.1. Cooperation with Customers

SGS Alaska maintains a customer service department whose sole responsibility is to service the customer. SGS Alaska makes allowances for client access for monitoring of work, while at all times ensuring the confidentiality of other customers. This is achieved through guided tours and on-going communication. Records of client access are recorded in the Visitor's Logbook and/or part of the client file(s), where pertinent communications are maintained. Procedures are in place to ensure that the confidentiality of all customers is protected at all times.

Reference:

SGS Visitor's Logbook

SGS SOP 007 (Laboratory Communications)

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

4.7.2. Feedback

SGS Alaska solicits feedback from customers on a regular basis. Feedback includes (but is not limited to) formal surveys, phone calls, and e-mails. Annually, a formal survey is conducted with results reviewed at the completion of the survey (within 1 month of sending out the survey). All customer feedback requiring follow-up is done as received with a general review of all customer feedback done annually during the Management Review.

Records of customer feedback are maintained by the QA Office.

Reference:

SGS SOP 113 (Audits, Assessments and Managerial Review)

4.8. Complaints

4.8.1. Policies and Procedures

SGS Alaska investigates all complaints made in person, on the telephone, or in writing. The investigation into a concern by a client occurs in a manner similar to Analyst recognition of a nonconformance event. The client is consulted to identify the procedure or data point(s) in question, the reason for the concern, and the expectation for the result or procedure. The documentation and technique of the subject procedure are reviewed to verify that SGS's SOPs were followed and that the SOPs are in line with EPA approved or industry accepted standards. The subject data are reviewed to determine the accuracy of the initial acquisition, calculations, and reporting. This review includes evaluating how the event affected the result(s) (e.g. positive bias).

All client complaints must be reported to management. The Technical Director must be consulted for technical matters outside of the Project Manager's scope of knowledge. Issues relating to data quality and/or

method/project compliance must also be directed to the QA Manager. Additionally, the General Manager must be involved in any situations with financial consequences.

The evaluation of feedback and any necessary action required is given **top priority** by all concerned. The customer is kept informed of the investigation and is involved in setting time-lines for resolution of problems.

Reference:

SGS SOP 007 (Laboratory Communications)

SGS SOP 105 (Corrective Actions)

4.8.2. Records

Documentation of the investigation and findings can occur by one of several means, depending on the nature of the concern. Example forms of documentation are a letter to the client, completion of a Corrective Action Report (CAR), or phone records from telephone/ conference calls.

4.9. Control of Nonconforming Testing

4.9.1. Policies and Procedures

Where a non-conforming result or action is discovered or suspected internally, the occurrence is reported immediately to the appropriate supervisors and the following remedial actions (where necessary) are taken immediately: confirm finding, stop work or withhold test report if necessary, determine if other areas affected by the nonconformance, and stop work or withhold test reports for any other work affected. Where necessary, customers may be notified and work may be recalled. The Quality Manager or Technical Director may review the circumstances of all non-conforming actions and determine whether corrective action should be taken.

Where the evaluation of the significance indicates that the nonconforming work could recur, or that there is doubt about the compliance of the lab's operations with its own policies and procedures, the corrective action procedures given in section 4.11 shall be promptly followed and resumption of work shall occur after authorization given by the QA Manager and/or Technical Director.

Reference:

SGS SOP 105 (Corrective Actions)

4.10. Improvement

4.10.1. Policies and Procedures

SGS Alaska has a continual improvement plan in place, within the quality policy, and with quality objectives, with inputs from analysis of data, internal and external audits; corrective and preventive actions, and management reviews.

Reference:

SGS SOP 105 (Corrective Actions)

SGS SOP 113 (Audits, Assessments and Managerial Review)

4.11. Corrective Action

4.11.1. Policies and Procedures

The corrective action investigation documents an out of control event (OCE) or systematic deficiency that adversely affects data quality objectives or fails to meet method/project requirements. This process further

serves to identify the root cause, recommend specific actions to prevent a similar occurrence, and include a follow-up to verify a return to control. The resultant corrective action creates a change in some element in the testing or analytical system to reduce the risk that a quality system failure will recur. This procedure is used as a tool for improving elements of the Quality System and may also involve client participation or notification as necessary.

Corrective action reports (CAR) describe responses to an OCE, including client notification procedures, procedures for repeating or stopping work, and the incorporation of proposed solutions and subsequent verification of its effectiveness. They may be initiated by an Analyst, Project Manager, the Technical Department, or the QA Office. CARs are tracked, investigated and reported by the Corrective Action Team (CAT). The process generally starts with initial interviews of the person(s) involved, with an emphasis on determining the root cause and opportunities for continuous improvement. Members of the CAT may invite involved staff to the CAT meeting for further discussion and/or initiate training, as warranted.

CARs are not initiated when standard corrective action procedures as outlined in the written SOPs are followed to address isolated OCEs. Documentation for these instances may be found on the QC sample summary reports, case narrative, and/or sample comments for the associated batch. Examples of corrective actions outlined in the analytical SOPs include:

- QC sample or calibration data are outside the acceptance windows.
- Blanks contain contamination above acceptable levels.

Non-conformances that are evidence of systematic error or breakdown in a procedure or for situations that are not typical to day-to-day operations require documentation with a CAR. Examples are:

- Performance Evaluation (PE) sample outliers
- Changes in SOPs due to an external audit
- A problem or non-conformance not under a person's direct control (e.g. inter-departmental)
- Recurring problems fixable by the employee or failure to follow the approved SOP.
- Undesirable trends in spike recoveries, RPDs, sensitivity capabilities or control charts.
- Customer complaints regarding lab error or deficiency, especially for corrected reports.

The Corrective Action Team (CAT), which includes the QA Manager and the Technical Director, reviews all CARs. A summary is provided to the Management Team via the QA monthly report.

Reference:

SGS Analytical SOPs

SGS SOP 105 (Corrective Actions)

4.12. Preventive Action

4.12.1. Action Identification

Needed improvements and potential sources of non-conformances, either technical or concerning the quality system are identified through the internal audit and/or the corrective action procedures.

CAR forms are reviewed and evaluated to ensure that there are no repeat occurrences of significant and/or preventable non-conformances. Where a recurrence is noted, additional actions will be taken.

Reference:

SGS SOP 105 (Corrective Actions)

SGS SOP 113 (Audits, Assessments and Managerial Review)

4.12.2. Action Plans

The Corrective Action Team (CAT) evaluates the CAR and, where appropriate, assigns action items for implementation. A signed copy of the CAR is maintained on the Network.

The Internal Audit Coordinator verifies that internal audit findings are effectively closed out. An electronic copy of internal audits reports is maintained on the Network.

Reference:

SGS SOP 105 (Corrective Actions)

SGS SOP 113 (Audits, Assessments and Managerial Review)

4.13. Control of Records

4.13.1. Procedures

SGS Alaska has procedures for identification, collection, indexing, access, filing, storage, maintenance, protection, backup and access of electronic records, and disposal of quality and technical records. Quality records shall include reports from internal audits and management reviews as well as records of corrective and preventive actions.

As technology permits, data may be retained in hardcopy and/or electronic format (e.g., Portable Data Format (PDF) or raw instrument data files). Data pertaining to sample analyses, quality control analyses, instrument or method studies (e.g., DL, IDL, RT windows, IDC) are retained for a minimum of 5 years. All analytical and calibration batches, final reports and data packages have been scanned, maintained and backed-up on the Network. Quality records not scanned electronically will be retained in hard copy for five years.

In the event that the facility changes ownership or location, or the facility is to be permanently closed, the DOD-ELAP accrediting body and relevant state certifying bodies will be notified in writing. In the event of closure of the facility, clients will be notified in writing so that records may be transferred according to their instructions. All appropriate regulatory and state legal requirements concerning laboratory records will be followed. The laboratory will be accountable and liable for analyses of all samples received before and after a change of ownership.

SGS is committed to providing customers with service excellence, which includes a strong emphasis and respect for customers' right to privacy. All personal information is collected only for the purpose of performing the requested service or of adding the customer name and contact information to our database or mailing list, so that we can provide them with information, or respond to a request they have made. By requesting services from SGS, customers consent to the collection and use of this information in accordance with the SGS Privacy Statement. SGS does not disclose any personal information to third parties, except as required by law or upon the customer's request. Specifically, confidentiality is maintained through Employee Agreements, and Human Resources specific policies for electronic storage and transmission of results.

Reference:

SGS SOP 125 (Archiving of Raw Data and Work Order Files)

SGS SOP 142 (Electronic Data Storage)

4.13.2. Record Integrity

All records shall be legible and shall be stored and retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss. Retention times of records shall be maintained.

Reference:

SGS SOP 142 (Electronic Data Storage)

4.13.3. Technical Records

SGS Alaska maintains technical records of:

- All original observations;
- Derived data;
- Sufficient information to establish an audit trail;
- Calibration records;
- Copies of each test report;
- Personnel responsible for the test;
- Personnel responsible for reviewing the results;

Reference:

SGS SOP 003 (Documentation and Error Correction)

SGS SOP 111 (Document Control)

SGS SOP 112 (Standards Labeling & Traceability)

4.13.4. Record Information

The records retained identify factors affecting uncertainty and contain sufficient information such that the method could be repeated under the original conditions.

Reference:

SGS SOP 003 (Documentation and Error Correction)

SGS SOP 111 (Document Control)

SGS SOP 141 (Uncertainty)

4.13.5. Recording

Observations, data, and calculations are recorded at the time they are made and are identifiable to the specific task; all runs will be documented.

Reference:

SGS SOP 003 (Documentation and Error Correction)

SGS SOP 111 (Document Control)

4.13.6. Corrections to Records

Where it is necessary to make a correction to a record, it shall be done in such a way to ensure the following:

- Original record is not obscured;
- Correct values are entered alongside;
- Alterations authorized by initial (or suitable electronic tracking system);

Reference:

SGS SOP 003 (Documentation and Error Correction)

4.13.7. Corrections to Electronic Records

SGS Alaska utilizes a Laboratory Information Management System (LIMS), Horizon, which is accessed through unique user login and password. In addition, where modifications to an electronic record are made through the data management system, it is retained in the system. Where applicable, instrument software maintains an audit trail of any deletions or manual integrations. All other quality records are retained on the write-protected folder of the SGS network, with only the QA Office having modification rights.

4.14. Internal Audits

4.14.1. Requirements

Audit reports are provided to the Production Manager, Technical Director, and General Manager by the QA Manager (or designee), who serves as the audit facilitator. Changes in laboratory SOPs as a result of an audit are communicated to the appropriate staff and implementation of changes is ensured via follow-up by the QA Manager, Technical Director and/or Production Manager.

In addition to external audits conducted by certifying agencies or clients, SGS conducts the following internal audits.

- Internal Audits are conducted by the QA Manager (or designee) in each area of the lab to assess method and program analytical areas are identified annually for the internal audit schedule. Audit reports are issued with corrective action plans (if necessary) and follow-up audits are performed as needed.
- Blind samples are introduced into the analysis stream to evaluate personnel and methods on an ongoing basis.
- Blind samples are also introduced on an as-needed basis when concerns arise about a particular analysis, the method, the instrument, or the Analyst via quick response testing services offered by ISO 17025 accredited vendors of PE or PT sample materials. This often includes blank samples to test for false positive results.

Reference:

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

4.15. Management Review

4.15.1. Objectives

SGS Alaska senior management reviews the quality system annually, in accordance with a predetermined schedule to ensure the continuing suitability and effectiveness, and to introduce changes or improvements.

The internal audit program, the corrective action system, the training program, issuance of the monthly QA reports and regular management meetings are all central elements of managerial review.

On an annual basis, the management team will review the previous year and develop action plans for the coming year. Their findings will be recorded in the Annual management Review (AMR) Report which is distributed to the corporate Vice President and local Management Team. Action items resulting from the AMR are monitored during Management Meetings held throughout the year to ensure progress and closure.

The laboratory's Management Team meets regularly in round-table discussions to review concerns regarding lab operations and to consider ideas for improvements.

The laboratory's General Manager and Production Manager track key performance indicators (KPIs) and changes in the volume and type of work. Lab resources, capacity and the ability to satisfy project turn-around-times are also reviewed during frequent status meetings involving the General Manager, Project Managers (PMs), Technical Director, QA Manager, Business Development, Production Manager and representatives from each analytical section.

Client feedback, in the form of Data Quality Reviews, inquiries, and/or complaints, is in most cases initially provided to the Project Manager. It is the PM's responsibility to notify management of any concerns and facilitate a prompt resolution.

Quality Assurance Reports to management are intended to keep management abreast of QA/QC activities and developments. Corporate QA KPIs (e.g., CARs, PEs, Complaints) are tracking monthly and submitted to the General Manager, who forwards them to SGS Laboratory Excellence. QA reports, distributed to the local Management Team, will generally include:

- Review of SOP status
- Status of DL, LOD & LOQ studies
- Results of control charts evaluations
- Performance test study status and scores.
- Status of various certification programs
- Results of external and internal audits
- CARs
- Comments and recommendations regarding other concerns affecting the quality of the data generated within the laboratory.

Additionally, the QA Manager issues monthly or quarterly reports tracking:

- Training and staff development opportunities
- Continuous Improvement activities

Originals are digitally signed, dated and maintained on the network (\\usfs700\ANK_GroupData\Public\QAQC\~QA_Reports), along with a record of their distribution.

Reference:

SGS SOP 113 (Audits, Assessments and Managerial Review Program)

4.15.2. Contents

The AMR takes account of:

- suitability of policies and procedures
- reports from managerial and supervisory personnel
- outcome of recent internal audits
- corrective and preventive actions
- assessments by external bodies
- results of interlaboratory comparisons or proficiency tests
- changes in the volume and type of work
- customer feedback
- complaints
- recommendations for improvement
- other relevant factors such as quality control activities, resources and staff training

All findings and necessary actions that arise from reviews are recorded and maintained.

4.15.3. Actions Taken

All actions identified are carried out within an appropriate and agreed time scale.

4.15.4. Records

Records of the management review are distributed to the management team.

5. Technical Requirements

5.1. General

SGS Alaska makes every attempt to ensure that the many factors affecting the correctness and reliability of the tests performed by the lab are controlled. Control is achieved through Analyst training and proficiency, appropriate environmental conditions and a rigorous and on-going QA/QC program.

5.2. Personnel

5.2.1. Qualifications

The objective of SGS Alaska is to provide quality analytical determinations in a timely manner. This can only be realized by fostering excellence in its staff, through training, and provision of a workplace that is safe, adequately sized, and results-oriented.

It is the responsibility of the Technical Director, to ensure that staff has the necessary qualifications and experience to produce quality analytical data and to provide appropriate training as required to achieve this.

Reference*:*

SGS Organization Chart (Alaska Division)

5.2.2. Trainees & Training

New hires begin with the onboarding program. In addition to norms and expectations outlined in the Welcome Packet, new hires are guided through the Orientation & General Training program. The goal of this program is to provide a common basis of knowledge for all staff and each module is facilitated by an experienced staff member. Topics include (for example): Training Manuals & the training program, Quality System Orientation, Introduction to the Ethics Program, Laboratory Communication, Introduction to LIMS, etc. For laboratory staff, modules also include (for example): General Chemistry, Use & Calibration of Balances, Use & Calibration of Pipettors, Foreign Soils, Waste Disposal, Peer Review Reports, etc.

Analysts are trained by an experienced Analyst on an individual basis using the procedures outlined in the SGS Training and Certification SOP. All documentation is filled in the individual's training record, maintained by QA. A Demonstration of Capability Record is completed annually for each method an Analyst is performing. Only Analysts who have completed training may run analyses independently. Analysts in training work directly with a trained Analyst.

The Technical Director, QA Manager, Safety Officer or their designee will coordinate the training and documentation thereof. Intra-laboratory training programs and on-the-job training include:

- Study of SOPs and references, including MSDS forms, reference methods, initial and ongoing training for safety precautions, etc.
- Observing experienced Analyst
- Performing the procedure under direct supervision of experienced personnel
- Analyzing blind QC samples prepared by the experienced trainer
- Completing Initial Demonstration of Capability (IDC), DL and PE studies (as applicable)

Each new hire is escorted through the laboratory by the Safety Officer for training in the location and use of the lab's safety equipment. Follow-up laboratory safety walk-through tours are also performed annually. Additional safety training is provided on an ongoing basis as coordinated by the Safety Officer. The Safety Officer maintains records of attendance.

Additional training from outside short courses or seminars (i.e. the SGS Sexual Harassment Policy, SGS Ethics Training, Manual Integration Policies and Practices, etc.) is also documented in the training record.

The laboratory maintains a comprehensive Training Program, managed by the QA Manager. The QA Manager (or designee) and Technical Director review documentation in support of an Analyst's certification to perform a particular test method. The qualification records are maintained on the network in the Central Data Storage (CDS) directory or with the QA office (as appropriate).

Reference:

SGS SOP 102 (Training and Certification)

5.2.3. Employees

The Company seeks to provide employees with meaningful and challenging work, as well as with development opportunities to prepare for new responsibilities. Supervisors provide feedback and review employee development plans annually through the SGS Employee Review. Employees are expected to take primary responsibility for their own careers, showing initiative, taking job training when necessary, and working with supervisors to achieve Company objectives while moving toward their own career goals. SGS Alaska encourages employees to continue to develop their skills through work experience, education and cross-training.

All training is documented and employees must pass a background check (which verifies degrees conferred). Additional training (e.g., course/seminar certificates) should be provided for inclusion in their personnel file.

SGS Alaska are primarily regular (with benefits) or temporary (seasonal without benefits) staff.

Reference*:*

SGS SOP 102 (Training and Certification)

5.2.4. Job Descriptions

The laboratory shall use personnel who are qualified on the basis of appropriate education, training, experience and/pr demonstrated skills, as required. The Senior Management maintains job descriptions for all staff. In addition to the General Manager (refer to Section 4.1.5.6) and the Technical Director (refer to Section 4.1.5.8), core job descriptions are as follows:

Project Manager: The PM serves as the liaison between the laboratory and its clientele. The PM is responsible for understanding the needs of the client and communicating this information to the operational staff. He or she handles all daily client interactions regarding project specifications and also tracks the status of all project analyses during testing and review.

Sample Control Staff: The sample receiving procedure is viewed as one of the most critical elements of the legal defensibility of the analytical process. It is essential that the client documents complete and accurate information on the CoC and sample bottles. Sample Control staff is responsible for the following tasks:

- Provide clients with proper sample containers and preservatives.
- Receive samples from clients; inspect them for proper preservation/volume and not irregularities.
- Receive and review the CoC record for collection dates and sample identifications.
- Assign unique sample IDs for each container and complete sample receiving records.
- Maintain the storage and handling of samples to ensure easy retrieval and compliance with storage requirements for the requested test methods.
- Track and perform sample disposal.
- The Fairbanks Manager will be responsible for forwarding samples to the Anchorage facility expeditiously, ensuring valid CoC.

Production Manager: Directly responsible for the supervision of the operations and sample control staff, including oversight responsibility of daily activities to ensure the generation of timely data that meets industry accepted practices and project-specific requirements. Oversees documentation practices supporting the tests performed, instrument maintenance, and decision making processes affecting the data.

Organic Chemist: Performs gas chromatographic analysis of volatile and/or semivolatile organic contaminants, fuels, pesticides, and polychlorinated biphenyls in water, soil, wipe, and oil samples.

Cold Vapor/AA/ICP-MS Chemist: Performs chemical analysis for metals in drinking water, wastewater, oil, and soil by cold vapor, AA and ICP-MS technology.

Inorganic Chemist: Performs analysis of water and wastewater for minerals, nutrients, solids, etc., by specific reference methods.

Organic Extraction and Metals Digestion Specialist: Performs extractions for analysis by the Organic Chemist and metals digestions for analysis by the Metals Chemist.

Microbiology Analyst: Performs microbiological analysis of drinking water and wastewater.

Hazardous Materials Specialist: Directs the technical operation of the proper disposal of laboratory generated hazardous waste.

5.2.5. Authorized Personnel

SGS Alaska operates under the direction of the General Manager, who is responsible for developing and maintaining the proper organizational structure to include authorized personnel for specific testing, issuing test reports, giving opinions and interpretations, and the operation of certain equipment types. In addition, the General Manager, is responsible for the description of the responsibilities of senior personnel, providing scientific leadership, project planning, ensuring overall timely delivery of project results and overall responsibility for the quality system within their departments.

5.2.6. Records

The QA Office maintains technical records of training; the QA Manager (or designee) maintains documents specific to the Quality Management System, the Human Resources department maintains academic and professional training records for all personnel (including contract staff), and the Safety Officer(s) maintain records of safety training. The records retained include training, skills and experience, educational and professional qualifications, proficiency records, authorizations, letters of commendation, and significant scientific reports.

All personnel files maintained by the Human Resource department are treated as confidential in so far as the individual (under the Freedom of Information Act) can access the contents.

Reference*:*

SGS Organization Chart (Alaska Division)

5.3. Accommodation and Environmental Conditions

5.3.1. Technical Requirements

SGS Alaska is a facility offering analytical functions. This requires a highly customized building with many specialized functions. Where necessary, the environmental conditions of the lab that can affect results are monitored and documented by the department personnel to ensure the integrity of the test work is not adversely affected.

5.3.2. Facility

The SGS Alaska Anchorage office is currently utilizing two buildings for its operation. The combined size of these buildings totals approximately 22,000 square feet. Building One houses most of the administrative offices which include: reception area, accounting, computer information systems management, purchasing office, data management, quality control, and all of the analytical facilities excluding volatile and semi-volatile gas chromatography. Building Two houses the volatiles and semivolatile gas chromatography departments, walk-in sample storage, and the warehouse.

Sample Storage: SGS Alaska has a walk-in refrigerator (>1000 ft^3) and two reach-in refrigerators (each 48 ft^3) to segregate samples for volatile analyses. There are two point-of-use refrigerators located in GC prep and the waters department (each 32 ft^3). In addition, there is one reach-in refrigerator (>100 ft^3) in sample receiving area to maintain controlled temperatures during temporary sample storage.

Sample Preparation Areas: The organics preparation area is supplied with a separate air handler to supply adequate ventilation. The metals preparation area has been upgraded to include a semi-clean room for low level metals analysis. A separate clean room is maintained for low level mercury analysis.

Volatiles Analysis: Instrumentation for GC/MS volatiles analysis is located in an isolated room to control potential laboratory contamination of samples.

The SGS Alaska Fairbanks receiving office consists of two rented rooms that total 976 square feet and includes: reception area, sample kit preparation area and storage. There are two refrigerators (each >20 ft^3) available for overnight sample storage.

Additionally, SGS Alaska owns a customized trailer which can serve as the on-site facility for select mobile laboratories.

5.3.3. Monitoring

Laboratory rooms containing fume hoods have air exhausted through fume hoods as well as through a general exhaust system to maintain minimum airflow requirements. Rooms not containing fume hoods are exhausted through the general exhaust system.

The Sample Control staff monitors fume hood velocities on a weekly basis. They determine a pass or fail if the fume hood based on the standard 100 fpm velocity for our fume hoods. All fume hoods are on a preventive maintenance schedule to ensure efficient operating parameters are maintained.

The laboratory monitors the DI water systems to ensure that the DI water is free from reagents or contaminants that would otherwise interfere with testing.

All laboratory areas are supplied with proper and adequate lighting. The water and power supply is gauged to the demands of the equipment and instrumentation in each laboratory area.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

5.3.4. Incompatible Activities

There is effective separation between incompatible activities in the SGS Alaska laboratory. This is accomplished through the use of space to physically separate specific areas.

5.3.5. Access

Access to the facilities is restricted at all times. All visitors are required to sign in at the front counter and are escorted by laboratory personnel while in the building.

5.3.6. Housekeeping

SGS Alaska maintains contract personnel to ensure good housekeeping in the lab. All staff are responsible for the housekeeping in their respective lab workspaces, using cleaning products that are compatible with the work done in the lab.

5.4. Test Methods and Method Validation

5.4.1. Methods and Procedures

SGS Alaska uses appropriate methods and procedures for testing (which include as necessary) estimation of uncertainty and statistical techniques for the analysis of data.

Reference:

SGS SOP 141 (Uncertainty)

SGS SOP 145 (Control Charts & Control Limits)

5.4.2. Equipment Instructions

All supporting documents for method performance, including SOPs for equipment, are in place and are available electronically on the SGS network. Where appropriate, they are either included or referenced in the test methods or supporting operating procedures. Alternatively, equipment operating instructions are located in the manufacture's guide, located in the laboratory.

Reference:

SGS SOP 006 (Preparation of SOPs)

5.4.3. Method Deviations

Where deviation from a test method is required, the deviation is documented, technically justified, authorized by Technical Director, and accepted by the customer prior to implementation. Records of method deviations are retained as part of the final report.

5.4.4. Method Selection

SGS Alaska performs its testing operations according to the most current, up-to-date-methods and procedures (where appropriate), which meet the needs of the customer and are appropriate for the test. Deviations, if any, from the reference method and regulatory guidance will be documented in the method SOP.

Where applicable (e.g., if in-house control limits do not meet DOD QSM, sample mass varies from reference method, etc.), deviations to the DOD QSM will be submitted in the DOD QSM Variance Request template and provided to clients requesting proposals for DOD projects.

5.4.5. Non-Customer Specified Method Selection

Where methods are not specified, methods are selected from those published by international or national bodies, reputable technical organizations or in scientific texts or journals and that have been validated, or that have been developed and validated in-house. Method selection is based upon the media of the sample (e.g. solid vs. liquid), the amount available, and the concentration range expected for the contaminant being tested.

5.4.6. Inappropriate Methods

If laboratory staff feels that the customer has specified an inappropriate method, this fact is documented, the customer is notified, and a valid method is selected from those published by international or national bodies, reputable organizations or in scientific texts or journals. Records of notification to customer are retained as part of the quote file and/or the CoC.

5.4.7. Published Reference Methods

Where SGS Alaska performs testing operations based on published standard methods, the performance characteristics of the standard method are verified and recorded (with the method). The verification of validation is repeated if the standard method changes.

5.4.8. Laboratory Developed Methods

Where it is necessary to employ performance based methods that have not been established as standard, SGS Alaska will endeavor to ensure that these methods are precise and accurate. The methods are assigned to qualified personnel, fully documented and validated if possible and fit-for-purpose through customer consultation.

Where it is necessary to modify or establish a lab developed method, this will be, with the Technical Director's approval, listed as a deviation in the applicable SOP.

5.4.9. Non-Standard Methods

Where it is necessary to employ methods that have not been established as standard, SGS Alaska endeavors to ensure that these methods are precise and accurate. Prior to use of a non-standard method, SGS Alaska will get customer approval (retained as part of the quote file and/or CoC). Non-standard methods are fully documented and validated if possible and deemed fit-for-purpose prior to use in the lab.

5.4.10. Method Validation

Method validation is the process of establishing performance characteristics and the fitness for the intended use of a method. SGS Alaska will retain documents relating to method development.

Reference:

SGS SOP 111 (Document Control)

SGS SOP 148 (Method Development)

5.4.11. Range and Accuracy

The range and accuracy (the closeness of the assessment between the result of a measurement and a true value of the measurement) of a method employed by the laboratory must be relevant to the customer's needs. Range and accuracy of all methods is established prior to use in the lab.

5.4.12. Measurement Uncertainty

Measurement Uncertainty is an estimate, attached to a test result, which characterizes the range of values within which the true value is asserted to lie. Potential sources of uncertainty include all parameters associated with sample preparation, sample analysis and computational effects. SGS Alaska has an uncertainty of measurement policy, which is applied to all analytical methods.

Reference:

SGS SOP 141 (Uncertainty)

SGS SOP 145 (Control Charts & Control Limits)

5.4.13. Reasonable Estimates

Where test methods do not allow for a statistical estimation of measurement uncertainty, SGS Alaska will make a reasonable estimation and reports this estimate in a way that does not give a wrong impression of the uncertainty.

5.4.14. Calibrations

SGS Alaska performs in-house calibrations for thermometers, mechanical pipettors and balances. Calibrations of reference thermometers and weights are contracted out to ISO 17025 accredited calibration laboratories.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

5.4.15. Calculations and Data Transfers

Calculations and data transfers are checked by laboratory staff authorized to preview and release of the final report. This is performed before the final report is generated and sent to the customer.

Reference:

SGS SOP 101 (Peer Review)

SGS SOP 122 (Login and Package Review)

5.4.16. Computers or Automated Equipment

Where computers or automated equipment are used:

- that have lab developed software and/or calculations, these are verified and records of verification maintained by the QA Office.
- these are maintained to ensure proper functioning through routine maintenance as required/planned
- appropriate environmental and operating conditions are provided.

5.4.17. Protection of Data

SGS Alaska has procedures in place for the protection of data and includes the following:

- Integrity and confidentiality of data entry or collection - Data integrity and confidentiality are maintained through proper training of employees and the use of security protocols. Two levels of password authentication are used to control user activity with customer data. To gain access to the network, each PC must be logged in using a valid Windows domain account. Access to various areas of the network, as well as the LIMS database, is restricted based on the account used. The second security level controls access into the LIMS, a specific LIMS logon ID and password combination is required and access levels are restricted based on this logon ID. Every user of the LIMS must log in using their own logon ID and password combination to gain access to the LIMS. Access to the LIMS system is fully audited and can be traced back to individual users. All user classes in LIMS have defined idle time allowances, after which the system will terminate the session.
- Storage - All critical data are stored on either the LIMS server, which holds the LIMS database as well as the worksheet files, or on the main file server. These servers are maintained in a secure climate controlled room. Each server has a redundant power supply for fault tolerance, as well as UPS battery backup. The LIMS database is backed up nightly to tape. Transaction logs are copied onto multiple locations on the server and are archived to tape weekly. File and database servers have a nightly incremental back up to tape, full backup to tape is performed weekly. The backup tape sets are taken from the primary location to a secure secondary location the next day for further recoverability in the event of a major catastrophe.
- Transmission - Electronic data transmissions are routinely sent out in PDF format to reduce the possibility of tampering with the data. Data authenticity and integrity can also be maintained and enforced using digital signatures and encryption of emails and attachments when required. *Note: all email transmissions are screened for viruses at the server level, as well as at the desktop level. This helps reduce the risk of infection resulting in data loss, as well as the sending out of infected emails to our customers.

Reference*:*

SGS SOP 142 (Electronic Data Storage)

5.5. Equipment

5.5.1. Operation

SGS Alaska ensures that all of the equipment required for performing all test work is maintained in good working order, is compliant with specifications, is checked and calibrated before use (where appropriate), is

operated by authorized personnel, is operated using available current instructions on use and maintenance, and is uniquely identified. It also meets the accuracy necessary for performing the test work and is checked on a regular basis to ensure compliance with the specifications. All available equipment is checked (and calibrated if necessary) before use to ensure proper functioning and is capable of achieving accuracy required for the test method.

SOPs, together with the manufacturer's instructions are in place to ensure proper use and maintenance of the equipment.

The SGS Alaska Production Manager assigns a unique identification (e.g., VKA and VNA are GC/MS instruments for volatiles; SOA and SQA are GC/MS instruments for semivolatiles) to each piece of equipment.

5.5.2. Records

It is the responsibility of the Production Manager to ensure that a maintenance log is kept for each piece for major analytical equipment. At a minimum, these logs must document the following.

- Each entry is dated and initialed by the person making the entry.
- Each time the instrument is taken out of service and the type of repair made.
- Any non-compliant behavior in the instrument that required the maintenance/repair (i.e. a cause and corrective action format).
- Each time the instrument receives routine maintenance from either SGS staff or instrument company representatives.
- Each time an instrument is returned to service.

Additionally, it is the responsibility of the analytical staff and Production Manager to implement preventive maintenance on the analytical equipment as necessary, to avoid instrument failures which could impact data quality.

SGS Alaska maintains records of equipment, which include the following information:

- Date purchased or put into service;
- Identity of the equipment and its software;
- Manufacturer's name, model, and serial number or other unique identification;
- Checks that the equipment complies with the lab requirements and standard specifications;
- Current location, where appropriate;
- The manufacturer's instructions, if available, or reference to their location;
- Calibration history and due date of next calibration;
- The maintenance plan, where appropriate, and maintenance carried out to date;
- Any damage, malfunction, modification or repair to the equipment;

Reference*:*

F072 - Equipment List

5.5.3. Procedures

Analytical instruments and equipment require routine and non-routine maintenance. The instrumentation employed in sample analysis is maintained by the primary Analyst to ensure that the data generated is of the utmost quality. The Production Manager is responsible for ensuring that preventive maintenance is performed. Records of preventive maintenance are part of the permanent record for each instrument. Analysts are responsible for monitoring an inventory of spare parts for each instrument. Spare parts are defined as: *Expendable parts as well as those parts subject to wear and/or breakage.* A sufficient inventory will be kept on hand to reduce down-time.

Routine maintenance is performed by the instrument operator as described in the preventive maintenance procedures of the operator's manual or instrument SOP. Typically, the following preventive maintenance activities will be performed:

1. Check instrument sensitivity and response daily or prior to each use as described in the operator's manual, SOP, or analytical method. This may include:
    - Tuning and Daily Calibration
    - Gas Flow Measurements/Leak Checks
    - Proper Energy Levels
    - Zeroing and Full Scale Operation
2. Incubators, refrigerators and freezers are checked daily for proper temperature. Liquid filled thermometers are calibrated annually and digital thermometers are calibrated on a quarterly basis.
3. Balances are checked daily for proper calibration. All readings are entered into a logbook.
4. Exhaust hoods are checked weekly to verify that they are functioning properly and flow rates are recorded in a logbook.
5. The waste storage area is also inspected weekly for safety.
6. Storage blanks, for volatile organic contaminants, (water and/or soil depending on matrix of samples stored in the refrigerator) are rotated and analyzed biweekly to monitor for laboratory contamination.
7. Annual DI Water Suitability Testing is performed to verify suitability for microbiology testing along with monthly checks.

Non-routine maintenance may be performed by vendor service technicians, Analysts, or the Technical Department. All non-routine maintenance must be recorded in the instrument maintenance logs with sufficient detail, noting the problem, corrective action, and the date on which the instrument returned to operational service.

Reference*:*

SGS Analytical SOPs

SGS SOP 104 (Laboratory Equipment Monitoring)

5.5.4. Out-of-Service

Out of service equipment is isolated (if appropriate) clearly labeled as "Out-of-Service" or "Not-in-Service" or "Do-Not-Use", examined for the effects of the problem and addressed appropriately.

Reference*:*

SGS SOP 104 (Laboratory Equipment Monitoring)

5.5.5. Calibration Status

For equipment not calibrated on an as-used basis, the calibration status of equipment is identified, including (where practicable) date when last calibrated and expiry date or recalibration date. DOD-ELAP requires that a calibration be performed annually at a minimum.

5.5.6. Return to Service

If equipment goes outside the direct control of the lab, it is checked and validated before being returned to service. Records of return to service are maintained in the equipment files.

5.5.7. Adjustments

Access to the lab is controlled, preventing unauthorized access by anyone into the lab area. The main doors to the facility are locked at all times (excluding the front door and GC prep doors during business hours) and visitors or non-SGS personnel are escorted while in the lab to further ensure no unauthorized adjustments are made to any equipment.

Internally, all equipment that could be affected by adjustments is monitored daily to ensure conformance to specifications. Records of monitoring (e.g. balance checks, incubators, etc.) are maintained.

5.6. Measurement Traceability

5.6.1. Calibration Program

Balances calibrations are checked at the start of the day and more frequently if necessary. The readings for each balance are entered into the equipment monitoring log as per the Equipment Monitoring SOP. Class S weights (calibrated and certified by a third party at least once every 5 years) are used in the calibration of the balances. The balances calibrations are verified monthly by SGS Staff and the balances are serviced annually by an ISO 17025 accredited provider.

Non-digital thermometers are calibrated annually using an NIST Certified reference thermometer. Sample receiving and other digital thermometers are calibrated quarterly. The temperature for each thermostatically controlled device is maintained and recorded daily (twice a day for Microbiology). Corrective actions for temperatures that are out of control are addressed according to the Equipment Monitoring SOP. The NIST-traceable reference thermometer is sent out for calibration from an independent source at least once every year.

In accordance with many of the regulatory protocols for analytical procedures, the temperatures of ovens, incubators, refrigerators, and freezers must be checked to ensure control. The verification data is recorded in logbook and reviewed for exceedance which may affect date quality by the QA Manager (or designee). Sample refrigerators and freezers are monitored 7 days a week. Microbiology equipment is monitored twice daily; once a day on weekends and holidays.

Mechanical Eppendorf (or equivalent) pipettors are all verified, and documented in the pipette log. Disposable volumetric pipettors are verified on a per lot basis. All calibration checks are recorded in the pipette logs.

All other Environmental Services equipment requiring calibration has a calibration procedure in place, which is referenced in the method.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

5.6.2. Traceability to International System of Units

Balances are calibrated monthly by SGS staff using reference weights that are calibrated by an external calibration laboratory that is accredited to ISO/IEC 17025. Thermometers are calibrated by SGS staff using a reference thermometer that is calibrated by an external calibration laboratory accredited to ISO/IEC 17025. External calibration services have a demonstrated competence, measurement capability and traceability with certificates that contain the measurement results and measurement uncertainty and/or compliance statement.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

SGS SOP 112 (Standards Labeling and Traceability)

5.6.3. Traceability

Where traceability cannot be strictly made to International System (SI) units, traceability is established through the use of certified reference materials, agreed methods (validated with interlaboratory comparisons where appropriate), and consensus standards (validated with interlaboratory comparisons where appropriate).

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

SGS SOP 112 (Standards Labeling and Traceability)

5.6.4. Reference Standards

SGS Alaska has procedures in place for handling reference standards. A set of reference standards (i.e. a weight set and a thermometer) are stored the QA Office (or other designated area) and are reserved for verification purposes only.

Reference:

SGS SOP 104 (Laboratory Equipment Monitoring)

5.6.5. Reference Materials

Reference Materials used in the laboratory are traceable to SI units where possible, or to certified reference materials. Internal reference materials are checked as far as is technically and economically practicable. Intermediate checks are carried out to maintain confidence in the calibration status of reference materials according to defined procedures and schedules. Procedures for the transport and storage of reference materials are in place.

Solvents (e.g., methylene chloride) are analyzed for purity by subjecting a solvent blank to the analytical method corresponding to its intended use. The solvent's purity is then monitored periodically through the analysis of method blanks. Any reagent will be discarded at the first sign of decomposition or contamination. The Analyst is responsible for checking expiration dates and discarding expired reagents/standards.

Water is considered to be laboratory grade (equivalent to EPA Type II) when it has been passed through a charcoal filter to remove organic constituents and then through a deionizing column. Deionizing cartridges are changed when conductivity exceeds 2 µmhos/cm. The quality of the water is routinely monitored against established acceptance criteria for each analysis. Monitoring for use by the Microbiology Section consists of periodic measurements of the conductivity, pH, residual chlorine, HPC, and an annual water suitability test. To further ensure the quality of water, method blanks are performed with each analysis.

Standard solutions are generally purchased. If prepared by Analysts for in-house use, they are recorded in a logbook along with supplier identity, lot number, grade, concentration, method of preparation, Analyst name,

the date of preparation, and the expiration date. Standard solutions are then validated prior to use. Standard solutions are monitored for deterioration and discarded if such signs as color changes, precipitation, or concentration changes are detected. Solutions known to be light sensitive are stored in amber glass bottles.

SGS has procedures in place to ensure traceability of the purchase, receipt, and use of consumable materials used for the technical operation of the laboratory. These procedures consist of:

- Maintaining the vendor's certificate of analysis or purity, if available.
- Labeling the original container with a unique identifier, date received, and expiration date.
- Documenting the receipt and preparation indicating traceability to purchased stock or neat compounds by lot number or other unique identifier, method or preparation, dates, preparer's initials, expiration dates.
- Standards and solvents used in an analysis are recorded in the preparation and/or run logs to ensure traceability.

Stock standards traceable to NIST standards are purchased from approved vendors. Staff will purchase standards from ISO Guide 34 vendors whenever available.

The quality of data generated in an analytical laboratory is directly related to the quality and purity of the reagents/solvents used in preparing samples and calibrating instruments. These reagents/solvents fall into four categories:

- Solvents used in sample extraction
- Reagents used in sample digestion
- Internal spike/surrogate compounds
- Instrument tuning/calibration reagents

Unyielding efforts are made to acquire, maintain and verify reagents of the highest quality. In order to ensure the highest quality and purity, all chemicals and reagents acquired by SGS are of an appropriate grade, purchased through reliable commercial sources. If it is necessary for a particular method or procedure, "Ultrex" or spectrochemical grade reagents are purchased. Lower grade reagents may be acceptable for some procedures. The method objectives and availability determine the grade. When a particular method requires reagents, it is the responsibility of the Analyst to order the proper grade through the purchasing agent.

All chemicals are inspected, initialed, and dated at the time of arrival. These are four areas of storage:

- Those items currently in use for analytical needs are stored in the lab area.
- Flammables, solvents, and liquid hazardous materials are stored in a regulated room meeting code requirements (i.e. explosion proof lighting, ventilation, spill kit, etc.)
- Reagents chemicals in powder form are stored in a separate room in storage cabinets marked with the appropriate safety information, hazard classification, and identification.
- Temperature sensitive reagents and standards are stored in a refrigerator or freezer.

The purchasing agent is responsible for the transfer of all MSDS forms (Material Safety Data Sheet) to the laboratory Safety Officer to be added to the employee MSDS library.

Reference:

A2LA Document P102 (www.a2la.org)

SGS SOP 112 (Standards Labeling and Traceability)

SGS SOP 126 (Procurement, Receipt of Supplies and Processing Vendor Invoices)

SGS SOP 500 (Analytical Chemistry Quality SOP)

5.7. Sampling

5.7.1. Procedures and Plan

There is a sampling procedure in place for taking sub-samples for analysis, which includes a sampling plan (based on appropriate statistical methods, wherever reasonable) and includes factors to be controlled to verify the validity of the results, the selection of samples, and the withdrawal and preparation of samples.

The responsibility for collecting and transporting samples to SGS resides with the client. In cases where SGS personnel perform the sampling, a sampling plan is first reviewed and approved by the client. Data quality is directly related to proper sampling procedures. SGS will provide consultation and assistance in designing sampling protocols to see that field procedures assure the following;

- Samples contain no foreign material and accurately represent the site where samples are collected.
- Samples are:
    - of adequate size
    - collected in containers of appropriate type and quality for the matrix and analysis requested
    - properly preserved in terms of pH and temperature during transport
- Airborne or sample cross-contamination does not occur during transport.
- Accurate records are generated and kept regarding on-site conditions, such as maps of sampling sites, labeling of samples and weather conditions.
- Field monitoring instruments are working properly.
- Samples arrive at SGS in a timely manner.
- If site-specific quality control (QC) sample analyses are required, sufficient sample bottles will be provided with instructions regarding sample volume requirements in order to achieve the QC objectives for the site.

SGS will supply containers that are properly cleaned, labeled, and preserved for sample collection. Extra bottles are provided upon client request or for projects of sufficient sample size for the collection of extra volume to fulfill method and/or site requirements for laboratory quality control sample analyses. The client will complete the label with information that matches the information on the CoC record. Sample holding times begin at the time of sample collection and determinations of the time held is based on the time of the test method by the bench chemist. For composite samples, the holding time assessment begins with the end date and time of the composite period. For trip blanks, the collection date and time assigned by the client should coincide with the collection of the first sample in the set.

In the event that SGS collects samples, the following will apply: samples should provide a fair representation of the media being sampled; the sampling supervisor/project manager should try to determine the quantity and type of samples and the sample location prior to actual field work. As few people as possible should handle samples to minimize potential variables. The field sampler will be solely responsible for the care and

custody of all samples collection until the time of transfer to the laboratory via commercial courier or hand delivery.

A written record will be kept of sampling activities in a bound book. In addition to a log of all samples collected and all field instruments readings, information on items such as weather conditions, sampling techniques, and on-site conditions at the site of sampling will be recorded. Changes in the visual appearance of samples, odors, notable characteristics of the materials being samples, and other observations made during sampling will be recorded. Sample labels will be completed for each sample container with waterproof ink.

Reference:

SGS SOP 106 (Sample Receiving)

SGS SOP 107 (Sample Custody)

SGS SOP 118 (Sample Kit Preparation)

5.7.2. Deviations

All customer-requested deviations are noted in the client file and are communicated to the lab personnel.

5.7.3. Records

The CoC form used by SGS Alaska, allows for a record of the following, where supplied by the customer:

- Sampling procedure;
- Sampler identification;
- Environmental conditions (if relevant);
- Sampling location;
- Basis for sampling procedure statistics (if appropriate);

The sub-sampling procedure used in-house is maintained on the network and is the procedure followed by all staff. Where deviations from this method occur, they will be noted in LIMS via sample comments.

Reference:

SGS SOP 143 (The Weighing of Soils and Solids)

5.8. Handling of Test Items

5.8.1. Procedures

Sample custody begins at the time of collection and concludes with disposal or complete consumption of the raw sample, extracts and/or digestates during laboratory procedures. Legal custody records should provide a continuous record of possession or storage of samples in the field and the laboratory. Commercial shipping couriers are not required to sign the custody records; however, documentation must be made that identifies the courier and the airbill number or copy of the bill of lading.

The original CoC Record will identify the transported contents and will accompany the shipment. The field services supervisor will retain a copy of the CoC. Samples shall be properly packaged for shipment and dispatched to the laboratory. Shipment via commercial couriers (other than USPS) must be accompanied by a bill of lading or airbill. All postal receipts, bills of lading or airbills must be retained as part of the permanent project file record. A sample is considered to be in the possession of a person if:

- It is in that person's physical possession.

- It is in view of that person after they accepted receipt of it and have physical possession of it.
- That person has placed it in a secure area.
- The three previous items are all qualifiers until that person has relinquished it to someone else who fulfills any of the above requirements.
    - The Sample Control personnel will accept custody of the shipped samples and will verify that the information on the sample bottle labels and CoC agree. Discrepancies are noted on the Sample Receipt form. CoC forms must accompany all samples. No more than one project may be recorded per CoC.

The internal CoC begins at the time of receipt and is completed upon sample disposal. The Sample Custodian will distribute samples to the appropriate storage locations. Laboratory personnel will be responsible for the care and custody of samples while in their possession. When sample analysis and necessary quality assurance checks have been completed in the laboratory, the unused portion of the sample will be retained for 14 days after release of the final report or data deliverables (whichever is later) unless prior arrangements are made. Other arrangements can be made if necessary. For samples transferred from the Fairbanks facility, condition upon receipt in Anchorage will be documented on an additional form.

Reference:

SGS SOP 106 (Sample Receiving)

SGS SOP 107 (Sample Custody)

5.8.2. Identification

All samples submitted to SGS Alaska are assigned a unique identification through the LIMS system.

5.8.3. Deficiencies

All abnormalities and deficiencies identified upon receipt of the test items are recorded and, if appropriate, the customer is notified. Records are maintained in the associated batch peer review report and/or final report.

Any changes to the CoC submitted (e.g., changes to sample ID and/or collection information, addition/deletion of rush requests) must be documented. The Change Order Form should be initiated by the PM and completed by the client. Alternatively, e-mail or fax directives from the client may be used. Any change order received must be scanned with the CoC and sample receipt forms as part of the official work request and the laboratory must be notified of the changes.

5.8.4. Facilities

All non-monitored exterior doors are locked, preventing the unauthorized entry of an individual into the laboratory. Entry is gained by use of a master key and a pass code, which is issued to each employee. Specific areas within the lab where there is controlled access have their own keys.

5.8.5. Environmental Conditions

Records of the environmental conditions are monitored and recorded, (as appropriate). Records of non-compliance with required conditions are communicated to the customer via the final report.

5.8.6. Handling Instructions

Where handling instructions are provided by the customer, these instructions are transcribed into LIMS, and records of instructions are retained as part of the CoC.

5.9. Assuring the Quality of Test Results

5.9.1. Quality Control

SGS Alaska has a method validation program to establish the performance characteristics of a method to demonstrate "fitness for use". The performance characteristics are established over the short term and long term; all data generated by the lab is evaluated against the performance characteristics to determine if the results are acceptable (or fit-for-use).

SGS Alaska has quality control procedures for monitoring data validity, which may include but not limited to: use of reference materials (certified wherever possible); participation in interlaboratory comparison or proficiency testing programs; replicates; re-testing of retained items; correlation of results for different characteristics of an item.

Reference*:*

SGS SOP 145 (Control Charts and Control Limits)

5.9.2. Quality Control Data

All quality controls in place in the laboratory are recorded using the on-line LIMS system and reviewed to detect trends, and, where practicable, statistical techniques are applied. Acceptance criteria is based on validation, reference methods, or control charting, or as determined by the Technical Director.

Where applicable, the QA Manager (or designee) will engage in routine electronic review of electronic data via the MintMiner software program.

Reference:

SGS SOP 101 (Peer Review)

SGS SOP 145 (Control Charts and Control Limits)

5.9.3. Quality Control Data Analyzed

Monitoring of quality control data is done by all groups through the data approval process, by use of the quality control program and by comparison of the result to established performance characteristics. Where practicable, data may be charted.

Where results do not fall within the specified tolerances, action is taken to correct the deficiency. Detailed steps on actions to be taken if results are unacceptable can be found in the Corrective Action Table of analytical SOPs. Any corrective actions needed to address QC outlier or other technical challenges that are not listed in the SOP require the prior approval of the QA Office or Technical Department. In the event that data quality is impacted, the Project Manager will be notified and a corrective action will be initiated as specified in the Corrective Action SOP.

In order to maintain quality control on an ongoing basis, laboratory control samples (LCSs) prepared from NIST-traceable sources are analyzed with each batch. Full compound list spikes are performed for all DOD projects. Data must fall within specified control limits in order for sample analyses to proceed.

Reference:

SGS SOP 101 (Peer Review)

SGS SOP 145 (Control Charts and Control Limits)

This document contains confidential business information and is not intended for distribution.

This electronically signed PDF will be considered the controlled copy for staff.

5.10. Reporting the Results

5.10.1. Test Reports

Hold times are monitored to the hour for analyses that are measured by the hour. Analyses with holding times measured by the day shall be tracked by the day.

It is the responsibility of each Analyst to assure that adequate written records are kept of each analysis performed.

SGS Alaska provides test reports that contain, (where appropriate), the following information:

- Work Order number
- Name and address of laboratory;
- Location where test carried out (if different);
- Unique identification of the report on each page, and a clear identification of the end of the report;
- Name and address of customer;
- Unique item identification;
- Date and time of sample receipt;
- Date and time of sample extraction/digestion and analysis;
- Sampling plan and procedure used (where relevant);
- Test result with units;
- Name(s), function(s) and signature(s) or equivalent identification of person(s) authorizing the report;
- Statement to the effect that the results relate only to the items tested, where relevant;
- Subcontracted results clearly identified;

The QA Manager and Technical Department regularly review data packages (including at least 10% of all DOD packages) and calibration activities to ensure their adherence to SGS QA/QC standards.

5.10.2. Test Result Interpretation

Upon request SGS Alaska will provide all information necessary for the interpretation of test results that include the following:

- Variances from test methods;
- Information on specific test conditions;
- Statement of compliance;
- Statement on the estimated uncertainty when it is relevant to the validity or application of the result, a customer requires it, or when the uncertainty affects compliance to a specification limit;
- Opinions and interpretations, which are clearly marked;
- Additional requested information;
- Date of sampling, where available;

- Identification of the substance, material, or product sample;
- Sampling location, (where available);
- Environmental conditions during sampling (where available);
- Sampling method or procedure used and deviations, (where available);

SGS offers four levels of PDF data packages, generated directly from LIMS. PDF reports, with authenticated electronic signatures, are considered official reports and intended to be used in their entirety. SGS provided all reports and deliverables online. This secure web portal, Engage, can be accessed at https://engage.sgs.com.

After peer review of all analyses is complete, LIMS will generate a final report. (A partial or preliminary report may be issued at the discretion of the Project Manager.) The PM will review the report for consistency and specific project and/or client requirements. With the completion of this final review stage, the report is issued to the client..

Reference:

SGS Statement of Qualifications – Data Deliverables Options

SGS SOP 122 (Login and Package Review)

5.10.3. Opinions and Interpretations

Where SGS Alaska provides opinions and interpretations, the lab shall document the basis upon which these have been made.

5.10.4. Amendments

All amendments made to test reports are identified by a change in revision number in the report and contains all information as required by section 5.10.1. Records of amendment are maintained in the customer file(s) and tracked through Engage. The customer is notified prior to the re-issue of any amended document.

5.10.5. Simplified Reporting

Where results are reported to the customer in a simplified way, all information normally reported is retained.

6. SUMMARY OF CHANGES FROM PREVIOUS REVISION

Effective 10/13/17:

- Section 2.1.1 Update reference to the 2009 TNI standard.
- Section 2.1.2 Links corrected to ADEC scopes of certification
- Section 4.1.2 Reference to 2009 TNI standard included
- Section 4.1.5.8 Update Technical Director who is absent in excess of 35 days the accrediting authority must be notified.
- Section 4.1.5.10 Added
- Section 4.1.5.11 Added
- Section 5.10.1 updated hold time criteria.

REFERENCES

International Standard ANSI/ISO/IEC 17025, Second Edition 2005(E), General Requirements for the Competence of Testing and Calibration Laboratories.

This document contains confidential business information and is not intended for distribution.

This electronically signed PDF will be considered the controlled copy for staff.

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

SGS NORTH AMERICA INC. – ALASKA DIVISION
200 W Potter Dr.
Anchorage, AK 99518
Mary McDonald Phone: (907)-550-3203
mary.mcdonald@sgs.com

ENVIRONMENTAL

Valid To: December 31, 2019 Certificate Number: 2944.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2009 TNI Environmental Testing Laboratory Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.1 of the DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Inductively Coupled Plasma Mass Spectroscopy, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Ion Chromatography, Hazardous Waste Characteristics Tests, Total Organic Carbon

Parameter/Analyte	**Solid & Chemical Materials**	
	Aqueous	**Solid**
Metals		
Aluminum	EPA 6020A	EPA 6020A
Antimony	EPA 6020A	EPA 6020A
Arsenic	EPA 6020A	EPA 6020A
Barium	EPA 6020A	EPA 6020A
Beryllium	EPA 6020A	EPA 6020A
Boron	EPA 6020A	EPA 6020A
Cadmium	EPA 6020A	EPA 6020A
Calcium	EPA 6020A	EPA 6020A
Chromium	EPA 6020A	EPA 6020A
Cobalt	EPA 6020A	EPA 6020A
Copper	EPA 6020A	EPA 6020A
Iron	EPA 6020A	EPA 6020A
Lead	EPA 6020A	EPA 6020A
Magnesium	EPA 6020A	EPA 6020A
Manganese	EPA 6020A	EPA 6020A
Mercury	EPA 6020A EPA 7470A	EPA 6020A EPA 7471A
Molybdenum	EPA 6020A	EPA 6020A
Nickel	EPA 6020A	EPA 6020A

Parameter/Analyte	Solid & Chemical Materials	
	Aqueous	**Solid**
Potassium	EPA 6020A	EPA 6020A
Selenium	EPA 6020A	EPA 6020A
Silver	EPA 6020A	EPA 6020A
Sodium	EPA 6020A	EPA 6020A
Thallium	EPA 6020A	EPA 6020A
Vanadium	EPA 6020A	EPA 6020A
Zinc	EPA 6020A	EPA 6020A
Metals digestion methods toxicity characteristic leaching procedure	EPA 3010A EPA 1311	EPA 3050B EPA 1311
Nutrients		
Nitrate (as N)	EPA 9056A	EPA 9056A
Nitrate-Nitrite (as N)	EPA 9056A	EPA 9056A
Nitrite (as N)	EPA 9056A	EPA 9056A
Demands		
Total Organic Carbon	EPA 9060A	EPA 9060A
Wet Chemistry		
Bromide	EPA 9056A	EPA 9056A
Chloride	EPA 9056A	EPA 9056A
Fluoride	EPA 9056A	EPA 9056A
Sulfate	EPA 9056A	EPA 9056A
Purgeable Organics (volatiles)		
Acetone	EPA 8260C	EPA 8260C
Benzene	EPA 8260C EPA 8021B	EPA 8260C EPA 8021B
Bromobenzene	EPA 8260C	EPA 8260C
Bromochloromethane	EPA 8260C	EPA 8260C
Bromodichloromethane	EPA 8260C	EPA 8260C
Bromoform	EPA 8260C	EPA 8260C
Bromomethane	EPA 8260C	EPA 8260C
2-Butanone	EPA 8260C	EPA 8260C
n-Butylbenzene	EPA 8260C	EPA 8260C
sec-Butylbenzene	EPA 8260C	EPA 8260C
tert-Butylbenzene	EPA 8260C	EPA 8260C
Carbon disulfide	EPA 8260C	EPA 8260C
Carbon tetrachloride	EPA 8260C	EPA 8260C
Chlorobenzene	EPA 8260C	EPA 8260C
Chloroethane	EPA 8260C	EPA 8260C
Chloroform	EPA 8260C	EPA 8260C
Chloromethane	EPA 8260C	EPA 8260C
2-Chlorotoluene	EPA 8260C	EPA 8260C
4-Chlorotoluene	EPA 8260C	EPA 8260C

Parameter/Analyte	**Solid & Chemical Materials**	
	Aqueous	**Solid**
Dibromochloromethane	EPA 8260C	EPA 8260C
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260C EPA 8260B SIM	EPA 8260C
Dibromomethane	EPA 8260C	EPA 8260C
1,2-Dibromoethane (EDB)	EPA 8260C EPA 8260B SIM	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C	EPA 8260C
Dichlorodifluoromethane	EPA 8260C	EPA 8260C
1,1-Dichloroethane	EPA 8260C	EPA 8260C
1,2-Dichloroethane	EPA 8260C	EPA 8260C
1,1-Dichloroethene	EPA 8260C	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260C	EPA 8260C
1,2-Dichloropropane	EPA 8260C	EPA 8260C
1,3-Dichloropropane	EPA 8260C	EPA 8260C
2,2-Dichloropropane	EPA 8260C	EPA 8260C
1,1-Dichloropropene	EPA 8260C	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C	EPA 8260C
Ethyl benzene	EPA 8260C EPA 8021B	EPA 8260C EPA 8021B
Freon 113	EPA 8260C	EPA 8260C
2-Hexanone	EPA 8260C	EPA 8260C
Hexachlorobutadiene	EPA 8260C	EPA 8260C
Isopropylbenzene	EPA 8260C	EPA 8260C
4-Isopropyltoluene	EPA 8260C	EPA 8260C
Methylene chloride	EPA 8260C	EPA 8260C
4-Methyl-2-pentanone	EPA 8260C	EPA 8260C
Methyl tert-butyl ether	EPA 8260C	EPA 8260C
Naphthalene	EPA 8260C	EPA 8260C
n-Propylbenzene	EPA 8260C	EPA 8260C
Styrene	EPA 8260C	EPA 8260C
1,1,1,2-Tetrachloroethane	EPA 8260C	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260C	EPA 8260C
Tetrachloroethene	EPA 8260C	EPA 8260C
Toluene	EPA 8260C EPA 8021B	EPA 8260C EPA 8021B
1,2,3-Trichlorobenzene	EPA 8260C	EPA 8260C
1,2,4-Trichlorobenzene	EPA 8260C	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C	EPA 8260C
Trichloroethene	EPA 8260C	EPA 8260C
Trichlorofluoromethane	EPA 8260C	EPA 8260C

Parameter/Analyte	Solid & Chemical Materials	
	Aqueous	**Solid**
1,2,3-Trichloropropane	EPA 8260C EPA 8260B SIM	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C	EPA 8260C
Vinyl acetate	EPA 8260C	EPA 8260C
Vinyl chloride	EPA 8260C	EPA 8260C
Xylenes, total	EPA 8260C EPA 8021B	EPA 8260C EPA 8021B
1,2-Xylene (O-Xylene)	EPA 8260C EPA 8021B	EPA 8260C EPA 8021B
1,3-Xylene & 1,4-Xylene (M+P-Xylene)	EPA 8260C EPA 8021B	EPA 8260C EPA 8021B
Volatiles Preparation Methods Toxicity Characteristic Leaching Procedure Zero Headspace Extraction	EPA 1311 EPA 3511 EPA 5030B	EPA 1311 EPA 3511 EPA 5035A
Total Petroleum Hydrocarbons (TPH)		
Gasoline Range Organics	EPA 8015C AK 101 (AK State Method)	EPA 8015C AK 101 (AK State Method)
GRO Preparation Methods	EPA 5030B	EPA 5035A
Diesel Range Organics	EPA 8015C AK 102 (AK State Method)	EPA 8015C AK 102 (AK State Method)
Residual Range Organics	EPA 8015C AK 103 (AK State Method)	EPA 8015C AK 103 (AK State Method)
DRO/RRO Preparation Methods	EPA 3520C Modified	EPA 3550C
Extractable Organics (semivolatiles)		
Acenaphthene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Acenaphthylene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Aniline	EPA 8270D	EPA 8270D
Anthracene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Azobenzene	EPA 8270D	EPA 8270D
Benzoic acid	EPA 8270D	EPA 8270D
Benzo(a)anthracene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Benzo(b)fluoranthene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Benzo(k)fluoranthene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Benzo(ghi)perylene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Benzo(a)pyrene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM

Parameter/Analyte	Solid & Chemical Materials	
	Aqueous	Solid
Benzyl alcohol	EPA 8270D	EPA 8270D
Bis (2-chloroethoxy) methane	EPA 8270D	EPA 8270D
Bis (2-chloroethyl) ether	EPA 8270D	EPA 8270D
Bis (2-chloroisopropyl) ether	EPA 8270D	EPA 8270D
Bis (2-ethylhexyl) phthalate	EPA 8270D	EPA 8270D
4-bromophenylphenyl ether	EPA 8270D	EPA 8270D
Butyl benzyl phthalate	EPA 8270D	EPA 8270D
Carbazole	EPA 8270D	EPA 8270D
4-Chloroaniline	EPA 8270D	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D	EPA 8270D
1-Chloronaphthalene	EPA 8270D	EPA 8270D
2-Chloronaphthalene	EPA 8270D	EPA 8270D
2-Chlorophenol	EPA 8270D	EPA 8270D
4-Chlorophenyl phenyl ether	EPA 8270D	EPA 8270D
Chrysene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Dibenzo(a,h)anthracene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Dibenzofuran	EPA 8270D	EPA 8270D
1,2-Dichlorobenzene	EPA 8270D	EPA 8270D
1,3-Dichlorobenzene	EPA 8270D	EPA 8270D
1,4-Dichlorobenzene	EPA 8270D	EPA 8270D
3,3'-Dichlorobenzidine	EPA 8270D	EPA 8270D
2,4-Dichlorophenol	EPA 8270D	EPA 8270D
2,6-Dichlorophenol	EPA 8270D	EPA 8270D
Diethyl phthalate	EPA 8270D	EPA 8270D
2,4-Dimethylphenol	EPA 8270D	EPA 8270D
Dimethyl phthalate	EPA 8270D	EPA 8270D
di-n-Butyl phthalate	EPA 8270D	EPA 8270D
di-n-Octyl phthalate	EPA 8270D	EPA 8270D
2,4-Dinitrophenol	EPA 8270D	EPA 8270D
2,4-Dinitrotoluene	EPA 8270D	EPA 8270D
2,6-Dinitrotoluene	EPA 8270D	EPA 8270D
Fluoranthene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Fluorene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Hexachlorobenzene	EPA 8270D	EPA 8270D
Hexachlorobutadiene	EPA 8270D	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D	EPA 8270D
Hexachloroethane	EPA 8270D	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Isophorone	EPA 8270D	EPA 8270D
1-Methylnaphthalene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM

Parameter/Analyte	**Solid & Chemical Materials**	
	Aqueous	**Solid**
2-Methylnaphthalene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
2-Methyl-4,6-dinitrophenol	EPA 8270D	EPA 8270D
2-Methylphenol (As O cresol)	EPA 8270D	EPA 8270D
3 & 4-Methylphenol (As P & M cresol)	EPA 8270D	EPA 8270D
Naphthalene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
2-Nitroaniline	EPA 8270D	EPA 8270D
3-Nitroaniline	EPA 8270D	EPA 8270D
4-Nitroaniline	EPA 8270D	EPA 8270D
Nitrobenzene	EPA 8270D	EPA 8270D
2-Nitrophenol	EPA 8270D	EPA 8270D
4-Nitrophenol	EPA 8270D	EPA 8270D
n-Nitrosodimethylamine	EPA 8270D	EPA 8270D
n-Nitrosodi-n-propylamine	EPA 8270D	EPA 8270D
n-Nitrosodiphenylamine	EPA 8270D	EPA 8270D
Pentachlorophenol	EPA 8270D	EPA 8270D
Phenanthrene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Phenol	EPA 8270D	EPA 8270D
Pyrene	EPA 8270D EPA 8270D SIM	EPA 8270D EPA 8270D SIM
Pyridine	EPA 8270D	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D	EPA 8270D
Pesticides/Herbicides/PCBs		
Aldrin	EPA 8270D SIM	EPA 8270D SIM
alpha-BHC	EPA 8270D SIM	EPA 8270D SIM
alpha Chlordane	EPA 8270D SIM	EPA 8270D SIM
beta-BHC	EPA 8270D SIM	EPA 8270D SIM
delta-BHC	EPA 8270D SIM	EPA 8270D SIM
gamma-BHC	EPA 8270D SIM	EPA 8270D SIM
gamma Chlordane	EPA 8270D SIM	EPA 8270D SIM
Chlordane (technical)	EPA 8270D SIM	EPA 8270D SIM
4,4’-DDD	EPA 8270D SIM	EPA 8270D SIM
4,4’-DDE	EPA 8270D SIM	EPA 8270D SIM
4,4’-DDT	EPA 8270D SIM	EPA 8270D SIM
Dieldrin	EPA 8270D SIM	EPA 8270D SIM
Endosulfan I	EPA 8270D SIM	EPA 8270D SIM
Endosulfan II	EPA 8270D SIM	EPA 8270D SIM
Endosulfan sulfate	EPA 8270D SIM	EPA 8270D SIM
Endrin	EPA 8270D SIM	EPA 8270D SIM
Endrin aldehyde	EPA 8270D SIM	EPA 8270D SIM
Endrin ketone	EPA 8270D SIM	EPA 8270D SIM

Parameter/Analyte	**Solid & Chemical Materials**	
	Aqueous	**Solid**
Heptachlor	EPA 8270D SIM	EPA 8270D SIM
Heptachlor epoxide	EPA 8270D SIM	EPA 8270D SIM
Methoxychlor	EPA 8270D SIM	EPA 8270D SIM
PCB-1016 (Aroclor)	EPA 8082A	EPA 8082A
PCB-1221 (Aroclor)	EPA 8082A	EPA 8082A
PCB-1232 (Aroclor)	EPA 8082A	EPA 8082A
PCB-1242 (Aroclor)	EPA 8082A	EPA 8082A
PCB-1248 (Aroclor)	EPA 8082A	EPA 8082A
PCB-1254 (Aroclor)	EPA 8082A	EPA 8082A
PCB-1260 (Aroclor)	EPA 8082A	EPA 8082A
Toxaphene	EPA 8270D SIM	EPA 8270D SIM
Semivolatile extraction methods Toxicity characteristic leaching procedure	EPA 1311 EPA 3520C Modified	EPA 1311 EPA 3550C EPA 3665A
Hazardous Waste Characteristics		
Corrosivity	EPA 9040C	EPA 9045D
Ignitability	EPA 1020B	----------

Parameter/Analyte	**Potable Water**
HPC	SM 9215B
Colilert *Escherichia coli* (MPN)	SM 9223B
Colilert *E. coli*/Total Coliform (P/A)	SM 9223B
Colilert-18 *E. coli* (MPN)	SM 9223B
Colilert-18 *E. coli*/Total Coliform (P/A)	SM 9223B

Accredited Laboratory

A2LA has accredited

SGS NORTH AMERICA INC. - ALASKA DIVISION

Anchorage, AK

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2009 TNI Environmental Testing Laboratory Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in version 5.1 of the DoD Quality System Manual for Environmental Laboratories (QSM), accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 20th day of December 2017.

President and CEO
For the Accreditation Council
Certificate Number 2944.01
Valid to December 31, 2019

For the tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

APPENDIX D:
CONCEPTUAL SITE MODEL SCOPING FORM

This page intentionally blank

Print Form

Appendix A - Human Health Conceptual Site Model Scoping Form and Standardized Graphic

Site Name: Kodiak RCRA SWMU Site 10/11 Air Station/Paint Storage

File Number: 2601.38.020 and 2601.38.021

Completed by: Brice Engineering, LLC

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☒ USTs
- ☒ ASTs
- ☒ Dispensers/fuel loading racks
- ☒ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☐ Other: Buried pipelines

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☐ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☒ Air
- ☒ Sediment
- ☒ Groundwater
- ☐ Surface water
- ☐ Biota
- ☐ Other: Note: potential impacts to surface water and biota from Site 10/11 will be addressed as part of Site 32

Receptors *(check receptors that could be affected by contamination at the site)*

- ☐ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☐ Subsistence harvester (i.e. gathers wild foods)
- ☐ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☐ Recreational user
- ☐ Farmer
- ☐ Other: Note: recreational users (fisherman) will be considered as part of Site 32

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

Land Use Controls are in place to prevent construction worker direct contact with soil. The presence of the paved tarmac precludes industrial worker/site visitor exposure to surface soils. The impact to sediment in Inner Womens Bay is addressed as part of Site 32, Marine Sediments.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Land Use Controls are in place to prevent construction worker direct contact with soil. The presence of the paved tarmac precludes industrial site worker/site visitor exposure to surface soils. The impact to sediment in Inner Womens Bay is addressed as part of Site 32, Marine Sediments.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the ground-water is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

ADEC has granted a 350 determination to Site 10/11 documenting the groundwater is not a current or future drinking water source.

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☒

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Potential impacts to surface water in Inner Women's Bay is addressed as part of Site 32. Note that the surface water body present at Site 10/11 is Inner Womens Bay, which has brackish water that will never be used as a drinking water source.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☐

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☐

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☐

If all of the boxes are checked, label this pathway complete: Incomplete

Comments:

Site 10/11 is in an active industrial area; a paved tarmac and buildings cover the site. Potential contaminant migration to sediment and surface water in Inner Womens Bay, which could impact marine organisms harvested by fisherman/subsistence consumers, is addressed as part of Site 32, Marine Sediments.

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Because VOCs are present in soil, inhalation of outdoor air is applicable to construction worker exposure scenarios.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

The vapor intrusion pathway is potentially complete for current/future commercial/industrial workers. Two occupied/occupiable industrial buildings (Hangar 1 and Building 24) are located within 30 feet of petroleum contamination in soil and groundwater and/or 100 feet of non-petroleum VOC soil/groundwater contamination.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Exposure could occur through contact with contaminated surface water (i.e., intertidal seeps) and construction workers could contact contaminated groundwater during construction/trenching activities.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Site 10/11 has a 350 determination documenting the groundwater is not a current or future household water source.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Inhalation of fugitive dust is potentially complete during construction activities.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

Evaluating potential impacts of Site 10/11 contamination on sediment in Inner Women's Bay will be addressed as part of Site 32, Marine Sediments.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

This page intentionally blank

Print Form

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Kodiak RCRA SWMU Site 10/11
USCG Base Kodiak, Alaska

Completed By: Brice Engineering, LLC
Date Completed: November 2018

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)
Check the media that could be directly affected by the release.

(2)
For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

(3)
Check all exposure media identified in (2).

(4)
*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)
Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Media / Transport Mechanisms

Surface Soil (0-2 ft bgs) ☑
- ☑ Direct release to surface soil — *check soil*
- ☑ *Migration to subsurface* — *check soil*
- ☐ *Migration to groundwater* — *check groundwater*
- ☑ *Volatilization* — *check air*
- ☑ *Runoff or erosion* — *check surface water*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Subsurface Soil (2-15 ft bgs) ☑
- ☑ Direct release to subsurface soil — *check soil*
- ☑ *Migration to groundwater* — *check groundwater*
- ☑ *Volatilization* — *check air*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Ground-water ☑
- ☑ Direct release to groundwater — *check groundwater*
- ☑ *Volatilization* — *check air*
- ☑ *Flow to surface water body* — *check surface water*
- ☑ *Flow to sediment* — *check sediment*
- ☑ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Surface Water ☑
- ☑ Direct release to surface water — *check surface water*
- ☑ *Volatilization* — *check air*
- ☐ *Sedimentation* — *check sediment*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Sediment ☐
- ☐ Direct release to sediment — *check sediment*
- ☐ *Resuspension, runoff, or erosion* — *check surface water*
- ☐ *Uptake by plants or animals* — *check biota*
- ☐ *Other (list):*

Exposure Media / Exposure Pathway/Route

Current & Future Receptors

Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ soil	☑ Incidental Soil Ingestion	F	C/F	C/F	C/F			
	☑ Dermal Absorption of Contaminants from Soil	F	C/F	C/F	C/F			
	☑ Inhalation of Fugitive Dust	F	I	I	C/F			
☑ groundwater	☐ Ingestion of Groundwater							
	☑ Dermal Absorption of Contaminants in Groundwater	I	I	I	C/F			
	☐ Inhalation of Volatile Compounds in Tap Water							
☑ air	☑ Inhalation of Outdoor Air	F	I	I	C/F			
	☑ Inhalation of Indoor Air	F	C/F	I	I			
	☑ Inhalation of Fugitive Dust	I	I	I	C/F			
☑ surface water	☐ Ingestion of Surface Water							
	☑ Dermal Absorption of Contaminants in Surface Water	I	C/F	C/F	C/F			
	☐ Inhalation of Volatile Compounds in Tap Water							
☐ sediment	☐ Direct Contact with Sediment							
☐ biota	☐ Ingestion of Wild or Farmed Foods							

03/04/2019

This page intentionally blank

APPENDIX C
SITE 18 – POST-REMEDIAL ACTION LONG-TERM MONITORING AND MAINTENANCE WORK PLAN

This page intentionally blank

U.S. Army Corps of Engineers
Alaska District

POST-REMEDIAL ACTION LONG-TERM MONITORING AND MAINTENANCE WORK PLAN

DRURY GULCH
KODIAK, ALASKA

FUDS NO. F10AK1007-01

DRAFT REVISION 1
NOVEMBER 2019

F10AK100701_xx.xx_yyyy_a
1200C PERM

U.S. Army Corps of Engineers
Alaska District

POST-REMEDIAL ACTION LONG-TERM MONITORING AND MAINTENANCE WORK PLAN

DRURY GULCH
KODIAK, ALASKA

FUDS NO. F10AK1007-01

DRAFT REVISION 1
NOVEMBER 2019

F10AK100701_xx.xx_yyyy_a
1200C PERM

TABLE OF CONTENTS

SECTION **PAGE**

ACRONYMS AND ABBREVIATIONS v
1.0 INTRODUCTION 1-1
1.1 OBJECTIVE 1-1
1.2 WORK PLAN ORGANIZATION 1-3
1.3 PROJECT OBJECTIVES 1-4
1.4 PROJECT SCHEDULE 1-4
1.5 KEY PROJECT PERSONNEL 1-5
2.0 SITE BACKGROUND AND PHYSICAL SETTING 2-1
2.1 PROJECT SITE LOCATION 2-1
2.2 SITE HISTORY 2-1
2.3 SITE TERMINOLOGY 2-1
2.4 SITE DESCRIPTION 2-2
2.4.1 Upper Gulch Area 2-3
2.4.2 Lower Gulch Area 2-4
2.4.3 Aviation Hill 2-6
2.4.4 Area North of the Rezanof Highway 2-7
2.4.5 Lower Drainage Channel Area 2-7
2.5 SURFACE WATER SOURCES INTO DRURY GULCH 2-8
2.6 PHYSICAL SETTING 2-8
2.6.1 Physiography and Topography 2-8
2.6.2 Climate 2-9
2.6.3 Geology 2-12
2.6.4 Hydrogeology 2-13
2.6.5 Hydrology 2-14
3.0 REGULATORY SETTING AND REMEDIAL ACTION OBJECTIVES 3-1
3.1 AFFECTED MEDIA, EXPOSURE PATHWAYS, AND SCREENING LEVELS 3-1
3.2 REMEDIAL ACTION OBJECTIVES 3-2

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

4.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS 4-1

5.0 FIELD ACTIVITIES – SITE INSPECTIONS AND MAINTENANCE 5-1

5.1 SITE MONITORING 5-1

5.1.1 Post-RA Monitoring Semi-Annual Inspections 5-1

5.1.2 Post-RA Monitoring Field Documentation 5-2

5.1.3 Post-Storm Event Inspections 5-2

5.1.4 Post-Storm Event Inspections Field Documentation 5-3

5.2 INSPECTION REQUIREMENTS 5-3

5.3 MAINTENANCE AND SAMPLING ACTIVITIES 5-6

5.3.1 General Site Maintenance 5-8

6.0 REPORTING REQUIREMENTS 6-1

6.1 POST-RA MONITORING REPORTING 6-1

6.2 POST-STORM EVENT INSPECTIONS REPORTING 6-1

6.3 ANNUAL POST-RA REPORT 6-2

6.4 ELECTRONIC DELIVERABLES 6-2

6.5 MAPS AND DRAWINGS 6-2

6.6 SURVEY 6-3

6.7 ANALYTICAL LABORATORY DATA 6-3

7.0 REFERENCES 7-1

FIGURES

Figure 1 Project Location and Vicinity Map

Figure 2 Overview Extent

Figure 3 Upper and Lower Drury Gulch Areas

Figure 4 Area North of the Rezanof Highway

TABLES

Table 1-1 Proposed Project Schedule 1-5

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

Table 1-2 Key Personnel Contact Information 1-6
Table 2-1 Mean Temperatures and Total Precipitation in Kodiak, Alaska by Month 2-10
Table 2-2 Monthly Total Precipitation for Kodiak Airport, Alaska from 2008 to Present . 2-11
Table 3-1 Remedial Action Objectives Summary 3-3
Table 4-1 Previous Investigations and Remedial Actions 4-1

CHART

Chart 1 Precipitation Probability in a 24-hour Period for Kodiak Airport, Alaska

APPENDICES

Appendix A Inspection and Maintenance Forms
Appendix B Sampling and Analysis Plan
Attachment B-1 Field Sampling Plan
Attachment B-2 Standard Operating Procedures
Attachment B-3 Quality Assurance Project Plan
Appendix C Accident Prevention Plan

(intentionally blank)

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADOT&PF	Alaska Department of Transportation and Public Facilities
ANRH	Area North of the Rezanof Highway
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
COC	contaminant of concern
cy	cubic yard(s)
DD	Decision Document
ECC	Environmental Compliance Consultants, Inc
EPA	U.S. Environmental Protection Agency
FRMD	FUDS Records Management Database
FS	feasibility study
FUDS	Formerly Used Defense Site
GIS	geographical information system
HHRR	Hydrology and Hydraulics Review Report
Jacobs	Jacobs Engineering Group Inc.
LDG	Lower Drury Gulch
LSB	Lower Stilling Basin
LTMM	long-term monitoring and maintenance
MED	Manual for Electronic Deliverables
mg/kg	milligrams per kilogram
NOAA	National Oceanic and Atmospheric Administration
PCB	polychlorinated biphenyl
PM	project manager
POL	petroleum, oil, and lubricants
QAPP	quality assurance project plan
RA	remedial action
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
SAIC	Science Applications International Corporation
SAP	sampling and analysis plan

ACRONYMS AND ABBREVIATIONS (Continued)

Sitrep	field situation report
SOP	standard operating procedure
SWMU	Solid Waste Management Unit
TSCA	Toxic Substances Control Act
USACE	U.S. Army Corps of Engineers
USB	Upper Stilling Basin
USCG	U.S. Coast Guard
WRCC	Western Regional Climate Center

1.0 INTRODUCTION

This long-term monitoring and maintenance (LTMM) plan presents the objectives, methods, and procedures for ongoing monitoring and maintenance of the Drury Gulch Formerly Used Defense Site (FUDS) in Kodiak, Alaska (Figure 1).

Work will be performed on behalf of the U.S. Army Corps of Engineers (USACE), Alaska District, under Contract Number W911KB-17-D-0017, Task Order W911KB19F0117. The project delivery team, consisting of Environmental Compliance Consultants, Inc. (ECC) and Jacobs Engineering Group, Inc. (Jacobs), has updated this LTMM plan based on the:

- 2018 *Final Addendum Work Plan, Drury Gulch Post-Remedial Action Monitoring and Maintenance Plan, Kodiak, Alaska* (USACE 2018c)
- 2016 *Final Long-Term Monitoring and Maintenance Plan, Drury Gulch Formerly Used Defense Site: F10AK1007-01, Kodiak, Alaska* (USACE 2016a)
- 2012 *Final Work Plan Five-Year Long-Term Monitoring and Maintenance Plan, Drury Gulch Site, Kodiak, Alaska* (USACE 2012b).

The Drury Gulch FUDS project is currently being administered by USACE and is situated on land owned and managed by U.S. Coast Guard (USCG) Base Support Kodiak. Drury Gulch FUDS and is identified as Solid Waste Management Unit (SWMU)-18 under the base Resource Conservation and Recovery Act (RCRA) Permit Number AK9690330742 (U.S. Environmental Protection Agency [EPA] 2018). Additionally, the site is listed in the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites Program Database as File Number 2601.38.026, Hazard ID 528 (ADEC 2019). Figures are provided at the end of this LTMM plan.

1.1 OBJECTIVE

The objective of the Drury Gulch FUDS LTMM project is to ensure that the selected remedial remedy, Alternative 2C – Complete Cover, Limited Excavation, Disposal and Institutional

Controls, remains protective of human health and the environment, which includes (USACE 2003a):

- Preventing ingestion and inhalation of surface soil containing polychlorinated biphenyls (PCBs) in excess of 1 milligram per kilogram (mg/kg) (18 Alaska Administrative Code [AAC] 75.341)
- Preventing ingestion and inhalation of subsurface soil containing PCB compounds in excess of 10 mg/kg for as long as the site is capped with an approved material and an appropriate deed notice or equivalent institutional control is established (18 AAC 75.341)
- Preventing dermal contact and ingestion of sediments containing PCBs in excess of the freshwater sediment ecological screening level (0.031 mg/kg)
- Eliminating downstream transport of PCB-contaminated sediment within the aquatic environment

Based on the selected remedy and as allowed by ADEC regulations, soil with PCB concentrations greater than 10 mg/kg were excavated from the Drury Gulch FUDS and disposed of at a Toxic Substances Control Act (TSCA)-permitted facility (USACE 2003a, 2003b, 2009). Residual PCB concentrations between 1 and 10 mg/kg were allowed to remain on site and were capped beneath a clean earthen cover and an engineered, lined drainage channel (USACE 2003a, 2009). To achieve the remedial objectives of the selected remedy, the integrity of the soil cover must be maintained while also conveying surface water through Drury Gulch without damage, erosion, or subsidence of the cover remedy and/or offsite transport of PCB-contaminated soil. This can be accomplished by ensuring that the engineered components of the remedy function as designed and are routinely monitored and maintained.

The purpose of this LTMM plan is to guide ongoing and future monitoring and maintenance activities at the Drury Gulch FUDS property.. This plan may be updated and amended to accommodate future work as directed by USACE. No edits will be made to this plan, nor implemented in the field without first notifying and obtaining approval from USACE and the ADEC.

1.2 WORK PLAN ORGANIZATION

This work plan is organized into the following subsections:

- **Section 1.0 Introduction.** This section summarizes the purpose and organizational layout of the LTMM plan, outlines the project objectives, provides a project schedule, and summarizes the key project personnel.
- **Section 2.0 Site Background and Physical Setting.** This section provides information on the project site location and history, addresses site terminology, provides a detailed description of the project areas, sub-areas and site features, and provides a brief summary of the physical setting.
- **Section 3.0 Regulatory Setting and Remedial Action Objectives (RAOs).** This section provides a brief regulatory background for the project and presents the affected media, exposure pathways, applicable soil cleanup levels and sediment screening levels, and the RAOs.
- **Section 4.0 Summary of Previous Investigations and Remedial Actions (RAs).** This section provides a summary of the previous environmental investigations and RAs which have been performed at Drury Gulch FUDS.
- **Section 5.0 Field Activities – Site Inspections and Maintenance.** This section describes the field activities that will be conducted as part of the monitoring and maintenance of Drury Gulch FUDS. These activities include inspection of the system components and possible maintenance requirements and specifications.
- **Section 6.0 Reporting Requirements.** This section describes the reporting requirements for the (1) post-RA monitoring, (2) post-storm event inspections, and (3) the annual post-RA reports. This section also addresses the electronic data deliverable, map and drawing, survey, and analytical laboratory data requirements.
- **Section 7.0 References.** This section provides the references used in developing and updating this LTMM plan.
- **Figures**. This section presents the figures used to describe present and proposed site features at the Drury Gulch FUDS.
- **Appendix A Inspection and Maintenance Forms.** The field forms used to document post-RA inspections and post-storm event site visits are provided in this appendix.
- **Appendix B Sampling and Analysis Plan (SAP).** This appendix provides the SAP which includes the field sampling plan (Attachment B-1), standard operating procedures (SOPs) (Attachment B-2), and the quality assurance project plan (QAPP) (Attachment B-3).
- **Appendix C Accident Prevention Plan.** This appendix includes the project health and safety plan, including a site safety and health plan (Attachment C-1).

1.3 PROJECT OBJECTIVES

The objectives of this LTMM plan are to (1) provide context for the project objectives through a review and summary of previous investigations, inspections, and maintenance activities; (2) to present field methods for conducting post-storm event inspections, semi-annual inspections, routine maintenance activities, scheduled maintenance activities, and sampling requirements and quality assurance/quality control; and (3) to outline reporting requirements for project related deliverables.

The tasks which may be completed to achieve the project objectives are as follows:

- Post-RA Monitoring: Conduct two semi-annual post-RA monitoring inspection events (spring and fall) in accordance with this LTMM plan. Findings of the post-RA monitoring inspections will be documented in an annual post-RA report.
- Post-RA Maintenance: Conduct maintenance activities to address issues with the Drury Gulch Cover, drainage system, fence/signage, and survey points to the extent warranted by site inspections. Post-RA maintenance activities will be documented in an annual post-RA report.
- Post-RA Reporting: Prepare one annual post-RA report to document the two semi-annual post-RA monitoring inspection events and any maintenance activities that occurred throughout the course of the year.
- Post-Storm Event Inspections: Conduct up to 30 post-storm event inspections of the Drury Gulch Cover and stormwater drainages systems. Inspections will be conducted within 24-hrs of the occurrence of a rainfall event, defined as greater than 0.5 inches of precipitation in a 24-hour period that is separated by a minimum of 72 hours of dry weather. Results of the post-storm event inspections will be documented in an annual post-RA report.
- Soil/Sediment PCB Sampling: As necessary, collect up to 20 primary analytical soil and/or sediment samples to be analyzed for PCBs using EPA Method SW8082A. Results of sampling will be included in an annual post-RA report.

1.4 PROJECT SCHEDULE

Table 1-1 provides a proposed schedule for the base year of the contract. Similar project scheduling is anticipated for subsequent follow-on annual terms.

Table 1-1
Proposed Project Schedule

Delivery Description	Approximate Completion Date
Base Year Activities – 2019 thru 2020*	
Draft LTMM plan	November 2019
Government review of draft LTMM plan	December 2019
Final LTMM plan	December 2019
Fall 2019 post-RA monitoring inspection event	December 2019
Fall 2019 inspection monitoring spreadsheet / electronic deliverable	January 2020
Spring 2020 post-RA monitoring inspection event	April 2020
Spring 2020 inspection monitoring spreadsheet / electronic deliverable	May 2020
Post-storm event inspections	September 2020
Post-RA maintenance	November 2020
Soil/sediment PCB sampling (as needed)	November 2020
Draft annual post-RA report	January 2020
Government review of annual post-RA report	February 2020
Final annual post-RA report	March 2020
Project complete (base year)	28 September 2020
Follow-on Activities – 2020 thru 2024	
Follow-on post-RA monitoring**	Semi-annually - April and October
Follow-on post-storm event inspections	Annually
Follow-on post-RA maintenance	Annually
Follow-on soil/sediment PCB sampling (as needed)	Annually
Additional annual post-RA reports***	Annually
End period of performance	30 September 2024

Notes:
*Milestones to be completed during the base year of USACE Contract Number W911KB-17-D-0017, Task Order 0117.
**After the base year contract period of performance (28 September 2020), semi-annual inspections will be conducted twice per year, ideally in April and October.
***The reporting schedule for follow-on post-RA reports will generally follow those outlined in the base year contract: (1) draft reports are due approximately 60 days following the end of the post-RA maintenance in November, (2) government review period will consist of 30 days, and (3) final reports will be submitted within approximately 30 days of receipt of review comments.
For definitions, refer to the Acronyms and Abbreviations section.

1.5 KEY PROJECT PERSONNEL

The project will be executed by key and supporting personnel from ECC, Jacobs, and their associated subcontractors. Table 1-2 provides contact information for the identified key project personnel.

Table 1-2
Key Personnel Contact Information

Organization and Title	Name and Contact Information
USACE Contracting Officer	Timothy Clapp (907) 753-2836 Timothy.L.Clapp@usace.army.mil
USACE Contracting Officer's Representative	Scott McKean (907) 753-5722 Scott.W.McKean@usace.army.mil
USACE PM	Greg Vanagel (907) 753-5529 Greg.W.Vanagel@usace.army.mil
USACE Project Engineer	Mr. Scott McKean (907) 753-5722 Scott.W.McKean@usace.army.mil
USACE Project Chemist	Mr. Jake Sweet (907) 753-2694 Jacob.M.Sweet@usace.army.mil
ADEC Regulator	Mr. Curtis Dunkin (907) 269-3053 curtis.dunkin@alaska.gov
USCG Civil Engineering	Ms. Kate von Rekowski (907) 463-2427 Kate.E.VonRekowski@uscg.mil
USCG Kodiak Contact	Ms. Jennifer Nutt (907) 487-5320 ext. 6698 Jennifer.N.Nutt@uscg.mil
ECC PM	Andy Larson (907) 385-0677 A.Larson@eccalaska.com
ECC Deputy PM	Jessica Bay (757) 754-9240 J.Bay@eccalaska.com
Jacobs PM	Greg Rutkowski (907) 762-1102 Greg.Rutkowski@jacobs.com
Jacobs Deputy PM	Jeremiah Knuth (907) 762-1388 Jeremiah.Knuth@jacobs.com

Table 1-2 (Continued)
Key Personnel Contact Information

Organization and Title	Name and Contact Information
Health and Safety Manager (ECC)	Stanley R. Seegars (907) 360-0416 stan@eccalaska.com
Site Safety and Health Officer (ECC)	Jessica Bay (757) 754-9240 J.Bay@eccalaska.com
Site Safety and Health Officer Alternate (Jacobs)	Jeremiah Knuth (907) 762-1388 Jeremiah.Knuth@jacobs.com
Field Team Lead (ECC)	Jessica Bay (757) 754-9240 J.Bay@eccalaska.com
Jacobs Project Chemist (Jacobs)	Nathaniel Gingery (907) 762-1039 Nathaniel.Gingery@jacobs.com
Project Consultant (NWFF Environmental)	Timothy Shaw (907) 250-0275 Tim_Shaw@nwffenviro.com

Note:
For definitions, refer to the Acronyms and Abbreviations section.

(intentionally blank)

2.0 SITE BACKGROUND AND PHYSICAL SETTING

The following subsections provide information regarding the project site location, site history, site description, and physical setting.

2.1 PROJECT SITE LOCATION

The Drury Gulch FUDS is located approximately 5 miles southwest of downtown Kodiak near the main entrance gate of the USCG Base Support Unit complex (Figure 1). The site is aligned southwest to northeast and is bisected by the Rezanof Highway, which curves around the southwestern (upgradient) portion of the site and consists of the natural, 6-acre Drury Gulch (Figure 2). The northwestern (downgradient) portion of the site consists of a man-made open drainage channel and associated culverts. Figure 2 shows the length of the Drury Gulch FUDS from the upgradient Drury Gulch Creek to the most downgradient, man-made open channel near the Firehouse Culvert Inlet. A more detailed site description is provided in Section 2.4.

2.2 SITE HISTORY

Drury Gulch and the surrounding area were used by the U.S. Navy from 1939 to 1972 as part of the Kodiak Naval Station Reservation. The Navy stored and disposed of a variety of metal and wood debris in Drury Gulch for an unknown period. During the rerouting of the Rezanof Highway in the mid-1970s and the mid-1980s, the majority of metal and debris was removed from the site or buried on site and the surface was subsequently regraded. Site investigations in 1993, 1999, and 2000 showed that elevated levels of PCBs remain in the gulch from past military activities. The presence of PCBs in the area is believed to result from dumping PCB-containing metal debris, such as electrical components, or reusing backfill material/soil cover containing PCBs (USACE 2003a).

2.3 SITE TERMINOLOGY

In July 2003, a cleanup Decision Document (DD) was finalized which presents the selected RA and supporting rationale for the cleanup at the Drury Gulch FUDS (USACE 2003a). The 2003 DD references the 2002 remedial investigation/feasibility study (RI/FS) report (USACE 2002)

and summarizes the site features and conditions. In 2013, the Hydrology and Hydraulics Review Report (HHRR) was prepared that further identified important site features associated with the Drury Gulch FUDS (USACE 2013a).

Terminology used before and after finalization of the DD has not been consistent throughout previous reporting and planning documents. Additionally, as new important features were identified throughout the history at the site, they were labeled but not clearly and consistently defined in previous reports. The terminology used in this LTMM plan will be consistent with that identified in the 2002 RI/FS, the 2003 DD, and the 2013 HHRR. Furthermore, in order to orient the reader to the various sub-areas and important site features, added clarity has been included in Section 2.4 to (1) define the Drury Gulch FUDS sub-areas, (2) define the important site features included in each sub-area and, (3) list previously used alternative names for reference when reading previous reports and planning documents.

2.4 SITE DESCRIPTION

Drury Gulch is a natural drainage basin bounded by shallow bedrock which slopes to the northwest and southeast, and primarily drains toward the northeast. A small, secondary side drainage slopes toward the southeast along the Site Access Road and conveys water from the Drury Gulch Creek through a culvert toward the Rezanof Highway. Figure 2 shows the length of the Drury Gulch FUDS.

The Drury Gulch FUDS is divided into four onsite sub-areas: Upper Gulch Area, Lower Gulch Area, Area North of the Rezanof Highway (ANRH), and the Lower Drainage Channel Area. The entirety of the Drury Gulch FUDS boundary encompasses these four sub-areas. The Rezanof Highway curves around the natural gulch and bisects the Drury Gulch FUDS, separating the Upper and Lower Gulch Areas from the ANRH and the Lower Drainage Channel Area. The Upper and Lower Gulch Areas, including the natural gulch, are located upgradient and are contained within a site perimeter fence (Figure 2). The ANRH and the Lower Drainage Channel Area are located outside the perimeter fence and extend downgradient toward the Kodiak Airport. The water conveyed through the Drury Gulch FUDS predominately flows

toward the northeast through aboveground, open drainage channels before entering the Kodiak Airport stormwater drainage system and ultimately discharging into Womens Bay. In addition, to the four onsite sub-areas, Aviation Hill is an offsite area that directly influences onsite conditions at Drury Gulch FUDS.

The sub-area descriptions and features are outlined in Sections 2.4.1 through 2.4.5.

2.4.1 Upper Gulch Area

The Upper Gulch Area consists of the southwestern portion of the gulch that is located within the perimeter fence. The Upper Gulch Area is bound to the southwest by Upper Gulch Creek, to the south by the Site Access Road, and to the northwest by the Lower Gulch Area (USACE 2002). This area is comprised of rocky, unconsolidated soil deposits resting upon shallow bedrock and is separated from the Lower Gulch Area based on geologically distinct properties (USACE 2002). Site features within and adjacent to the Upper Gulch Area are shown on Figure 3 and are described in downgradient order as follows:

- **Drury Gulch Creek**: The Drury Gulch Creek, also known as Upper Gulch Creek, is located outside the site perimeter fence and flows into the southwestern portion of the Upper Gulch Area.
- **Drury Gulch Creek Diversion**: The Drury Gulch Creek Diversion, also known as Diversion Point 1, captures and channels the flow from Drury Gulch Creek through an 18-inch culvert that flows underground and parallel to the Site Access Road. The surface water flow then passes beneath the Rezanof Highway, onto USCG property, and enters the USCG stormwater system (USACE 2013a). The Drury Gulch Creek Diversion is located outside of the site perimeter fence and was constructed as part of the remedy to divert surface water from Drury Gulch Creek away from Drury Gulch during normal flow conditions. Based on the geometry of the inlet, flow into the 18-inch diameter culvert is limited to approximately 17 cubic feet per second (cfs). However, if flow exceeds this rate threshold or the culvert is obstructed, surface water overflows into an earthen spillway and travels downslope into the Upper Gulch Area toward the Upper Drainage Channel.
- **Site Access Road**: The Site Access Road provides vehicular access to Drury Gulch from the northside of the Rezanof Highway and is the main entrance to the Drury Gulch FUDS. This road also provides access to the USCG water storage tanks located southwest of the site. Channelized flow from Drury Gulch Creek Diversion travels parallel to Site Access Road until entering a culvert and crossing under the road. Access into the Drury Gulch FUDS is provided through a locked gate in the perimeter site fence across the Site Access Road.

- **Drury Gulch Cover**: In accordance with the selected site remedy, onsite soil with PCB concentrations greater than 10 mg/kg were excavated from both the Upper and Lower Gulch Areas in 2007 and 2008 and disposed of at a TSCA-permitted facility (USACE 2003b, 2009). After excavation of the contaminated soil, the remaining areas within the Upper and Lower Gulch Areas that had been disturbed and/or reworked and contained PCB concentrations greater than 1 mg/kg (but less than 10 mg/kg) were covered with an approximately 200,000 square foot, earthen cover (the Drury Gulch Cover) (USACE 2003a, 2003b, 2009). The purpose of the Drury Gulch Cover is to stabilize the remaining PCB-contaminated soil in place and prevent the potential onsite and offsite transport of contaminated soil and sediment via surface water flow. The cover consists of a minimum of 2-feet clean earthen fill and 0.5-feet of top soil cover, which was subsequently revegetated during construction (USACE 2003a, 2009). The Drury Gulch Cover expands throughout the Upper and Lower Gulch Areas and was designed to maintain the hydraulic characteristics of the gulch, minimize erosion, accommodate settling and subsidence, and function with minimum maintenance. There are three survey control markers (Control Points 59, 60, and 61) located within Drury Gulch to facilitate survey of the cover and other site features (Figure 3).

2.4.2 Lower Gulch Area

The Lower Gulch Area is comprised of the northeastern portion of the gulch and terminates at the location where the Rezanof Highway bisects the Drury Gulch FUDS. The Lower Gulch Area begins at the northeastern boundary of the Upper Gulch Area approximately 200 feet downgradient of the Site Access Road and approximately 1,000 feet southwest of the Rezanof Highway bisection (USACE 2002). The Lower Gulch Area is also located within the perimeter fence. Site features associated with the Lower Gulch Area are shown on Figure 3 and are described in downgradient order as follows:

- **Upper Drainage Channel**: The Upper Drainage Channel was constructed as part of the chosen remedy and is the upgradient portion of an engineered surface water channel designed to convey stormwater northeast through Drury Gulch, beneath the Rezanof Highway and into the Lower Drainage Channel. The Upper Drainage Channel begins at the upgradient boundary of the Lower Gulch Area, traverses through the Lower Gulch Area, and terminates at the Upper Stilling Basin (USB) at the downgradient end of the gulch adjacent the Rezanof Highway.
- **Deer Bone Drainage**: The Deer Bone Drainage is a small gully within the gulch's northwestern slope that is an area of concentrated but intermittent discharge into the gulch (USACE 2013b, 2017a). The Deer Bone Drainage concentrates overland sheet flow from the slopes of Aviation Hill and has been observed contributing water flow and potentially transporting soil into the gulch from outside the perimeter fence.

- **Lower Drury Gulch (LDG)-10 Slide Area**: The LDG-10 Slide Area is the location of a former contaminated soil "hotspot" excavation area on the northwestern slope of the gulch that sloughed into the gulch during the winter of 2007-2008 (USACE 2009).
- **Dog Leg Drainage**: The Dog Leg Drainage is a small gully in the gulch's western slope that is an area of concentration but intermittent discharge into the gulch (USACE 2013b, 2017a). Historical reports indicate that during storm events this drainage can contribute stormwater and potentially transport soil from Aviation Hill into the gulch from outside the perimeter fence.
- **USB**: The USB, also known as Diversion Point 2, is a stormwater control structure constructed in 2008 with the purpose of reducing the velocity of stormwater flowing through the Upper Drainage Channel before it enters the 24-inch diameter culvert beneath the Rezanof Highway (USACE 2013a). The USB also improves the quality of the discharging surface water by allowing suspended solids within the water to settle out. The USB receives water from the Upper Drainage Channel, the Rezanof Highway Drainage via an 18-inch diameter culvert, the Area-3 Slope, and from any other surface water flow entering the Lower Gulch Area. Overtime, the USB accumulates sediment and debris and must be periodically dredged and cleared to maintain design function.
- **Rezanof Highway Drainage Ditch 18-inch Culvert**: This 18-inch diameter culvert is approximately 75 feet long and receives surface water flow from Aviation Hill via the Rezanof Highway Drainage Ditch (see Section 2.4.3) (USACE 2013a). Water conveyed through this culvert discharges directly into the USB. The culvert inlet is located outside of the perimeter fence adjacent to the Area-3 Slope while the culvert outlet is located at the USB. Based on the geometry of the inlet, flow into the 18-inch diameter culvert is limited to approximately 17 cfs. If flow exceeds this rate threshold, or the culvert is obstructed, surface water overflows the culvert inlet into the Lower Gulch Area and travels downslope as overland flow toward the USB and/or Upper Drainage Channel. This culvert inlet is prone to blockage by debris and requires regular clearing to maintain flow through the culvert. When the culvert inlet overflows, soil from the Area-3 Slope can be transported from offsite (outside the site perimeter fence) and deposited onto the Drury Gulch Cover within the Lower Gulch Area.
- **Area-3 Slope**: The Rezanof Highway Drainage Ditch 18-inch culvert conveys surface water beneath the Area-3 Slope before discharging into the USB. When the inlet of this 18-inch diameter culvert is obstructed by debris, stormwater overflows the culvert inlet and travels as overland flow down the Area-3 Slope and into the Lower Gulch Area. The Area-3 Slope is a source of soil transportation into the gulch from outside the perimeter fence.
- **Rezanof Highway 24-inch Culvert**: The Rezanof Highway 24-inch culvert conveys water beneath the Rezanof Highway from the USB into the Lower Stilling Basin (LSB) located in the ANRH (USACE 2013a). This culvert was constructed by the Alaska Department of Transportation and Public Facilities (ADOT&PF) and is capable of adequately passing a 100-year storm (flood) event without overtopping the Rezanof Highway (USACE 2013a).

2.4.3 Aviation Hill

Aviation Hill consists of the northwestern uphill slope of Drury Gulch and overlooks both the Upper and Lower Gulch Areas. Aviation Hill lies outside of the Drury Gulch FUDS boundary but directly contributes surface water flow into the gulch and can significantly influence conditions on site. The Aviation Hill residential subdivision was constructed in the late 1990s atop Aviation Hill and includes a system of drainage channels and ditches that conveys stormwater downslope into the USB within the Lower Gulch Area. Site features associated with the ANRH are shown on Figure 2 and are described in downgradient order as follows:

- **Aviation Hill Drainage**: The Aviation Hill Drainage consists of approximately 600 feet of open drainage channels that captures storm runoff and surface water from the Aviation Hill subdivision. Captured surface water is conveyed downgradient toward the Aviation Hill diversion. (USACE 2013a). The Aviation Hill Drainage and the associated diversion are located outside the boundaries of the Drury Gulch FUDS.
- **Aviation Hill Diversion**: The Aviation Hill Diversion, also known as Access Road "Y" or Diversion Point 3, was constructed in the late 1990s, splits the flow from the Aviation Hill Drainage, and diverts approximately one-third of the flow east into the Rezanof Highway Drainage Ditch before discharging into the USB within the Lower Gulch Area (USACE 2013a). The remaining two-thirds of the flow are diverted west toward Devils Creek and the Kodiak Airport drainage system.
- **Rezanof Highway Drainage Ditch**: The Rezanof Highway Drainage Ditch is located north of the Lower Gulch Area and outside the site perimeter fence. The rock-lined ditch runs parallel along the western side of the Rezanof Highway, conveying surface water flow from the upper drainage areas of Aviation Hill and the Rezanof Highway southeast into an 18-inch diameter culvert prior to discharging into the USB. Four check dams (Check Dams 1 through 4; numbered upgradient to downgradient) and four catch basins (Catch Basins 1 through 4) were installed along the length of the Rezanof Highway Drainage Ditch by ADOT&PF in July 2013. These features are intended to slow the velocity of the water flowing through the ditch; however, there is potential for the stilling basins to fill with sediment (requiring dredging to clear) and for the check dams to fail, as well as the transportation of soil, including gravel and large cobbles, along the site perimeter fence and/or into the Lower Gulch Area. The check dams and stilling basins have previously failed and the ditch is considered to contribute to significant drainage issues associated with the Area-3 Slope and the USB. In addition, erosion issues within the ditch itself have contributed to soil and sediment deposition around and into the 18-inch diameter culvert. Potential failure of the ditch and associated check dams and stilling basins may be triggered by a rain event less intense than a 100-year storm (flood) event (for which the features were designed).

2.4.4 Area North of the Rezanof Highway

The ANRH is comprised of an approximately 600-feet long by 100-feet wide rectangular area located northeast of the Rezanof Highway, between the highway and Cape Decision Road (USACE 2003a, 2002). The ANRH parallels Dolphin Avenue to the northwest. Site features associated with the ANRH are shown on Figure 4 and are described in downgradient order as follows:

- **LSB**: The LSB receives discharge from the 24-inch diameter culvert that passes beneath the Rezanof Highway. Like the USB, the LSB reduces the velocity of stormwater discharging from the 24-inch diameter culvert beneath the Rezanof Highway and into the Lower Drainage Channel (USACE 2013a). The LSB continues to improve the quality of flowing stormwater water by further settling out suspended solids. The LSB also receives water from a natural seep located adjacent to the LSB. Overtime, the USB accumulates sediment and debris and requires periodic dredging and clearing as a maintenance activity.
- **Lower Drainage Channel**: The Lower Drainage Channel is the downgradient portion of the engineered surface water channel designed to convey stormwater from Drury Gulch, to the northeast through open drainage channels and into the airport's underground stormwater system, and ultimately discharging into Womens Bay. The Lower Drainage Channel begins at the upgradient boundary of the ANRH, traverses through the ANRH and the Lower Drainage Channel Area and terminates at the Firehouse Culvert Inlet. The channel was realigned in 2008 and in 2014, approximately 250 feet of the Lower Drainage Channel was armored with approximately 12 cubic yards (cy) of shot rock to stabilize localized areas of soil erosion (USACE 2015).
- **Roadway Culverts**: Surface water flowing through the Lower Drainage Channel is conveyed through underground culverts beneath Cape Decision Street and an unnamed gravel access road that both branch northwest off Dolphin Avenue.

2.4.5 Lower Drainage Channel Area

The Lower Drainage Channel Area, also known as the Storm Drain Area, is an approximately 1,000-foot long area containing the downgradient portion of the Lower Drainage Channel. The area is bound between Cape Decision Street and the Firehouse Culvert Inlet and includes the roadway culvert beneath Cape Decision Road. Site features associated with the Lower Drainage Channel Area are shown on Figure 4 and are described in downgradient order as follows:

- **Roadway Culverts**: Surface water flowing through the Lower Drainage Channel is conveyed through underground culverts beneath Cape Decision Street and an unnamed

gravel access road approximately 225 feet downgradient (northeast) of Cape Decision Street.

- **Firehouse Culvert Inlet**: The Firehouse Culvert Inlet is the location where surface water within the Lower Drainage Channel flows underground into the Firehouse culvert, which conveys water into the Kodiak Airport stormwater drainage system and Womens Bay.

2.5 SURFACE WATER SOURCES INTO DRURY GULCH

Five primary hydrological sub-basins contribute water to the Drury Gulch FUDS such that surface water enters the site from four primary drainage sources, which are as follows (USACE 2013a):

- ***Drury Gulch Creek***: Water from Drury Gulch Creek can enter the Upper Gulch Area if the flow is significant enough to overflow and bypass the Drury Gulch Creek Diversion. A typical storm event of between 0.5 and 1.0-inches of rainfall in a 24-hour period is usually insufficient to bypass the diversion.
- ***Aviation Hill Drainage***: Runoff from the Aviation Hill Drainage is a major source of water into the Lower Gulch Area, which is conveyed through the Rezanof Highway Drainage Ditch and the associated 18-inch diameter culvert prior to discharging into the USB.
- ***Drury Gulch Overland Flow***: Water enters the gulch as overland sheet flow from the slopes surrounding the gulch. Certain areas along the slopes have concentrated surface water flow, including the Deer Bone and Dog Leg drainages, both of which have been observed contributing water flow and transporting soil into the gulch (USACE 2013b, 2017a).
- **LSB Seep**: Water from a seep located adjacent to the LSB flows into the aboveground drainage channel located within the ANRH.

2.6 PHYSICAL SETTING

The following subsections present local conditions such as climate, geology, and land use.

2.6.1 Physiography and Topography

The Kodiak Archipelago is characterized by steep and rugged mountainous terrain with a northeast-southwest trending ridge of mountains transecting the island. The region is extensively glaciated and exhibits many glacial landform features. Small cirque glaciers are evident along the main divide, and numerous hanging U-shaped valleys branch out from the central divide. The coastline of Kodiak is extremely irregular with numerous bays and inlets.

Exposed bedrock shores account for a large percentage of the shoreline of Kodiak and are characterized by steeply sloping topography. Drury Gulch FUDS is characterized by the same rugged terrain with a steep access to the upper drainage and surrounding hillside slopes (USACE 2002). Surface topography and elevation undulates in sequence with the underlying bedrock.

2.6.2 Climate

Kodiak Island has a maritime climate with relatively uniform daily temperatures, frequent cloud cover, and occasional high winds. Severe storms are common from December through February with the drier months being April and July. The average annual precipitation is 69.07 inches but varies with topography (National Oceanic and Atmospheric Administration [NOAA] 2019). Table 2-2 presents the mean (average) monthly and annual maximum and minimum temperatures, precipitation, snowfall, and snow depth at the Kodiak Airport from 1931 to 2019.

Table 2-3 presents the total monthly and annual precipitation for the past 10 years (NOAA 2019). The average annual precipitation for the past 5 years (2013-2019) is 77.09 inches and the average annual precipitation for the past 10 years is 75.96 inches.

Table 2-1
Mean Temperatures and Total Precipitation in Kodiak, Alaska by Month

Statistical Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Max Temp (°F)	35.2	36.2	37.9	43.0	49.3	55.4	60.1	61.2	55.9	46.9	39.7	35.8	46.4
Mean Min Temp (°F)	26.2	26.6	27.4	32.4	38.5	44.4	49.0	49.4	44.1	35.6	29.8	26.2	35.8
Mean Average Temp (°F)	30.8	31.4	32.6	37.7	43.9	49.9	54.6	55.3	50.0	41.3	34.7	31.0	41.1
Mean Total Precipitation (inches)	6.90	5.66	4.53	4.91	5.63	4.93	4.02	4.58	6.71	7.54	6.10	6.79	69.07
Mean Total Snowfall (inches)	13.9	13.9	12.9	6.3	0.5	T	0	T	0	1.6	5.8	12.8	71.5
Mean Total Snow Depth (inches)	6	7	5	2	0	0	0	0	0	1	2	5	11

Notes:
Values presented are the means based on available data from January 1931 through August 2018 (NOAA 2019).
T = trace amount between zero and 0.1 inches.
For definitions, refer to the Acronyms and Abbreviations section.

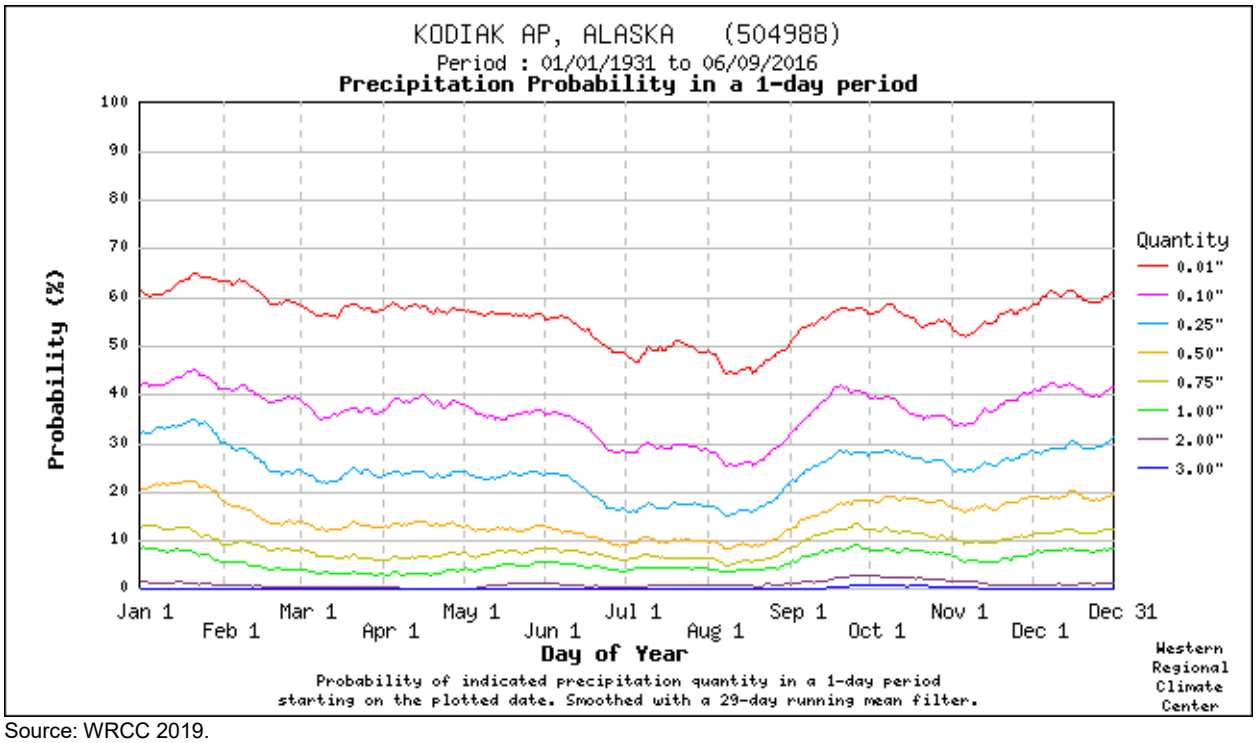
Table 2-2
Monthly Total Precipitation for Kodiak Airport, Alaska from 2008 to Present

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2019	7.42	0.66	7	5.93	7.41	3.29	2.57	1.1	--	--	--	--	**--**
2018	6.27	4.66	2.16	5.61	9.3	4.17	5.52	6.97	3.2	5.58	13.59	8.05	**75.08**
2017	2.95	2.6	0.7	7.34	7.17	7.97	3.76	8.19	7.06	5.29	1.95	12.9	**67.88**
2016	10.41	12.88	7.34	8.9	3.25	3.48	2.46	3.28	4.99	11.58	9.31	4.11	**81.99**
2015	10.13	8.79	7.53	6.64	6.03	3.08	3.32	2.01	2.16	13.8	6.93	12.28	**82.7**
2014	14.3	6.95	3.96	7.13	1.19	6.22	2.58	6.9	7.52	5.9	13	13.79	**89.44**
2013	9.53	6.65	4.47	2.57	2.22	4.11	1.06	9.3	7.54	9.96	3.6	4.45	**65.46**
2012	4.72	7.41	3.33	3.99	5.93	0.8	4.05	3.18	9.64	4.71	4.54	5.64	**57.94**
2011	8.13	2.8	2.99	5.99	6.91	3.24	1.9	7.42	15.49	5.21	4.53	5.92	**70.53**
2010	11.3	9.59	4.72	6.04	7.09	4.22	5.49	3.57	3.1	7.42	1.67	3.13	**67.34**
2009	7.71	3.33	5.2	5.68	5.3	2.39	8.18	6.25	10.98	16.58	7.83	10.25	**89.68**
2008	4.18	9.21	7.96	2.26	14.05	7.94	9.71	8.03	7.59	4.53	4.19	7.73	**87.38**
Mean	**8.09**	**6.29**	**4.78**	**5.67**	**6.32**	**4.24**	**4.22**	**5.52**	**7.21**	**8.23**	**6.47**	**8.02**	**75.95**

Notes:
Values presented are the sum of precipitation (total) based on available data from January 2008 through August 2019 (NOAA 2019)
-- = No data collected
For definitions, refer to the Acronyms and Abbreviations section.

In addition to total and mean precipitation, the precipitation intensity and frequency of storm events are important to the hydrological conditions at Drury Gulch FUDS. Chart 1 shows the probability throughout the year of precipitation events up to 3 inches over a 24-hour period, based on data from 1931 to 2016 (Western Regional Climate Center [WRCC] 2019). The probability of precipitation events greater than 3 inches over 24-hours are estimated to be less than 1 percent.

Chart 1
Precipitation Probability in a 24-hour Period for Kodiak Airport, Alaska



Source: WRCC 2019.

2.6.3 Geology

The geology of Kodiak Island can be characterized by metamorphosed bedrock underlying unconsolidated Quaternary sedimentary deposits. The underlying bedrock is comprised of the Cretaceous Kodiak Formation and the Tertiary Ghost Rocks Formation, which underlie the northeast part of Kodiak Island and are both estimated to be at least 5,000 meters thick. The Kodiak Formation is composed of thick mudstone and shale sequences with interstratified sandstone beds and minor conglomerates that have largely been metamorphosed to argillite,

slate, and graywacke. The Ghost Rocks Formation is characterized by sheared and highly deformed shale, argillite, and mudstone with isolated sandstone and siltstone facies.

The bedrock surface in the Kodiak area is blanketed by Quaternary sedimentary deposits of glacial drift, alluvium, and volcanic ash. Glacial till and outwash are widely distributed in the lower portions of the island and appear only as thin and discontinuous patches on uplands and steep ridges. Alluvial sand and gravel deposits are found in coastal areas and occupy the valleys of major streams, in some places up to 500 feet thick. A coarse and dense layer of volcanic ash is observable in the upper soil layers as a result of the 1912 eruption of the Novarupta volcano, which is located northwest of Kodiak Island on the Alaska Peninsula.

Surface and near surface soil consist of shallow topsoil (1 to 2 inches deep) overlying layers of primarily silty and gravelly sands and sandy and silty gravels (USACE 2002). Lenses of silt are known to be present and interspersed within the sand and gravel lithology. Across the Drury Gulch FUDS, a volcanic ash layer composed of fine to medium, pale yellow sand has been encountered at depths ranging from surficial outcrops to 9.5 feet below ground surface. The volcanic ash layer ranges in thickness from 6 inches to 2 feet thick and is underlain by a layer of tight dark reddish-brown sandy silt up to 2 feet thick. Beneath the silt layer were layers of silt, gravel, and broken rock interpreted as a layer of decomposing bedrock overlying more competent bedrock. Bedrock is located at the shallowest depths along the edges of Drury Gulch and consists of heterogeneous zones of very competent to highly fractured bedrock.

2.6.4 Hydrogeology

Groundwater on Kodiak Island occurs in both the unconsolidated deposits and bedrock. Total well depths range from between 54 to 260 feet below ground surface and often penetrate fractured bedrock zones. Quantities sufficient for domestic use have been found in bedrock formations, with yields between 1 to 15 gallons per minute. Larger wells with yields of greater than 200 gallons per minute have been drilled into formations of shale, sandstone, and conglomerates at depths between 300 and 400 feet.

2.6.5 Hydrology

The hydrology observed at Drury Gulch FUDS is indicative of a low-energy fluvial environment. With the exception of airborne volcanic deposits, the sand and silt layers within Drury Gulch were transported from higher elevations and deposited within the basin by surface water flow. Today, the gulch supports intermittent surface flow in the form of rainfall runoff and snowmelt. Runoff is high as a result of the wet maritime climate, mountainous terrain, short streams with steep gradients, and thin soil overlying bedrock, resulting in limited infiltration of precipitation in the upland areas surrounding the gulch. The result is that the highest stream flows occur immediately following a rain event or during rapid snow melt. Mean annual precipitation runoff on Kodiak Island ranges from 4 to 8 cfs per square mile (U.S. Department of the Interior 1971). Stream flow, along with surface water in lakes and man-made impoundments, account for the majority of domestic drinking water supplies on Kodiak Island.

3.0 REGULATORY SETTING AND REMEDIAL ACTION OBJECTIVES

This section provides information about impacted media, exposure pathways, and screening levels at the Drury Gulch FUDS. This section also summarizes the RAOs for the selected remedy.

3.1 AFFECTED MEDIA, EXPOSURE PATHWAYS, AND SCREENING LEVELS

PCBs are the only contaminant of concern (COC) which remain at the Drury Gulch FUDS that exceed site-specific and/or other applicable cleanup criteria, as identified in the 2003 DD (USACE 2003a). Soil and sediment are the primary affected media at the Drury Gulch FUDS. Once contaminants reach various environmental media they may come in contact with terrestrial or aquatic receptors through different routes of exposure (ADEC 2014). For scoping purposes, human and terrestrial ecological receptors generally use land to meet their lifecycle needs. Aquatic receptors primarily use and spend the majority of their lifecycle in water.

The predominate complete exposure pathway for human health and terrestrial ecological receptors at Drury Gulch FUDS is exposure to PCBs through direct contact with contaminated soil (ADEC 2014, 2017); therefore, in accordance with 18 AAC 75 and the 2003 DD, the ADEC Method Two, Table B1 human health under 40-inch zone soil cleanup level for total PCBs in soil is 1 mg/kg, which is considered a conservative screening level for the protection of human health and terrestrial ecological receptors (ADEC 2018).

The predominate complete exposure pathway for aquatic ecological receptors at Drury Gulch FUDS is exposure to PCBs through direct contact with contaminated sediments deposited within the aquatic environment; deposition occurs primarily through contaminated surface runoff (ADEC 2014). Therefore, a freshwater sediment quality guideline of 0.031 mg/kg PCBs is considered as a conservative screening level for the ecological protection of aquatic receptors (EPA 1996).

Based on these differing exposure pathways, PCB-contaminated soil is not considered sediment until it is deposited within the aquatic environment and is within direct contact with aquatic ecological receptors.

3.2 REMEDIAL ACTION OBJECTIVES

Based on the selected remedy and as allowed by ADEC regulations, soil with PCB concentrations greater than 10 mg/kg were excavated from the Drury Gulch FUDS and disposed of at a TSCA-permitted facility (USACE 2003a, 2003b, 2009). Remaining PCBs in the soil were left on site and the entire disturbed area within the gulch was capped with a minimum of 2-feet of clean earthen fill (consisting of soil with non-detectable concentrations of PCBs at appropriate laboratory quantitation limits) and 0.5-feet of top soil cover, which was subsequently revegetated during construction (USACE 2003a, 2009). Defined as the Drury Gulch Cover, this soil cap must be maintained to achieve the RAOs of the selected remedy and ensure protection of human health and the environment, which includes (USACE 2003a):

- Preventing ingestion and inhalation of surface soil containing PCBs in excess of 1 mg/kg (18 AAC 75.341)
- Preventing ingestion and inhalation of subsurface soil containing PCB compounds in excess of 10 mg/kg for as long as the site is capped with an approved material and an appropriate deed notice or equivalent institutional control is established (18 AAC 75.341)
- Preventing dermal contact and ingestion of sediments containing PCBs in excess of the freshwater sediment ecological screening level (0.031 mg/kg)
- Eliminating downstream transport of PCB-contaminated sediment within the aquatic environment

Table 3-1 summarizes the project RAOs in greater detail.

Table 3-1
Remedial Action Objectives Summary

Area	Medium	COC	Exposure Scenario	Threshold Concentration (mg/kg)
Upper Gulch	Surface soil	PCBs	Ingestion & inhalation	1.0
	Subsurface soil	PCBs	Ingestion & inhalation	10.0
	Freshwater sediment	PCBs	Dermal contact & ingestion	0.031
Lower Gulch	Surface soil	PCBs	Ingestion & inhalation	1.0
	Subsurface soil	PCBs	Ingestion & inhalation	10.0
	Freshwater sediment	PCBs	Dermal contact & ingestion	0.031
ANRH	Surface soil	PCBs	Ingestion & inhalation	1.0
	Subsurface soil	PCBs	Ingestion & inhalation	10.0
	Freshwater sediment	PCBs	Dermal contact & ingestion	0.031
Storm Drain	Surface soil	PCBs	Ingestion & inhalation	1.0
	Subsurface soil	PCBs	Ingestion & inhalation	10.0
	Freshwater sediment	PCBs	Dermal contact & ingestion	0.031

Note:
For definitions, refer to the Acronyms and Abbreviations section.

(intentionally blank)

4.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

Several site investigations and RAs had been conducted at the Drury Gulch FUDS. Detailed descriptions of these previous site investigations and RAs are presented in the 2003 DD (USACE 2003a) and subsequent reports from 2003 to present. Previous investigations and RAs are summarized in Table 4-1. Document citations are provided for future document reference.

Table 4-1
Previous Investigations and Remedial Actions

Year	Action	Description	Referenced Documents
1993	Limited site investigation	Samples collected throughout the Drury Gulch FUDS. PCBs and metals were identified in surface soil samples.	SAIC 1995
1999	Site investigation	Samples collected throughout Drury Gulch FUDS and the Lower Drainage Channel within the ANRH. PCBs were detected at concentrations up to 897 mg/kg in the upper 1 foot of soil and storm drainage soil/sediment.	SAIC 1995; USACE 1999a
1999	Time-critical removal action	A time-critical removal action was initiated in September 1999 to remove PCB-contaminated soil and potential PCB exposure pathways from the Drury Gulch FUDS. A total of 172 cy of PCB-contaminated soil was removed from the Lower Gulch Area; 4,600 to 50,000 cy of PCB-contaminated soil were estimated to remain.	USACE 1999b, 2002
2000	RI/FS	An RI/FS was conducted to delineate (1) the nature and extent of contamination, (2) the fate and transport of contaminants, and (3) the risk posed by each of the four Drury Gulch FUDS project sub-areas. The RI/FS determined unacceptable risk from exposure to PCB-contaminated surface soil in the Upper and Lower Gulch and the ANRH, and from exposure to PCB-contaminated subsurface soil in the Upper and Lower Gulch Areas. PCBs were below action levels in water matrix samples. The recommended remedial alternative was Alternative 2C – Complete Cover, Limited Excavation, Disposal, and Institutional Controls.	USACE 2000, 2002
2002	Test pit investigation	Six test pits were excavated to support additional site characterization activities. Contents of the test pits included metal debris, piping, automobile parts and drums.	USACE 2002 (Appendix I)
2003	Cleanup DD issued	A cleanup DD was developed which presents the selected remedy for the Drury Gulch FUDS to reduce the risks associated with exposure to PCBs.	USACE 2003a

Table 4-1 (Continued)
Previous Investigations and Remedial Actions

Year	Action	Description	Referenced Documents
2004	Construction specification and design calculations	The drainage design was evaluated using the 100-year storm (8 inches in a 24-hour period) as a worst-case scenario. Using flow rates for a 24-inch diameter culvert, water accumulation in the basin was calculated to determine whether water would overflow the Rezanof Highway. The maximum accumulation was estimated to be less than the available storage; therefore, the culvert appeared sufficient.	USACE 2004b
2005	Explanation of Significant Differences issued	An Explanation of Significant Differences was published in 2005 after it became apparent during implementation of the selected remedy that PCB contamination at the site was much more widespread than previously estimated and the programmed funding at the time would not be sufficient for fully implementing the remedy.	USACE 2005b
2003-2008	RAs	A total of 20,335 tons of PCB- and POL-contaminated soil and debris was excavated from the Drury Gulch FUDS: 92 tons in 2003; 3,372 tons in 2004; 6,200 tons in 2005; 4,600 tons in 2006; 2,700 tons in 2007; and 3,371 tons in 2008. In addition, 531 tons of trichloroethylene-contaminated soil was excavated from Drury Gulch during 2008. Sixteen excavation areas were closed after analytical sampling confirmed that the areas had achieved target cleanup levels of less than 10 mg/kg total PCBs.	USACE, 2003b, 2004a, 2005a, 2006, 2007, 2008a, 2008b, 2009
2008	Cap and drainage design	Upon completion of previous RAs, a cover was installed over the remaining PCB-contaminated soil (PCB <10 mg/kg) to limit exposure. The cover was installed gradually as annual RA activities were completed, and in fall 2008 the final cover was installed, contoured, and reseeded. In addition, the drainage channel was realigned, the culverts were cleaned, and site restoration was completed, including revegetation.	USACE 2009
2009	Monitoring and maintenance activities	An approximately 50-year storm event occurred 6 to13 October 2009, which resulted in approximately 9.98 inches of precipitation (6.4 inches in 24-hours). The storm event deposited sediment up to 12 inches thick on the cover and Upper Drainage Channel and plugged the 24-inch culvert that connects the USB and LSB. The storm occurred approximately one month after construction activities were completed and prior to vegetation establishment. A total of three post-storm inspections occurred in 2009. One sediment and surface water sample each were collected from the LSB. Both Aroclor 1254 and Aroclor 1260 were detected in the sediment sample and field duplicate. No PCBs were detected in the surface water sample.	USACE 2012a

Table 4-1 (Continued)
Previous Investigations and Remedial Actions

Year	Action	Description	Referenced Documents
2010	Monitoring and maintenance activities	Eleven storm event inspections and three maintenance inspection events were completed in 2010. A total of 41 sediment and near surface soil samples were collected from within the gulch, of which 15 samples exceeded the 0.031 mg/kg PCB freshwater sediment quality guideline. Ten super sacks were filled with sediment removed from the USB and LSB and characterized. One sample exceeded 0.031 mg/kg PCBs. Other activities included hydroseeding the LDG-10 Slide Area and stormwater runoff BMPs were implemented within the gulch.	USACE 2012a
2011	Monitoring and maintenance activities	Twenty-four storm event inspections and two maintenance inspection events were completed in 2011. A total of 11 sediment and near surface soil samples were collected from areas outside the perimeter fence and throughout the drainage system in an attempt to identify a PCB source area outside the perimeter fence which could have contributed PCB-contaminated soil/sediment onto the Drury Gulch Cover and downgradient portions of the drainage channel during the October 2009 storm event. Other activities included hydroseeding of the sparsely vegetated areas within the gulch, LDG-10 slide area, and repaired bank of the Lower Drainage Channel.	USACE 2012c
2012	Monitoring and maintenance activities	Twenty-nine storm event inspections and two maintenance inspection events were completed in 2012. Preventive maintenance activities were conducted throughout 2012 including clearing sediment/debris from culverts. A land survey of the cover and drainage system was conducted and overall system subsided 0.35 feet between 2008 and 2012.	USACE 2012c, 2013b
2013	Hydrology and hydraulics review	An HHRR was conducted by USACE with the objective to re-evaluate the hydrology of the Drury Gulch FUDS Project and evaluate several project features that were modified during construction to ensure that the project meets the original project design criteria. The HHRR determined that overall the project meets the original design objective.	USACE 2013a
2013	Monitoring and maintenance activities	Twenty-nine storm event inspections and two maintenance inspection events were completed in 2013. Routine maintenance activities were conducted throughout 2013 including clearing sediment/debris from culverts. ADOT&PF constructed a series of four gravel and cobble check dams and associated catch basins in the Rezanof Highway Drainage Ditch.	USACE 2013b, 2017a

Table 4-1 (Continued)
Previous Investigations and Remedial Actions

Year	Action	Description	Referenced Documents
2014	Monitoring and maintenance activities	Thirty-one storm event inspections and two maintenance inspection events were completed in 2014. Routine maintenance activities were conducted throughout 2014, including clearing sediment/debris from culverts and trimming vegetation. The four ADOT&PF check dams installed in 2013 failed in January 2014 as the result of a record-setting rainfall event during which over 4.5 inches of rain fell over a 48-hour period.	USACE 2017a, 2017b
2015	Monitoring and maintenance activities	Four storm event inspections and two maintenance inspection were completed in 2014. Routine maintenance activities were conducted throughout 2015, including clearing sediment/debris from culverts, repairing silt fences, and clearing soil deposited on the lower Area 3 slope.	USACE 2017b, 2016c
2015	Stormwater drainage improvements and repairs	In August 2015, 250 feet of scoured area in the Lower Drainage Channel was filled in with approximately 12 cy of ditch lining material. Areas of land with disturbed vegetation due to movement of the excavator were reseeded.	USACE 2015
2015	Five-Year Review	A Five-Year Review of the Drury Gulch FUDS was conducted during September to December 2015. Issues, recommendations, and proposed follow-up actions were presented associated with the Rezanof Highway Drainage Ditch 18-inch culvert, the Deer Bone and Dog Leg drainages, and freshwater sediment remaining on site with PCBs in excess of the RAO concentration. These recommendations were proposed in coordination between EPA, ADEC, USCG, ADOT&PF, and USACE.	USACE 2016b
2016	Monitoring and maintenance activities	Six storm event inspections and two maintenance inspection were completed in 2016, including clearing sediment/debris from culverts, repairing silt fences, and trimming vegetation.	USACE 2018a, 2018b, 2019a
2017	Monitoring and maintenance activities	Nine storm event inspections and two maintenance inspection were completed in 2017, including clearing sediment/debris from culverts and trimming vegetation.	USACE 2019a, 2019b, 2019c, 2019f
2018	Monitoring and maintenance activities	Thirteen storm event inspections and two maintenance inspection were completed in 2018, including clearing sediment/debris from culverts and trimming vegetation.	USACE 2019d, 2019e, 2019f. 2019g

Table 4-1 (Continued)
Previous Investigations and Remedial Actions

Year	Action	Description	Referenced Documents
2018	PCB soil and sediment sampling	On 7 August 2018, 20 soil and sediment samples were collected and analyzed for PCBs from the Deer Bone Drainage, Dog Leg Drainage, Rezanof Highway Drainage Ditch, the USB, the LSB, and the Area 3 slope. Aroclor 1260 was detected at low levels across the sampled areas and ranged in concentration from 0.0023 mg/kg to 0.58 mg/kg in the soil matrix and from 0.0028 mg/kg to 0.033 mg/kg; exceeding the to be considered ecological benchmark screening value of 0.031 mg/kg. There was only one detection of Aroclor 1254, which was collected from the LSB and had a concentration of 0.060 mg/kg.	USACE 2019h
2019	Monitoring and maintenance activities	Six storm event inspections and one maintenance inspection have been completed in 2019 to date, including trimming vegetation.	USACE 2019g, 2019i

Note:
For definitions, refer to the Acronyms and Abbreviations section.

(intentionally blank)

5.0 FIELD ACTIVITIES – SITE INSPECTIONS AND MAINTENANCE

This section describes the field activities that will be conducted as part of the monitoring and maintenance of the Drury Gulch FUDS.

5.1 SITE MONITORING

The Drury Gulch Cover, drainage systems, and other site features within and associated with the Drury Gulch FUDS will be inspected to ensure the integrity of the cover is maintained and surface water is conveyed at the site as designed. Site inspections following scheduled monitoring inspections and select storm events will be performed; the frequency and requirements of these events are provided in the following subsections.

5.1.1 Post-RA Monitoring Semi-Annual Inspections

Post-RA monitoring inspection events include identifying and documenting any damage to the Drury Gulch Cover, the stormwater drainage systems, and any areas that have required recent maintenance. The site will be inspected for disturbances from stormwater erosion, any flooding or unexpected onsite sedimentation, any unauthorized access or vandalism, signs of illicit dumping, the condition of access roads, fences and gates, and the integrity of existing markers and control points. The location, extent, pattern, and possible causes of damage from erosion, flooding, and unexpected onsite sedimentation will be observed and documented. If erosion of the Drury Gulch Cover results in the exposure of contaminated soil, then USACE will be notified immediately.

Post-RA monitoring inspection events will be conducted on a semi-annual basis (spring and fall). These inspections will preferentially occur in the months of April and October each year; however, this schedule may be adjusted as needed to ensure planning documents are finalized and site conditions are conducive to conducting the inspections. April is an ideal month for a semi-annual inspection because much of the vegetation is still dormant or has died back, snow cover has most likely melted or has not accumulated, and the cover and major site features are visible for inspection. Specific site features to be inspected are discussed below in Section 5.2.

5.1.2 Post-RA Monitoring Field Documentation

Post-RA monitoring inspection activities will be recorded on *Post-RA Monitoring Inspection Forms* in electronic format (e.g., spreadsheet or similar) or alternatively in a hardcopy format if necessary (Appendix A). Photograph stations have been established for use during each post-RA monitoring inspection event to consistently and reproducibly document site conditions and potential erosion damage (Figure 3, Figure 4). Photographs are taken at each station in the direction indicated on the figures. The icons on the figures represent the direction of view, which may include photographing multiple directions from a single location or capturing 360-degree panoramic photographs. Areas that required recent maintenance will also be photographed to document any restoration or repair efforts. Photographs and descriptive information will be summarizing in a photographic log. Field documentation will be recorded and managed in accordance with JE-SOP-7000 *Field Documentation* and JE-SOP-7001 *Project File Management*.

5.1.3 Post-Storm Event Inspections

Post-storm event inspections include identifying and documenting any damage to the Drury Gulch Cover or stormwater drainage system resulting from significant storm rainfall events and the subsequent runoff. Inspections will be conducted within 24 hours of the occurrence of a storm event, as can be safely conducted. By definition, a storm event is defined as a precipitation event that produces greater than 0.5 inch of rainfall in 24 hours and that is separated by 72 hours of dry weather from the previously measured storm event. A dry weather period is a time interval during which less than 0.1 inch of rainfall is observed across a minimum of 72 hours. Additionally, professional judgement will be used to define if other precipitation events warrant post-storm event inspection as well. Other conditions potentially warranting inspection may include:

- Multiple consecutive days of rainfall that are each equal to or less than 0.5 inch per day. For example, three consecutive days with rainfall measurements of 0.3 inch, 0.5 inch, and 0.4 inch, respectively.
- Large or intense precipitation events greater than 0.5 inch that are separated by less than 72 hours of dry weather. For example, 48 hours of dry weather followed by two days of 2.5 inches of average daily rainfall (a rainfall event totaling 5.0 inches in 48 hours).

The location, extent, pattern, and possible causes of damage from erosion, flooding, and unexpected onsite sedimentation will be observed and documented. If erosion of the Drury Gulch Cover results in the exposure of contaminated soil, then USACE will be notified immediately. Specific site features to be inspected are discussed below in Section 5.2.

5.1.4 Post-Storm Event Inspections Field Documentation

Post-storm event inspections activities will be recorded on *Post-Storm Event Inspection Forms* in electronic format (e.g., spreadsheet or similar) or alternatively in a hardcopy format if necessary (Appendix A). Damage from erosion, including location, extent, pattern, and plausible causes will be documented. As necessary, representative photographs will be collected to document specific site conditions including observed flow stages, flooding or pooling, and/or any observed erosion processes. Photographs and descriptive information will be summarizing in a photographic log. Field documentation will be recorded and managed in accordance with JE-SOP-7000 *Field Documentation* and JE-SOP-7001 *Project File Management*.

5.2 INSPECTION REQUIREMENTS

Site features at the Drury Gulch FUDS will be inspected and monitored for damage or disturbance as specified in Appendix I, Section 2.2 of the 2003 Drury Gulch RA work plan (USACE 2003b) and as summarized below. Inspections will consist of visually observing the Drury Gulch Cover, the stormwater drainage systems, other associated site features (e.g., fences, gates, etc.), and any areas that have required recent maintenance.

Specific site features and items to inspect at the Upper Gulch Area include the following:

- Drury Gulch Cover – Upper Area
  - Identify signs of erosion or removal of the cover.
  - Discern locations of possible settlement or subsidence of the cover.
  - Locate any deposition of sediment and/or surface water ponding on to the cover.
  - Observe that adequate vegetation is present on and adjacent to the cover.
  - Identify where vegetation is providing inadequate erosion protection.

- Identify locations and indications of digging and burrowing activity by voles, foxes, bears, and other burrowing animals.
- Check the presence or evidence of debris, litter, waste/garbage, liquid releases, or unauthorized waste dumping.
- Check the integrity of survey cover markers and control points and ensure they are not damaged.
- Inspect the entire perimeter site fence for penetrations (holes), excessive vegetative overgrowth, damage from borrowing animals, and any other damage.

- Drury Gulch Creek Diversion

  - Inspect the 18-inch diameter culvert inlet for obstructions and determine if Drury Gulch Creek is flowing unimpeded into the culvert.
  - Verify that the Drury Gulch Creek Diversion is directing surface water flow away from the Upper Gulch Area under normal flow conditions.
  - Check for indications of ponding or pooling in the Upper Gulch Area.
  - Evaluate for signs of recent excessive flows conditions or culvert obstructions at the diversion which may have caused surface water to overflow into the Upper Gulch Area.

- Site Access Road

  - Inspect the Site Access Road for signs of erosion of the roadbed.
  - Inspect the fence gate across the Site Access Road is locked/lockable and undamaged.
  - Identify that water is free-flowing from the 18-inch diameter culvert outlet and is not obstructed.
  - Inspect the ditch parallel to the Site Access Road and evaluate for excessive erosion.
  - Examine the 24-inch diameter culvert that crosses beneath the Site Access Road alongside the Rezanof Highway and identify if water is free-flowing and if any obstructions/debris are present.

Specific site features and items to inspect at the Lower Gulch Area include the following:

- Drury Gulch Cover – Lower Area

  - Identify signs of erosion or removal of the cover.
  - Discern locations of possible settlement or subsidence of the cover.
  - Locate any deposition of sediment and/or surface water ponding on to the cover.
  - Observe that adequate vegetation is present on and adjacent to the cover.
  - Identify where vegetation is providing inadequate erosion protection..
  - Identify locations and indications of digging and burrowing activity by voles, foxes, bears, and other burrowing animals.
  - Check the presence or evidence of debris, litter, waste/garbage, liquid releases, or unauthorized waste dumping.
  - Check the integrity of survey cover markers and control points and ensure they are not damaged.

- Inspect the entire perimeter site fence for penetrations (holes), excessive vegetative overgrowth, damage from borrowing animals, and any other damage.

- Upper Drainage Channel
  - Check for water running through the Upper Drainage Channel and identify any obstructions/debris present.
  - Examine for damage of the riprap and geotextile fabric lining the drainage channel.
  - Check for indications of ponding or pooling in the Lower Gulch Area.
  - Check for animal activity or destructive plant growth.

- Deer Bone and Dog Leg Drainages
  - Check the Deer Bone Drainage for runoff and soil accumulation onto Drury Gulch FUDS.
  - Check the Dog Leg Drainage for runoff and soil accumulation onto Drury Gulch FUDS.

- LDG-10 Slide Area
  - Inspect the LDG-10 slide area for signs of slope failure or erosion.

- USB
  - Check for water running through the USB and identify any obstructions/debris present.
  - Inspect the USB for sediment and/or debris accumulation.
  - Inspect that the inlet of the 24-inch diameter culvert beneath the Rezanof Highway is free-flowing and not obstructed with sediment or debris.
  - Inspect 24-inch diameter culvert inlet for signs sediment deposition on the geotextile grate cover.

- Rezanof Highway Ditch 18-inch Culvert and Area-3 Slope
  - Check that the inlet and outlet of the Rezanof Highway Drainage Ditch 18-inch culvert are free-flowing and not obstructed.
  - Check for sediment accumulation around the 18-inch diameter culvert inlet and/or around the perimeter fence.
  - Examine the Area-3 Slope for signs of overland sheet flow.
  - Inspect the Area-3 Slope for signs of erosion and sediment deposition from upgradient, offsite sources.

Specific site features and items to inspect at the ANRH include the following:

- LSB
  - Check for water running through the LSB and identify any obstructions/debris present.
  - Inspect the LSB for sediment and/or debris accumulation.
  - Inspect that the outlet of the 24-inch diameter culvert beneath the Rezanof Highway is free-flowing and not obstructed with sediment or debris.
  - Assess if water is discharging from the natural seep located adjacent to the LSB.

- Lower Drainage Channel
  - Investigate the entire length of the Lower Drainage Channel located within the ANRH for signs of erosion, obstruction, failure, damaging plant growth, and/or animal borrowing activity.
  - Inspect the inlets and outlets of the roadway culverts that cross beneath Cape Decision Street and the unnamed gravel road are free-flowing and identify any obstructions/debris present.

Specific site features and items to inspect at Lower Drainage Channel Area include the following:

- Investigate the entire length of the Lower Drainage Channel located within the Lower Drainage Channel Area (formerly known as the Storm Drain Area) for signs of erosion, obstruction, failure, damaging plant growth, and/or animal borrowing activity.
- Assess that the Firehouse Culvert Inlet is free-flowing and identify any obstructions/debris present.

Specific site features and items to investigate at Aviation Hill include the following:

- Rezanof Highway Drainage Ditch
  - Determine if water is free-flowing through the ditch and identify any obstructions/debris present or any locations of potential diversion or sedimentation.
  - Inspect the portion of the Rezanof Highway Drainage Ditch located within the fenced site perimeter for signs of erosion, obstruction, failure, damaging plant growth, and/or animal borrowing activity.
  - Survey the portion of the Rezanof Highway Drainage Ditch located outside the fenced site perimeter for signs of erosion, obstruction, and failure, including the Aviation Hill Diversion (Access Road "Y") and the series of drainage ditch check dams and stilling basins.

5.3 MAINTENANCE AND SAMPLING ACTIVITIES

Post-RA maintenance will be conducted preventively and as needed based on the findings of site inspections. Maintenance will be performed to maintain the integrity of the Drury Gulch Cover, drainage system components, perimeter fence, photograph station pin flags and survey control points . Post-RA maintenance will be conducted in accordance with Appendix I, Section 2.4 of the 2003 Drury Gulch RA work plan (USACE 2003b) and the relevant SOPs in

Attachment B-2 including but not limited to the JE-SOP-1400 *Contaminated Soil Removal* and JE-SOP-2110 *Stockpile Construction*.

Preventive maintenance will be completed semi-annually and includes activities such as clearing debris from culverts and channels, replacing gate locks, and repairing or replacing photograph station pin flags and survey control points. Maintenance includes activities such repairing of eroded or damaged areas, dredging sediments from drainage channels and basins, and clearing vegetation. The USACE will be notified and provide concurrence before any maintenance activities are performed that could alter the designed remedy. Post-RA maintenance may include activities such as:

- Repairing eroded, damaged, or settled areas of the Drury Gulch Cover (see Section 5.2)
- Repairing eroded portions of the upper and lower drainage channel
- Dredging sediment and clearing debris from stilling and catch basins, drainage channels, flow diversions, and culverts
- Installing temporary silt fencing, straw wattles, or other man-made erosion and sediment protections Fertilizing and reseeding failed areas of vegetation
- Removing vegetation from within the drainage channels and along the perimeter site fences
- Repairing damage caused by burrowing animals
- Repairing or replacing photograph station markers and/or survey control points
- Replacing damaged perimeter fencing and gate locks

Light impact, off-highway vehicles, including utility-terrain and all-terrain vehicles, may be used for transporting materials on site as long as use of the vehicles do not result in damage to the Drury Gulch Cover. Otherwise, vehicular traffic on the cover is prohibited.

All proposed maintenance activities will be documented on a *Maintenance Request & Completion Form* (Appendix A) and submitted to USACE for approval. The nature and extent of deposits, debris, obstruction, restriction, or damage requiring maintenance will be documented during inspection and representative photographs will be collected before and after any maintenance activities.

5.3.1 General Site Maintenance

General site maintenance and upkeep include repairing damaged fences, gates, culvert protective grates, culvert identification markers, silt fences, and photograph station markers and will be completed as needed. General site maintenance and repairs will be implemented as outlined in Appendices B and I of the 2003 RA work plan (USACE 2003b).

The USCG maintains the grass growing between the Lower Drainage Channel and Dolphin Avenue from Cape Decision Street to the USCG Firehouse (Figure 4). Lawn mowing will not be performed within the Upper Gulch Area, Lower Gulch Area, or the ANRH. The access road between Rezanof Highway and the fire water tanks will be maintained by USCG; however, the condition of roadways will be recorded during inspections.

Erosion Repair

Should eroded or damaged areas of the Drury Gulch Cover be identified during site inspections, eroded areas, any holes or burrows created by animals, or other damage, will be filled with the same materials used to construct the cover, compacted, regraded to maintain the design thickness and slope, and reseeded in accordance with the design. Material specifications, compaction, grading, and seeding requirements are provided in the technical specifications presented in Appendix B of the 2003 RA work plan (USACE 2003b).

In the event of extreme precipitation events, overland sheet flow and gullying may occur. Timely action may be necessary, such as the construction of temporary barriers to divert flow and control erosion of the cover, including the implementation of silt fences or straw wattles, spreading mulch, or placing sandbags.

Settlement Repair

If the function of the Drury Gulch Cover has been impaired due to settlement, the areas will be repaired by filling depressions with the same materials used to construct the cover, compacting,

regrading, and seeding in accordance with the design technical specifications (USACE 2003b). Repairs will be made such that a positive surface drainage is sufficiently maintained.

Vegetative Coverage Repair

Cover areas lacking adequate vegetative coverage (resulting from drought, fire, landslides, etc.) will be reseeded. The following seed mixture is acceptable: Arctared Fescue (33 percent), Park Kentucky Blue (33 percent), and Omega 3 Perennial Rye (33 percent). Large areas (i.e., greater than 1,000 square feet) or several smaller areas will be hydroseeded. Smaller areas will be seeded through broadcasting either by hand or using a hand operated broadcaster. The seed will be applied as at a rate of 1 pound per 100 square feet. Hand broadcast seeds will be applied in two intersecting directions, and then lightly raked. A 20-20-10 fertilizer will be included in the hydroseed mixture and will be applied at a rate of 100 pounds per acre. Seeds sown by hand will be fertilized if required to sustain growth.

Indigenous vegetation (e.g., alders, salmonberries, cow parsnip) grow within the gulch and are naturally and preferentially adding to the vegetative cover growing on the protective cap.

Drainage Obstructions

Obstructions blocking or restricting stormwater runoff through the drainage system will be removed. Areas where blockages or restrictions regularly occur include the inlets and discharges to culverts, the USB, and LSB, but may occur at other portions of the drainage system. Note that the inlet of the Rezanof Highway Drainage Ditch 18-inch diameter culvert and the discharge of the Firehouse culvert are located outside of the Drury Gulch FUDS project area but are considered site drainage control features and will be cleared of any drainage obstructions. If the flow within the drainage system is obstructed or restricted, USACE will be contacted to assist in facilitating clearance of the blockage or restriction, as needed.

Soil and Sediment Management

Soil from Aviation Hill, Area-3 Slope, and other upgradient sources have previously been deposited onto the Drury Gulch Cover as well as being deposited as sediment into the Upper and Lower Drainage Channels and the USB and LSB. Soil deposited onto the Drury Gulch Cover may require removal. The USB and LSB may need to be dredged of sediment periodically. Removed soil and dredged sediment will be containerized, characterized, and disposed of at an approved offsite facility. Soil removal and sediment dredging activities will be conducted in accordance with the JE-SOP-1400 *Contaminated Soil Removal*, JE-SOP-2110 *Stockpile Construction*, JE-SOP-3000 *Collection of Soil Samples*, JE-SOP-5300 *Sediment Sampling*, JE-SOP-2100 *Waste Management Plan*, and other relevant SOPs (Attachment B-2).

Soil and Sediment Sampling

In event that the Drury Gulch Cover is damaged, and the remedy fails, PCB-contaminated soil could potentially be transported by surface water and deposited as sediment within downgradient drainage features and eventually offsite waterbodies. In response, soil and sediment samples may be collected within the Drury Gulch FUDS to determine if PCB-contaminated soil was exposed and migrated downgradient as a result of a cover failure.

Field procedures associated with soil and sediment sample collection are described in detail in the SAP, which is comprised of the field sampling plan, SOPs, and the QAPP (Attachments B-1 through B-3). Relevant SOPs include JE-SOP-3000 *Collection of Soil Samples* and JE-SOP-5300 *Sediment Sampling* (Attachment B-2). Laboratory analytical results will be compared to project-specific cleanup levels presented in Section 3.1.

6.0 REPORTING REQUIREMENTS

Field activities, observations, and associated analytical data will be reported within the following deliverables and in accordance with the proposed project schedule (Table 1-1):

- Annual post-RA report
- Field situation reports (Sitreps)
- Post-RA monitoring inspection forms
- Post-storm event inspection forms
- Inspection photographic logs

All deliverables will comply with the most recent version of the USACE *Manual for Electronic Deliverables* (MED) (USACE 2017c).

6.1 POST-RA MONITORING REPORTING

Post-RA monitoring inspection events will be conducted on a semi-annual basis (spring and fall). Following each Post-RA monitoring inspection, a Sitrep summarizing the activities and observations of the inspection will be subsequently submitted to USACE (an example is provided in Appendix A). The Sitrep will note the date of the storm event, the date of the inspection, and any major changes, impacts, or situations observed during the inspection.

Post-RA monitoring inspection activities will be recorded on the *Post-RA Monitoring Inspection Form* in electronic format (e.g., spreadsheet or similar) or alternatively in a hardcopy format if necessary (Appendix A). *Post-RA Monitoring Inspection Forms* will be subsequently submitted to USACE within approximately 60 days of inspection completion.

6.2 POST-STORM EVENT INSPECTIONS REPORTING

Following each post-storm event inspection, a Sitrep summarizing the activities and observations of the inspection will be subsequently submitted to USACE within two days of completing the inspection. The Sitrep will note the date of the storm event, the date of the inspection, and any major changes, impacts, or situations observed during the inspection.

Post-storm event inspections activities will be recorded on the *Post-Storm Event Inspection Form* in electronic format (e.g., spreadsheet or similar) or alternatively in a hardcopy format if necessary (Appendix A). *Post-Storm Event Inspection Forms* will be subsequently submitted to USACE within approximately one week of inspection completion.

6.3 ANNUAL POST-RA REPORT

At the end of each contract year, an annual post-RA report will be developed and submitted, including a summary of the spring and fall semi-annual monitoring inspections, post-storm event inspection events, and any maintenance activities from the preceding year (Table 1-1). Completed post-RA monitoring inspection forms, post-storm event inspection forms, maintenance request forms, and photographic logs documenting site activities, observations, and data collected will be included as attachments to the annual report.

6.4 ELECTRONIC DELIVERABLES

All electronic deliverables required for this project (e.g., reports, databases, figures, maps, drawings) will be in the formats outlined in the MED (USACE 2017c).

6.5 MAPS AND DRAWINGS

Survey-quality map and drawing will be developed into geographical information system (GIS) deliverables compatible to the Environmental Systems Research Institute ArcGIS software and/or computer aided drafting drawings in *.dwg format.

GIS activities may include:

- Use and management of *.mdx files, shapefiles, geodatabases, coverages, and raster imagery related to global positioning system field data collection and processing
- Datum and coordinate system transformation
- Georeferencing and rectification
- Geodatabase development
- Adherence to the Spatial Data Standards for Facilities, Infrastructure, and Environment, Version 3.0 (U.S. Department of Defense 2018)

- Metadata preparation using Federal Geographic Data Committee standards

6.6 SURVEY

If needed, land surveying be conducted in accordance with Section 5 (Survey) of the MED and JE-SOP-1000 *Global Positioning System Surveying* and JE-SOP-1001 *Differential Global Positioning System Surveying* (Attachment B-2).

The location of any survey points will be collected to a minimum of 3.3 feet (1 meter) horizontal accuracy and 0.5 foot (0.15 meter) vertical accuracy. The horizontal control will be referenced to the World Geodetic System 1984 latitude/longitude in decimal degrees, and the vertical control will be reference to the North American Vertical Datum 1988.

6.7 ANALYTICAL LABORATORY DATA

Analytical laboratory data will be analyzed and reported as defined in the project QAPP presented in Attachment B-3.

(intentionally blank)

7.0 REFERENCES

ADEC (Alaska Department of Environmental Conservation). 2014 (March). *Ecoscoping Guidance. A Tool for Developing an Ecological Conceptual Site Model*. https://dec.alaska.gov/media/11935/ecoscoping-guidance-march-2014-se-final-3-20-14.pdf. Accessed 9 October 2019.

ADEC. 2017 (January). *Guidance on Developing Conceptual Site Models*. https://dec.alaska.gov/media/11926/adec-csm-guidance-222017.pdf. Accessed 9 October 2019.

ADEC. 2018 (27 October). *Oil and Other Hazardous Substances, Pollution Control*. Division of Spill Prevention and Response, Contaminated Sites Program. 18 AAC 75.

ADEC. 2019. *Site Report: USCG Kodiak Drury Gulch, Site 18*. Division of Spill Prevention and Response, Contaminated Sites Program. File Number 2601.38.026. https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/528. Accessed 11 September 2019.

EPA (U.S. Environmental Protection Agency). 1996 (September). *Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod Hyalella azteca and the midge Chironomus riparius*. EPA 905-R96-008. Great Lakes National Program Office: Chicago, IL.

EPA. 2018 (March). *Hazardous Waste Sites Summary, Current Site Details for AK9690330742*. https://rcrapublic.epa.gov/rcrainfoweb/action/modules/hd/showhdcurrent/false/AK/null/null/AK9690330742. Accessed 30 September 2019.

NOAA (National Oceanic and Atmospheric Administration). 2019. *NOWData – NOAA Online Weather Data, Kodiak Airport, AK, Monthly Summarized Data, Year Range 1931-2019*. National Weather Service Forecast Office. https://w2.weather.gov/climate/xmacis.php?wfo=pafc Accessed 27 September 2019.

SAIC (Science Applications International Corporation). 1995 (October). *Final RFI Contaminant Characterization Study, Sites 9, 12, 13, 18, 19, 20, and 24, U.S. Coast Guard Support Center Kodiak*. Rev. 2. Kodiak, Alaska.

USACE (U.S. Army Corps of Engineers). 1999a (May). *Technical Memorandum, 1999 Site Investigation, Drury Gulch, Kodiak, Alaska*. Final. Prepared by Jacobs Engineering Group Inc.

USACE. 1999b (September). *Final Work Plan, Interim Removal Action, Drury Gulch, Kodiak, Alaska*.

USACE. 2000 (September). *Final Work Plan, 2000 Remedial Investigation/Feasibility Study, Drury Gulch, Kodiak Alaska.* Prepared by Jacobs Engineering Group Inc.

USACE. 2002 (October). *Final Report, 2000 Remedial Investigation/Feasibility Study, Drury Gulch, Kodiak, Alaska.* Prepared by Jacobs Engineering Group Inc. FRMD No. F10AK100701_03.10_0500_a_200-1e.

USACE. 2003a (July). *Clean-up Decision Document, Drury Gulch, Kodiak, Alaska*. Prepared by Jacobs Engineering Group Inc. FRMD No. F10AK100701_05.09_0500_a 200-1e.

USACE. 2003b (July). *Remedial Action Work Plan, Drury Gulch, Kodiak, Alaska*. Prepared by Jacobs Engineering Group Inc. FRMD No. F10AK100701_07.04_0503_p_200-1f.

USACE. 2004a (May). *2003/2004 Remedial Action Update Report, Drury Gulch*. Prepared by Jacobs Engineering Group Inc.

USACE. 2004b (June). *Construction Specifications and Design Calculations Report*. Final. Prepared by Jacobs Engineering Group Inc.

USACE. 2005a (May). *2004 Remedial Action Update Report, Drury Gulch, Draft II*. Prepared by Jacobs Engineering Group Inc.

USACE. 2005b (23 June). *Explanation of Significant Differences, Kodiak Army/Navy Property, Drury Gulch, Project F10AK1007-01, Kodiak, Alaska*. FRMD No. F10AK100701_05.11_0001_a.

USACE. 2006 (April). *2005 Remedial Action Update Report, Drury Gulch, Draft III.* Prepared by Jacobs Engineering Group Inc.

USACE. 2007 (February). *2006 Remedial Action Update Report, Drury Gulch, Draft IV*. Prepared by Jacobs Engineering Group Inc.

USACE. 2008a (June). *2007 Remedial Action Update Report, Drury Gulch, Draft V*. Prepared by Jacobs Engineering Group Inc.

USACE. 2008b (April). *2008 Drury Gulch Remedial Action Work Plan*. Prepared by Jacobs Engineering Group Inc.

USACE. 2009 (April). *2008 Remedial Action Report, Drury Gulch, Kodiak, Alaska*. Revised Final. Prepared by BC Contractors-Jacobs Joint Venture. FRMD No. F10AK100701_07.08_0500_p_200-1f.

USACE. 2012a (January). *2010 Final Post Remedial Action Report Drury Gulch, Formerly Used Defense Site, Kodiak, Alaska*. Prepared by Fairbanks Environmental Services. FRMD No. F10AK100701_07.11_0506_a_200-1e.

USACE. 2012b (January). *Final Work Plan Five-Year Long-Term Monitoring and Maintenance Plan, Drury Gulch Site, Kodiak, Alaska*. Prepared by Fairbanks Environmental Services. FRMD No. F10AK100701_07.11_0507_a 200-1e.

USACE. 2012c (December). *Final 2011/2012 Post Remedial Action Report Drury Gulch, Formerly Used Defense Site, Kodiak, Alaska*. Prepared by Fairbanks Environmental Services. FRMD No. F10AK100701_07.11_0508_a_200-1e.

USACE. 2013a (August). *Drury Gulch Hydrology and Hydraulics Review Report*.

USACE. 2013b (October). *Final 2012/2013 Post Remedial Action Report, Drury Gulch, Kodiak, Alaska*. Prepared by Fairbanks Environmental Services. FRMD No. F10AK100701_07.11_0510_a 200-1e.

USACE. 2015 (December). *Final After-Action Report, Drury Gulch Stormwater Control, Kodiak, Alaska.* Prepared by Marsh Creek LLC. FRMD No. F10AK100701_07.11_0514_a_ 200-1e.

USACE. 2016a (July). *Final Long-Term Monitoring and Maintenance Plan, Drury Gulch Formerly Used Defense Site: F10AK1007-01, Kodiak, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0513_a_200-1e.

USACE. 2016b (November). *Final Second CERCLA Five-Year Review Report, Drury Gulch Formerly Used Defense Site (F10AK1000701) Kodiak, Alaska*. FRMD No. F10AK100701_07.11_0520_a_1200C.

USACE. 2016c (November). *Technical Memorandum Post-Remedial Action December 2015 Semi-Annual Inspection, Drury Gulch Post-Remedial Action Monitoring and Maintenance Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0519_a_1200C.

USACE. 2017a (January). *Final 2013/2014 Post-Remedial Action Report, Drury Gulch, Kodiak, Alaska*. Prepared by Fairbanks Environmental Services. FRMD No. F10AK100701_07.11_0515_a_1200C.

USACE. 2017b (January). *Final 2014/2015 Post-Remedial Action Report, Drury Gulch, Kodiak, Alaska*. Prepared by Fairbanks Environmental Services. FRMD No. F10AK100701_07.11_0518_a_1200C.

USACE. 2017c (April). *Manual for Electronic Deliverables, Requirements for Submittals of Documents, Laboratory, Data, and Other Items*.

USACE. 2018a (April). *Final Technical Memorandum Post-Remedial Action 26 April 2016 Semi-Annual Inspection #14, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0521_a_1200C.

USACE. 2018b (April). *Final Technical Memorandum Post-Remedial Action 30 October 2016 Semi-Annual Inspection #15, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0522_a_1200C.

USACE. 2018c (July). *Final Addendum Work Plan, Drury Gulch Post-Remedial Action Monitoring and Maintenance Plan, Kodiak, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0523_a_1200C.

USACE. 2019a (May). *Final Technical Memorandum Post-Remedial Action 17 April 2017 Semi-Annual Inspection #16, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0525_a_1200C.

USACE. 2019b (June). *Final Technical Memorandum Post-Remedial Action 21 October 2017 Semi-Annual Inspection #17, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0527_a_1200C.

USACE. 2019c (June). *Final 2016/2017 Post-Remedial Action Report, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0524_a_1200C.

USACE. 2019d (June). *Final Technical Memorandum Post-Remedial Action 26 April 2018 Semi-Annual Inspection #18, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0528_a_1200C.

USACE. 2019e (June). *Final Technical Memorandum Post-Remedial Action 7 October 2018 Semi-Annual Inspection #19, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0526_a_1200C.

USACE. 2019f (September). *Final 2017/2018 Post-Remedial Action Report, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0530_a_1200C.

USACE. 2019g (September). *Final 2018/2019 Post-Remedial Action Report, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0531_a_1200C.

USACE. 2019h (September). *Final Technical Memorandum 7 August 2018 Sampling Event, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0532_a_1200C.

USACE. 2019i (September). *Final Technical Memorandum Post-Remedial Action 22 April 2019 Semi-Annual Inspection #20, Drury Gulch Post-Remedial Action Monitoring and Maintenance, Kodiak Island, Alaska*. Prepared by Bethel Services, Inc. – TechLaw, Inc. Joint Venture. FRMD No. F10AK100701_07.11_0533_a_1200C.

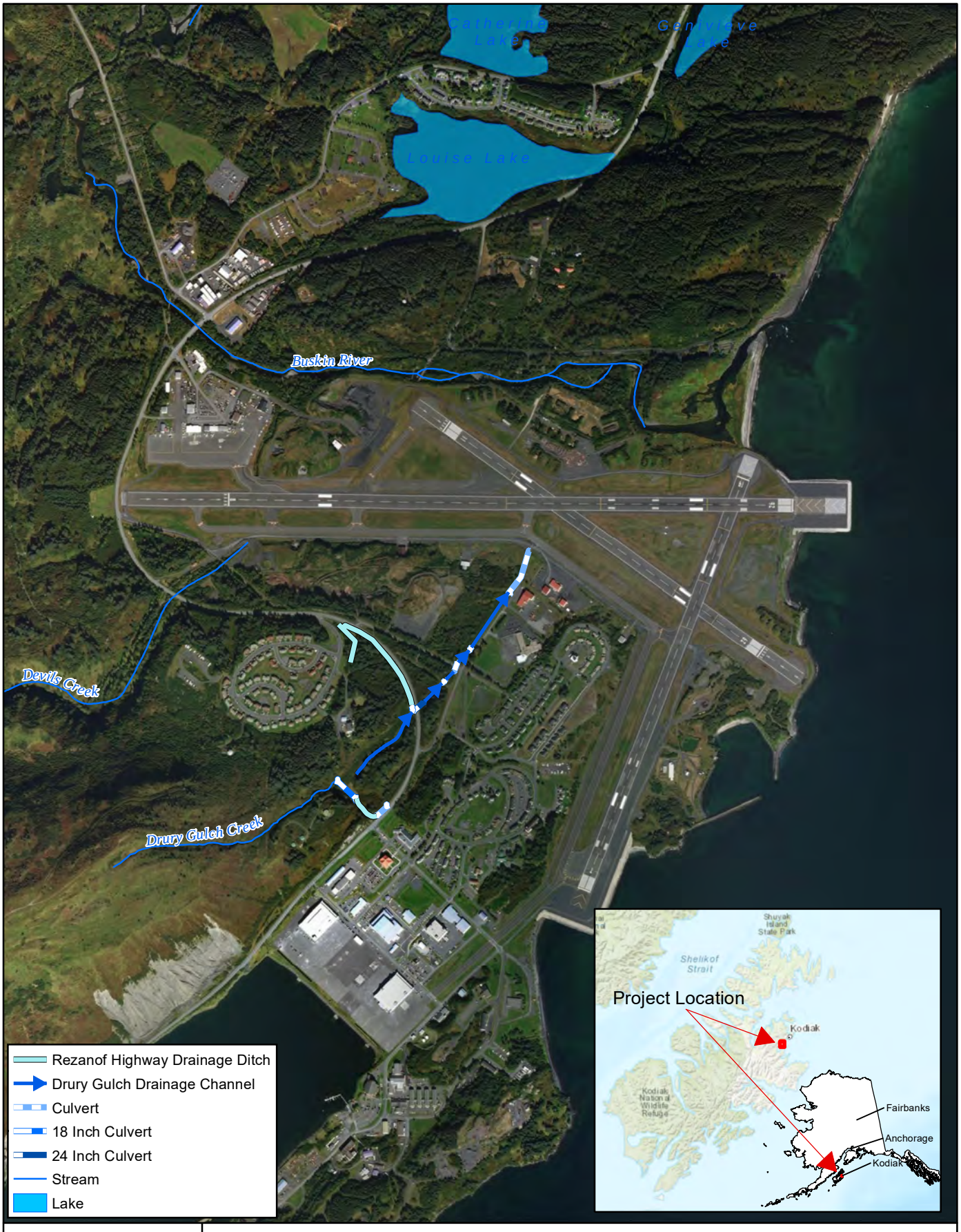
U.S. Department of Defense. 2018. *Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) Online*. Version 3.0. U.S. Army Geospatial Center. https://www.sdsfieonline.org/. Accessed 11 October 2019.

U.S. Department of the Interior. 1971. *Water Resources of Alaska*. U.S. Geological Survey, Water Resources Division, Alaska District. Open file report 1971. Authored by Alvin J. Feulner, Joseph M. Childers, and Vernon W. Norman. https://pubs.usgs.gov/of/1971/0105/report.pdf. Accessed 27 September 2019.

WRCC (Western Regional Climate Center). 2019. *Kodiak AP, Alaska (504988), Precipitation Probability by Duration*. https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ak4988 Accessed 26 September 2019.

(intentionally blank)

FIGURES



PROJECT LOCATION AND VICINITY MAP

U.S. Army Corps of Engineers Alaska District

DRURY GULCH
FORMALLY USED DEFENSE SITE
FUDS # F10AK100701
KODIAK ISLAND, ALASKA

FIGURE 1

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\U\USACE\AK_Kodiak\GIS\FUDS_F10AK100701_MXD\Figure 1 - Location Vicinity.mxd eggerikt

X NGS Control Point (Not from GFM)

Control Point (Location is approximate)

Lower Stilling Basin

Upper Stilling Basin

Drainage Ditch

Culvert

18 Inch Culvert

24 Inch Culvert

Drury Gulch Drainage Channel

Stream

Silt Fence

Area 3 Slope

Area North of Rezanof Highway

LDG10 Slide Area

Lower Gulch Area

Upper Gulch Area

Fence

Notes:
Overview Extent

N

0 200 400
FEET

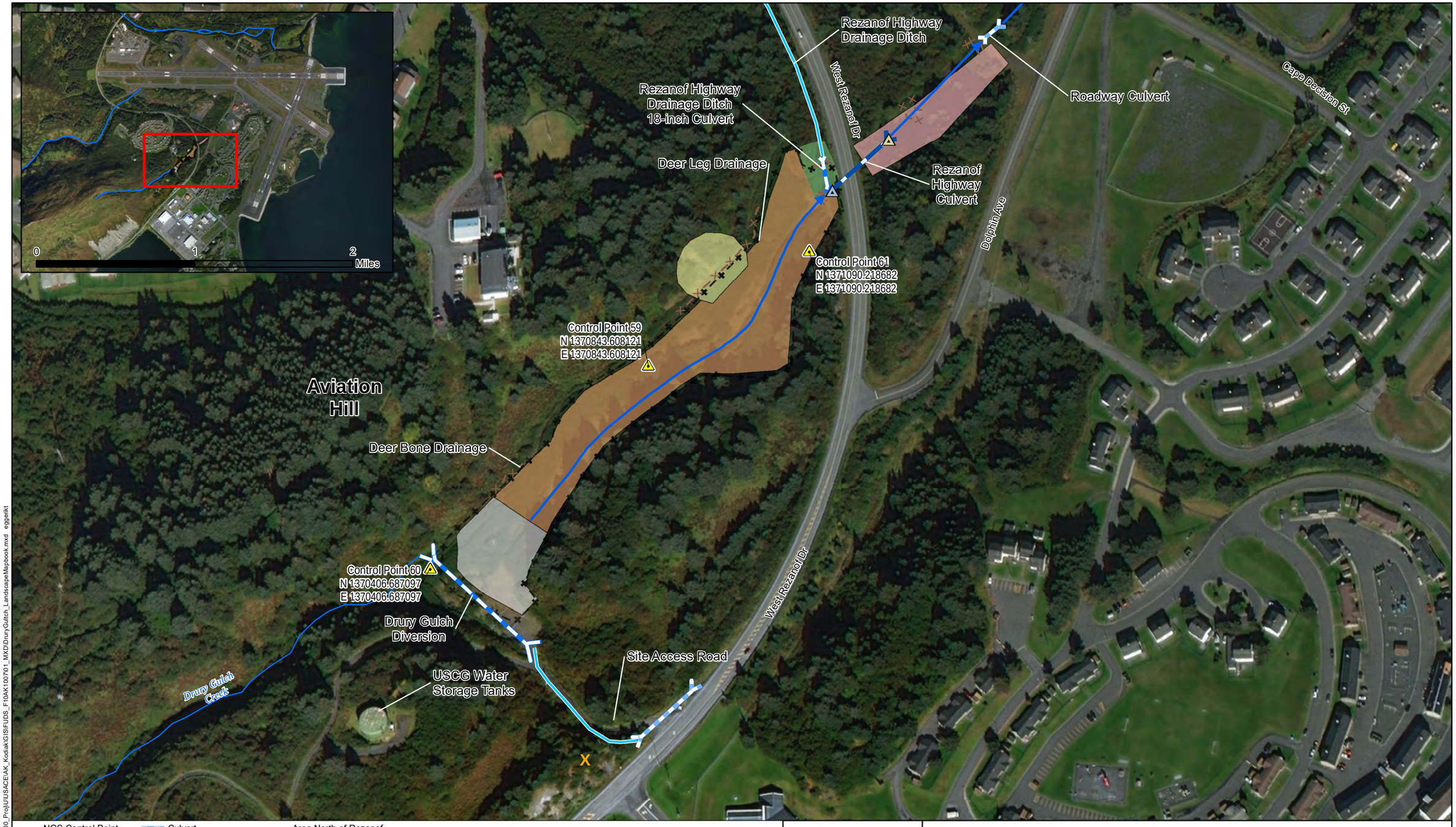
U.S. Army Corps of Engineers Alaska District

OVERVIEW EXTENT

DRURY GULCH
FORMERLY USED DEFENSE SITE
FUDS # F10AK100701
KODIAK ISLAND, ALASKA

FIGURE 2

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\USACE\AK_Kodiak\GIS\FUDS_F10AK100701_MXD\DruryGulch_LandscapeMapbook.mxd eggerikt



X NGS Control Point (Not from GFM)

Control Point (Location is approximate)

Lower Stilling Basin

Upper Stilling Basin

Drainage Ditch

Culvert

18 Inch Culvert

24 Inch Culvert

Drury Gulch Drainage Channel

Silt Fence

Area 3 Slope

Area North of Rezanof Highway

LDG10 Slide Area

Lower Gulch Area

Upper Gulch Area

Fence

Notes:
Southern Extent - Area that lies southwest of Rezanof Highway
Photo Direction Arrows point in direction that photograph is to be taken.

N

0 100 200

FEET

UPPER AND LOWER DRURY GULCH AREAS

U.S. Army Corps of Engineers Alaska District

DRURY GULCH
FORMERLY USED DEFENSE SITE
FUDS # F10AK100701
KODIAK ISLAND, ALASKA

FIGURE 3

\\brookside\files\GIS_SHARE\ENBG\00_Proj\USACE\AK_Kodiak\GIS\FUDS_F10AK100701_MXD\DruryGulch_LandscapeMapbook.mxd egganikt

\\brookside\files\GIS_SHARE\ENBG\00_Proj\USACE\AK_Kodiak\GIS\FUDS_F10AK100701_MXD\DruryGulch_LandscapeMapbook.mxd egerirkt

Control Point (Location is approximate)
Lower Stilling Basin
Upper Stilling Basin
Drainage Ditch
Culvert
18 Inch Culvert
24 Inch Culvert
Drury Gulch Drainage Channel
Silt Fence
Area 3 Slope
Area North of Rezanof Highway
LDG10 Slide Area
Lower Gulch Area
Fence

Notes:
Northern Extent - Area that lies northeast of Rezanof Highway
Photo Direction Arrows point in direction that photograph is to be taken.

N
0 100 200
FEET

AREA NORTH OF THE REZANOF HIGHWAY

U.S. Army Corps of Engineers Alaska District

DRURY GULCH
FORMERLY USED DEFENSE SITE
FUDS # F10AK100701
KODIAK ISLAND, ALASKA

FIGURE 4

This page intentionally blank

APPENDIX A
Inspection and Maintenance Forms

DRURY GULCH FUDS
POST-RA MONITORING INSPECTION FORM

Date: _____ **Time:** _____

Names: _____

Weather Conditions during Previous 24 Hours:	Current Weather Conditions
Storm (heavy rain)	Storm (heavy rain)
Rain (steady rain)	Rain (steady rain)
Showers (intermittent rain)	Showers (intermittent rain)
Overcast	Overcast
Clear (sunny)	Clear (sunny)
Other:	Other:

1. Access Road

List Condition of Access Road:

Was the gate locked?

Was surface water overflowing ditch?

Was surface water overflowing onto Rezanof Highway?

Notes:

Take Photograph of Access Road (A) and drainage ditch/Rezanof Highway if it is overflowing.

2. Upper Gulch Creek and Diversion

List General Appearance of Culvert Inlet

List General Appearance of Culvert Outlet

Was surface water overtopping the diversion spillway or otherwise flowing into the Upper Gulch Area?

What is the condition of Contol Point 60?

Notes:

DRURY GULCH FUDS
POST-RA MONITORING INSPECTION FORM

3. Site Fence and Access Gates

List General Site Appearance.

Condition of site perimeter fence.

Were the gate entrances locked?

Conditions of the gates.

Signs of vandalism.

Condition of the signs.

Notes:

Take Photograph of any damage to fence, gates, or signage.

4. Upper Gulch Area

List General Site Appearance.

List Condition of Upper Drainage Channel.

Condition of Control Points:

Condition of Cover:

- Cracks?
- Ponding?
- Signs of Vehical Traffic?
- Soil Saturated?
- Debris?
- Erosion?
- Animal tracks or burrowing?
- Vegetation
  - Density and vitality of grass
  - Estimate Growth rates and patterns
  - Any sign of stress (inadequate nutrients, drought, etc.)?
  - Any loss of vegetation?

Notes:

Take Photograph of Upper Gulch Area (B), Drainage Channel (C), and previous sediment deposition (D).

DRURY GULCH FUDS
POST-RA MONITORING INSPECTION FORM

5. Lower Gulch Area

List General Site Appearance:

List Condition of Upper Drainage Channel:

Condition of Two Control Points:

Condition of Cover:

- Cracks?
- Ponding?
- Signs of Vehical Traffic?
- Soil Saturated?
- Debris?
- Erosion?
- Animal tracks or burrowing?
- Vegetation
  - Density and vitality of grass
  - Estimate Growth rates and patterns
  - Any sign of stress (inadequate nutrients, drought, etc.)?
  - Any loss of vegetation?
- Any other Damage to Cover?

List Condition of Upper Stilling Basin:

- Depth of Water Present in Basin:
- Depth of Sediment Present in Basin:
- Is the Culvert Entrance Obstructed?

Notes:

Take Photograph of Lower Gulch Area (E), Upper Stilling Basin, (F), closeup of Upper Stilling Basin (G), and areas with previous sediment deposition (H) and (I).

6. Aviation Hill

List General Appearance of Hillside overlooking Drury Gulch.

Any signs of Erosion or Deposition?

DRURY GULCH FUDS
POST-RA MONITORING INSPECTION FORM

Condition of Vegetation.

Condition of the Aviation Hill Diversion.

Condition of the Rezanof Highway Ditch.

Condition of the check dams.

Condition of the catch basins.

Notes:

Take Photograph of an areas of hillside that appear unstable.

7. Area North of Rezanof Highway

List General Site Appearance:

List Condition of Drainage Channel:

Condition of Cover:

- Cracks?
- Ponding?
- Signs of Vehical Traffic?
- Soil Saturated?
- Debris?
- Erosion?
- Animal tracks or burrowing?
- Vegetation
  - Density and vitality of grass
  - Estimate Growth rates and patterns
  - Any sign of stress (inadequate nutrients, drought, etc.)?
  - Any loss of vegetation?
- Any other Damage to Cover?

List Condition of Lower Stilling Basin

- Depth of Water Present in Basin:
- Depth of Sediment Present in Basin:
- Estimate Flow through culvert:

Notes:

Take Photograph of Lower Stilling Basin (J) and Drainage Ditch (K).

DRURY GULCH FUDS
POST-RA MONITORING INSPECTION FORM

8. Lower Drainage Channel

List General Site Appearance:

List Condition of Drainage Channel:

Condition of Cover:

- Cracks?
- Ponding?
- Signs of Vehical Traffic?
- Soil Saturated?
- Debris?
- Erosion?
- Animal tracks or burrowing?
- Vegetation
  - Density and vitality of grass
  - Estimate Growth rates and patterns
  - Any sign of stress (inadequate nutrients, drought, etc.)?
  - Any loss of vegetation?
- Any other Damage to Cover?

Notes:

Take Photographs of Drainage Ditch Segments (L, M, N, O, and P) and any closeups of any damage noted.

DRURY GULCH FUDS
POST-STORM EVENT INSPECTION FORM

Date: _____ **Time:** _____

Inspection Performed By: _____

Storm Event Conditions

Storm Duration (days, hours)

Measurable Precipitation (inches)

Temperature Range (degrees F)

Details, by Date:

Precipitation Actual to Date: *% of normal*

Precipitation Normal to Date:

Current Weather Conditions:

1. SLOPE STABILITY

Were the slopes within the perimeter fence stable/intact? ☐ YES ☐ NO

Were the slopes within / adjacent to the LDG-10 slide area stable/intact? ☐ YES ☐ NO

List any sloughing/slumping observed: ☐ YES ☐ NO

Additional Notes:

2. STORMWATER SEDIMENT CONTROLS

Was the silt fencing in good condition - intact and upright? ☐ YES ☐ NO

Were the straw wattles in good condition? ☐ YES ☐ NO

Was sediment accumulated against a silt fence, in a Stilling Basin, or in a culvert? ☐ YES ☐ NO

If YES, where was sediment accumulated?

Rezanof Highway Drainage Ditch - Catch Basin #1 (northernmost / upstream basin):

Basin filled with sediment? ☐ YES ☐ NO

Approximate depth of sediment in basin: _____ inches

Rezanof Highway Drainage Ditch - Catch Basin #2:

Basin filled with sediment? ☐ YES ☐ NO

Approximate depth of sediment in basin: _____ inches

Rezanof Highway Drainage Ditch - Catch Basin #3:

Basin filled with sediment? ☐ YES ☐ NO

Approximate depth of sediment in basin: _____ inches

Rezanof Highway Drainage Ditch - Catch Basin #4 (southernmost / downstream basin):

Basin filled with sediment? ☐ YES ☐ NO

DRURY GULCH FUDS
POST-STORM EVENT INSPECTION FORM

Approximate depth of sediment in basin: _____ inches

Additional Notes:

DRURY GULCH FUDS
POST-STORM EVENT INSPECTION FORM

3. STORMWATER RUNOFF

Was runoff observed flowing into the gulch from the Rezanof Highway ditch?	☐ YES	☐ NO
Was runoff ovserved flowing into the USB from the Area 3 slope 18-inch culvert?	☐ YES	☐ NO
Was runoff flowing down the UDC to/discharging into the USB?	☐ YES	☐ NO
Was runoff flowing into the USB from the Area 3 slope 18-inch culvert inlet / lower Area 3 eastern stormwater drainage?	☐ YES	☐ NO
Was the Upper Stilling Basin at or near capacity (water level above top of 24-in Rezanof culvert inlet)?	☐ YES	☐ NO
Was runoff observed flowing into the LSB from the 24-inch Rezanof culvert?	☐ YES	☐ NO
Was runoff observed flowing into the LSB from the seep located along the northern side of the basin?	☐ YES	☐ NO
Height of water contained in LSB - inches below 24-inch culvert discharge flare end:	_____	inches
Was runoff observed flowing down the LDC?	☐ YES	☐ NO
If YES, did runoff reach the Firehouse Culvert?	☐ YES	☐ NO
Inspection of the drainage divide downslope / downstream of the Aviation Hill housing area:		
Volume of runoff flowing northwest to the Kodiak airport stormwater system:		
Volume of runoff flowing northeast to Drury Gulch:		
Rezanof Highway Drainage Ditch - Catch Basin #1 (northernmost / upstream basin):		
Basin filled with water / runoff?	☐ YES	☐ NO
Basin filled with water to what percent of capacity?	_____	%
Rezanof Highway Drainage Ditch - Catch Basin #2:		
Basin filled with water / runoff?	☐ YES	☐ NO
Basin filled with water to what percent of capacity?	_____	%
Rezanof Highway Drainage Ditch - Catch Basin #3:		
Basin filled with water / runoff?	☐ YES	☐ NO
Basin filled with water to what percent of capacity?	_____	%
Rezanof Highway Drainage Ditch - Catch Basin #4 (southernmost / downstream basin):		
Basin filled with water / runoff?	☐ YES	☐ NO
Basin filled with water to what percent of capacity?	_____	%
Rezanof Highway Drainage Ditch - Check Dam #1 (northernmost / upstream basin):		
Dam in good condition?	☐ YES	☐ NO
If not, describe condition:		
Water / Runoff flowing over / under check dam?	☐ YES	☐ NO
Rezanof Highway Drainage Ditch - Check Dam #2:		
Dam in good condition?	☐ YES	☐ NO
If not, describe condition:		
Water / Runoff flowing over / under check dam?	☐ YES	☐ NO
Rezanof Highway Drainage Ditch - Check Dam #3:		
Dam in good condition?	☐ YES	☐ NO
If not, describe condition:		
Water / Runoff flowing over / under check dam?	☐ YES	☐ NO
Rezanof Highway Drainage Ditch - Check Dam #4 (southernmost / downstream basin):		
Dam in good condition?	☐ YES	☐ NO
If not, describe condition:		
Water / Runoff flowing over / under check dam?	☐ YES	☐ NO

DRURY GULCH FUDS
POST-STORM EVENT INSPECTION FORM

Additional Notes:

4. EVIDENCE OF SEDIMENT TRANSPORT

Was evidence of sediment transport observed on the lower Rezanof ditch / upper Area 3 slope?	☐ YES	☐ NO
Was sediment / organic material accumulated against the 18-inch Area 3 slope culvert inlet (inlet screen / geofabric cover)	☐ YES	☐ NO
Was sediment / organic material accumulated against the 24-inch Rezanof culvert (inlet screen / geofabric cover)?	☐ YES	☐ NO

Additional Notes:

5. PONDING

Was ponded / pooled water observed throughout the gulch?	☐ YES	☐ NO
Was ponded water observed ~100 feet northeast of Station R?	☐ YES	☐ NO
Was ponded water observed in the vicinity of Station U?	☐ YES	☐ NO

Additional Notes:

DRURY GULCH FUDS
POST-STORM EVENT INSPECTION FORM

6. MAINTENANCE EVENTS COMPLETED DURING INSPECTION

7. ADDITIONAL OBSERVATIONS

DRURY GULCH FUDS
MAINTENANCE REQUEST & COMPLETION FORM

Complete one form for each Problem Requiring Maintenance.

BRIEF DESCRIPTION OF ISSUE

Person Requesting Maintenance (Name): _____

Date of Request: _____

Date Problem was Noted: _____

MAINTENANCE PERFORMED

Maintenance Performed By: _____

Date Maintenance Performed: _____

APPENDIX B
Sampling and Analysis Plan

U.S. Army Corps of Engineers
Alaska District

POST-REMEDIAL ACTION LONG-TERM MONITORING AND MAINTENANCE WORK PLAN

APPENDIX B
SAMPLING AND ANALYSIS PLAN

DRURY GULCH
KODIAK, ALASKA

FUDS NO. F10AK1007-01

DRAFT REVISION 1
NOVEMBER 2019

ATTACHMENT B-1
Field Sampling Plan

U.S. Army Corps of Engineers
Alaska District

POST-REMEDIAL ACTION LONG-TERM MONITORING AND MAINTENANCE WORK PLAN

ATTACHMENT B-1
FIELD SAMPLING PLAN

DRURY GULCH
KODIAK, ALASKA

FUDS NO. F10AK1007-01

DRAFT REVISION 1
NOVEMBER 2019

TABLE OF CONTENTS

SECTION **PAGE**

ACRONYMS AND ABBREVIATIONS B1-iii

1.0 INTRODUCTION B1-1-1

1.1 PROJECT ORGANIZATION AND RESPONSIBILITIES B1-1-1

1.2 REGULATORY SCREENING LEVELS B1-1-2

2.0 FIELD SAMPLING ACTIVITIES B1-2-1

2.1 GENERAL SAMPLING METHODOLOGY B1-2-1

2.2 SAMPLE NUMBERING SYSTEM B1-2-2

2.3 SAMPLE CONTAINER LABELING B1-2-3

2.4 CONTAINERIZED SOIL/SEDIMENT SAMPLING B1-2-4

2.5 DECONTAMINATION PROCEDURES B1-2-4

2.6 FIELD QC REQUIREMENTS B1-2-5

3.0 FIELD DOCUMENTATION B1-3-1

3.1 FIELD LOG BOOK AND SAMPLE FORMS B1-3-1

3.2 PHOTOGRAPHIC RECORDS B1-3-2

3.3 SAMPLE AND CHAIN-OF-CUSTODY RECORDS B1-3-3

3.4 SAMPLE LOCATIONS B1-3-4

4.0 SAMPLE PACKAGING AND SHIPPING B1-4-1

5.0 INVESTIGATION-DERIVED WASTE B1-5-1

6.0 NONCONFORMANCE/CORRECTIVE ACTIONS B1-6-1

7.0 REFERENCES B1-7-1

TABLES

Table 2-1 Summary of Sampling Activities B1-2-1

Table 2-2 Requirements for Soil/Sediment Samples B1-2-4

Table 5-1 Investigation-Derived Waste Disposal B1-5-1

EXHIBIT

Exhibit B1-1 Chain-of-Custody Form

(intentionally blank)

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
CoC	chain-of-custody
DoD	U.S. Department of Defense
ECC	Environmental Compliance Consultants, Inc.
FSP	field sampling plan
FRMD	FUDS Records Management Database
FUDS	Formerly Used Defense Site
IDW	investigation-derived waste
Jacobs	Jacobs Engineering Group Inc.
LL	low level
LTMM	long-term monitoring and maintenance
mg/kg	milligrams per kilogram
MS	matrix spike
MSD	matrix spike duplicate
PCB	polychlorinated biphenyl
PM	project manager
PPE	personal protective equipment
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RA	remedial action
RAO	remedial action objective
USACE	U.S. Army Corps of Engineers

(intentionally blank)

1.0 INTRODUCTION

This project field sampling plan (FSP) is to be used in combination with the field standard operating procedures (SOPs) (Attachment B-2) and quality assurance project plan (QAPP) (Attachment B-3), which all together comprise the sampling and analysis plan for the Drury Gulch post-remedial action (RA) monitoring and maintenance project on Kodiak Island, Alaska. The site is being addressed under the Formerly Used Defense Site (FUDS) program. These documents were developed in accordance with Alaska Department of Environmental Conservation (ADEC) 18 Alaska Administrative Code (AAC) 75 (ADEC 2018b) and 18 AAC 70 (ADEC 2018a).

The objective of the Drury Gulch FUDS long-term monitoring and maintenance (LTMM) project is to ensure that the selected remedial remedy, "Alternative 2C – Complete Cover, Limited Excavation, Disposal and Institutional Controls", remains protective of human health and the environment (U.S. Army Corps of Engineers [USACE] 2003). The purpose of the sampling and analysis plan, which includes this FSP, is to provide guidance pertaining to field sampling activities to support ongoing monitoring and maintenance activities.

This FSP provides detail about field sample collection methods and tools including:

- Sampling equipment, containers and preservation
- Quality assurance/quality control (QA/QC) requirements
- Documentation requirements
- Sample identification, handling, and shipping
- Disposal of investigation-derived waste (IDW)
- Decontamination procedures

1.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

The project will be executed by key and supporting personnel from Environmental Compliance Consultants, Inc. (ECC), Jacobs Engineering Group Inc. (Jacobs), and their associated subcontractors. Field personnel will reside on and mobilize from Kodiak Island, as well as from

Anchorage, Alaska. Technical support, including a professional land surveyor, analytical laboratory services, and certain maintenance activities may be provided by subcontractors.

Sampling personnel will be qualified environmental personnel as defined in 18 AAC 75.333 (ADEC 2018b). The key management and field personnel and associated contact information is provided in Table 1-2 of the LTMM plan, including the ECC and Jacobs project managers (PMs), health and safety manager, site safety and health officer, project chemist, field lead, and project consultant.

1.2 REGULATORY SCREENING LEVELS

Polychlorinated biphenyls (PCBs) are the only contaminant of concern which remain at the Drury Gulch FUDS that exceed site-specific and/or other applicable cleanup criteria, as identified in the 2003 DD (USACE 2003). The remedial action objectives (RAOs) applicable for this project are summarized in Section 3.2 of the LTMM plan. The RAO for surface soil is 1.0 milligrams per kilogram (mg/kg), the RAO for subsurface soil is 10.0 mg/kg, and the RAO for freshwater sediment is 0.031 mg/kg.

2.0 FIELD SAMPLING ACTIVITIES

As part of LTMM activities, field sampling of soil and/or sediment for PCB analysis may be required based on project needs. Sampling is likely to occur under two scenarios, which are presented in Table 2-1.

Table 2-1
Summary of Sampling Activities

Sample Types	Objectives
Containerized soil/sediment samples for waste characterization/disposal	Determine disposal pathway and methods for excavated or removed soil/sediment resulting from maintenance activities. Anticipate activities include removing deposited soil and dredging accumulated sediment from the drainage system.
Investigative samples of deposited or accumulated soil/sediment after remedy failure (e.g., PCB soil exposed after stormwater erosion)	Determine if PCB concentrations in deposited or accumulated soil or sediment exceed the project screening levels. Determine if PCB contamination is potentially migrating downgradient and/or offsite.

Note:
For definitions, refer to the Acronyms and Abbreviations section.

2.1 GENERAL SAMPLING METHODOLOGY

All samples shall be collected in accordance with the objectives, methods, and procedures presented in the LTMM plan, the field SOPs (Attachment B-2), the QAPP (Attachment B-3), and this FSP. Soil and sediment samples will be collected using the procedures described in JE-SOP-3000 *Collection of Soil Samples*, JE-SOP-5300 *Sediment Sampling*, and other relevant SOPs (Attachment B-2).

In general, the following methods and guidelines will be employed:

- Only new, clean, laboratory-provided sample containers will be used for sample collection.
- Prior to the collection of each sample, the sampler(s) will don new, clean nitrile gloves to avoid cross-contamination.
- Sample material will be placed in a Ziploc bag or decontaminated stainless-steel bowl and will be homogenized.
- All soil samples will be collected using clean, disposable sample spoons/scoops or clean, decontaminated stainless-steel spoons and placed in sample containers.

- Excess soil will be removed from the lip of the container using a clean paper towel and a laboratory-supplied lid will be used to seal the container.
- The sample collection date, time, analysis requested, preservation, place of collection, project name, and sampler initials will be placed on the prepared sampled label and chain-of-custody (CoC) form (Exhibit B1-1).
- Each sample will be assigned a unique identification number, as described in Section 2.2.
- Soil samples will be immediately placed in a cooler after sample collection and chilled with gel ice to between 0 and 6 degrees Celsius (°C). Upon return to the field office, samples will continue to be chilled or refrigerated at between 0 and 6 °C until packaged for shipping.
- Applicable sampling procedures, including dates, times, analytes, personnel, notes will be recorded in the field logbook in accordance with the procedures discussed in Section 3.1.
- Documentation of the soil sample will be kept in accordance with the procedures discussed in Section 3.3.
- Sample packaging and shipping procedures will be followed, as described in Section 4.0.
- Field duplicate and matrix spike (MS)/MS duplicate (MSD) samples will be designated on the CoC form for each sample shipment.
- The field sampler(s) will dispose of nitrile gloves and other disposable sample equipment after sample collection is completed at each sample location to minimize potential for cross-contamination, as described in Section 5.0.
- Samples will remain in the custody of the sampler until relinquished and transfer of custody is recorded.

2.2 SAMPLE NUMBERING SYSTEM

For the purposes of sample tracking, each sample submitted to the analytical laboratory will be given a unique, alphanumeric sample identification code corresponding to the sample numbering system described below. The sample identification codes indicate the year the sample was taken, the facility, the location of sample collection, the sequential sample number, and the matrix sampled.

Each digit of the identification code is described below:

- Digits 1 and 2: Calendar year – the year code will be “19”, “20”, etc.
- Digits 3 and 4: Project ID – Digits 3 and 4 will be the facility code, “DG” for the Drury Gulch site.

- Digits 5 and 6: Two letters, as described below, will designate the built-in location identifier based on the sub-area in which the sample was collected:
  - UG Upper Gulch
  - LG Lower Gulch
  - NR Area North of the Rezanof Highway
  - LD Lower Drainage Channel
- Digits 7 and 8: Two letters, as described below, will designate the sampled matrix:
  - SO Soil
  - SE Sediment
  - SQ QC samples
- Digits 9 and 10: Digits 7 and 8 will be a unique, sequential number, starting with "01".
- Field duplicates: Duplicate samples will be labeled sequentially to the primary sample to ensure that they are submitted blind to the laboratory. For example, primary sample 19DGSO07 would have a field duplicate sample 19DGSO08; primary and field duplicate pairings will be recorded in the field logbook but the laboratory will not know which samples are field duplicates.

2.3 SAMPLE CONTAINER LABELING

Each sample container will be labeled with the following information:

- Sample identification number
- Sample matrix
- Method of analysis
- Project name
- Name or initials of collector
- Date and time of collection
- Place of collection
- Preservation method

The analytical method for PCB analysis, along with the sample container, preservation, and hold time requirements are provided in Table 2-2.

Table 2-2
Requirements for Soil/Sediment Samples

Matrix	Analysis	Analytical Methods	Sample Containers	Preservative	Holding Time
Soil Sediment	PCBs	8082A (LL)	4 or 8 ounce amber glass, Teflon-lined screw caps	0 to 6 °C	365 Days

Note:
For definitions, refer to the Acronyms and Abbreviations section.

2.4 CONTAINERIZED SOIL/SEDIMENT SAMPLING

If soil or sediment is containerized, samples will be collected for determining waste characterization and disposal options. One composite soil/sediment sample will be collected for each waste container (e.g., Super Sack or drum) and will be analyzed for PCBs. Soil/sediment will be collected in such a way that representative sediments from all depths within the containers are collected. This may be accomplished using a coring device such as a hand auger, shovel, or other tool.

If a shovel is used to hand fill the Super Sacks or drums, subsamples of soil/sediment material will be collected directly from the shovel and placed in a mixing bowl or zipper top bag for homogenization. Alternatively, a hand auger may be used to collect soil/sediment already in a Super Sack by coring down in 0.5- to 1-foot intervals and collecting subsamples for later composite. Homogenized composite sample material will then be used to fill the sample container.

2.5 DECONTAMINATION PROCEDURES

Decontamination will be completed in accordance with the JE-SOP-2000 *Decontamination* (Attachment B-2). Disposable sampling equipment will be used whenever possible. Reusable sampling equipment that may directly or indirectly contact samples will be decontaminated prior to reuse. This may include shovels, buckets, coring devices, and instruments. Dry decontamination will be the preferred decontamination method and attempts will be made to avoid wet decontamination whenever possible. In the event that wet decontamination methods

are used, decontamination will take place over catch basins (e.g., wash tubs, buckets) to prevent the release of contaminants. Reusable sampling equipment used during the sample collection process will be thoroughly pre-cleaned before initial use, between use, and at the end of the field work in the following manner:

1. Scrub and rinse the equipment using a solution of potable water and laboratory-grade detergent (Liquinox or similar product).
2. Rinse the equipment with distilled or deionized water until free from suds.
3. Allow the equipment to air-dry.

2.6 FIELD QC REQUIREMENTS

Field QA/QC samples are designed to help identify potential sources of external sample contamination and to evaluate potential error introduced by sample collection and handling. QA/QC samples are labeled with QA/QC identification numbers and will be sent to the project laboratory with the other samples for analysis. The following QA/QC samples will be collected and analyzed to assess cross-contamination of samples and precision, accuracy, and comparability of data in accordance with the U.S. Department of Defense (DoD) Quality Systems Manual, Version 5.3 (DoD 2019):

- **Duplicate Samples**: Duplicate samples are samples collected to assess precision of sampling and analysis. Duplicate samples will be collected at the same time and for the same parameters as the investigative (primary) samples. The primary sample containers for a particular parameter or set of parameters will be filled first, then the duplicate sample containers for the same parameters, and so on until all necessary sample containers for both the primary samples and the duplicate samples have been filled. The duplicate samples will be handled in the same manner as the primary samples. The duplicate samples will be assigned a QA/QC identification number that is blind to the laboratory, preserved according to the QAPP, and shipped to the laboratory. Field duplicate samples will be collected at a rate of one every 10 samples, or daily, in accordance with DoD and ADEC guidance (DoD 2019; ADEC 2019).

- **MS and MSD**: MS/MSD samples are used to assess the potential for matrix effects. MS/MSD sample sets will be collected from locations that are anticipated to exhibit lower concentrations of contaminates of concern. Samples requested for MS/MSD analysis will be identified on both the CoC form and on the sample containers. MS/MSD samples will have the same sample ID as the associated primary sample. It may be necessary to collect three times the volume of soil as a primary sample when MS/MSD samples are requested. MS/MSD samples will be analyzed at an approximate frequency of one per every 20 field samples (5 percent), or at minimum of one per batch per matrix in accordance with DoD and ADEC guidance (DoD 2019; ADEC 2019).
- **Temperature Blank:** A laboratory-provided temperature blank will be included with each cooler to document sample receipt temperature. The temperature blank is to remain in the sample cooler from the time the sample cooler is used for containing samples until the cooler is delivered to the laboratory.
- **Equipment Blank Samples:** Equipment blank samples are aqueous samples of ultra-pure water that is poured over decontaminated sampling equipment and used to assess the adequacy of decontamination procedures. It is anticipated that disposable sampling equipment will be used; however, in the event reusable equipment is utilized requiring decontamination, an equipment blank will be collected in accordance with the QAPP. Equipment blank samples only need to be collected from decontaminated sample equipment that directly contacts the sampled soil/sediment. If necessary, equipment blank samples will be collected and analyzed at a frequency of one per 20 samples per specific sampling task or otherwise every five days of sampling.

3.0 FIELD DOCUMENTATION

Effective documentation of field activities is paramount to producing defensible data. Field documentation will be recorded and managed in accordance with JE-SOP-7000 *Field Documentation* and JE-SOP-7001 *Project File Management* (Attachment B-2). Project-specific field documentation requirements include completing the following:

- Field situation reports
- Post-RA monitoring inspection forms
- Post-storm event inspection forms
- Inspection photographic logs
- Field notebooks
- Survey location and elevation data

The types of documentation required, and methods and criteria for recording the data, are further described in Sections 3.1 through 3.4.

3.1 FIELD LOG BOOK AND SAMPLE FORMS

Sampling activities will be properly documented to facilitate a timely and accurate reconstruction of events in the field. All information pertinent to the investigation will be recorded in a bound logbook with consecutively numbered pages. All entries in field logbooks will be made in waterproof ink and corrections will consist of line-out deletions that are initialed and dated.

A single field logbook will be maintained for sampling activities and will be bound with pre-numbered pages and contain the following information on the cover:

- Sampler(s) names
- Book number
- Drury Gulch Post-RA Monitoring and Maintenance Sampling Logbook
- Contract No.: W911KB-14-D-0017
- Start and end dates

Standard entries shall be recorded daily and shall include at a minimum:

- Project name, site ID, and client
- Date
- Weather conditions and temperature
- Site conditions and other salient observations
- Level of personal protective equipment (PPE)
- Full names of onsite personnel and visitors with their affiliation and project title (e.g., field team leader, sampler)
- Daily objectives
- Location of work area and sampling points (sketches when appropriate)
- Work start/stop times
- Field observations and comments in chronological order of events
- Sample identification numbers and descriptions
- Sample shipping information (date, time, destination, location, CoC number)
- Type of field instrumentation (model number and serial number)
- Any deviations from the work plan
- Any other pertinent and valuable notes or observations

3.2 PHOTOGRAPHIC RECORDS

All photographs associated with sampling activities will be recorded in the field log book or a field photographic log. If appropriate, an item that indicates scale will be included in photographs. Information that must be included with each photograph includes:

- Photographer's name
- Digital photograph number
- Date and time
- Photo location
- Direction of photograph
- Detailed description of photograph, including sampling point, sample name, depth, and any other relevant identifying information

3.3 SAMPLE AND CHAIN-OF-CUSTODY RECORDS

Sample collection information will be documented in the project logbook and all samples will be recorded on a field CoC form (Exhibit B1-1). Field personnel will maintain CoC records for all field and field QC samples. The CoC form will accompany each sample shipment container (e.g., each cooler) from the field to the laboratory to establish the documentation needed to trace sample possession. The following minimum information concerning the sample shall be documented on the CoC form.

- Project name and laboratory project identification number
- Site name
- Client name
- USACE North Pacific Division Laboratory number (requested from USACE before sample collection and will be assigned based on the sample year)
- Source of sample (including name, location, sample type, and matrix)
- Unique sample ID
- Date and time of sample collection
- Preservative used
- Analyses requested
- Name of collector(s)
- Pertinent field data (e.g., observation of significant contamination, color, temperature, pH)
- Serial numbers of custody seals and transportation cases (if used)
- Cooler name, custody transfer signatures, and dates and times of sample transfer from the field to the transporters and finally to the laboratory or laboratories
- Bill of lading or transporter tracking number (if applicable)

Upon arrival at the project laboratory, the CoC form will be completed with:

- Name of the person receiving the container and date of arrival or receipt of samples
- Name of the person opening the shipping container, along with date, time, temperature of shipping container, seal number, and condition of shipping container
- Any remarks regarding sample condition upon arrival

Sample custody will remain intact until the samples are received by the project laboratory. A sample is defined as being under a person's custody if any of the following conditions exist:

- It is in their physical possession
- It is in their view after being in their physical possession
- It was in their possession, and they locked it up or otherwise sealed it so that tampering would be evident
- It is in a designated secure area

Any or all of the above are documented as such in the field notebook, CoC record, or other field documentation.

3.4 SAMPLE LOCATIONS

Sample locations will be surveyed using either a mapping-grade, differential global positioning system or real-time kinetic system (e.g., Trimble GeoXH6000, Leica System 1200, or equivalent). Location surveying will be conducted in accordance with Section 5 (Survey) of the Manual for Electronic Deliverables and JE-SOP-1000 *Global Positioning System Surveying* and JE-SOP-1001 *Differential Global Positioning System Surveying* (Attachment B-2).

Sample location data will be collected to a minimum of 3.3 feet (1 meter) horizontal accuracy and 0.5 foot (0.15 meter) vertical accuracy and meet the requirements specified in the Manual for Electronic Deliverables. The horizontal control will be referenced to the World Geodetic System 1984 (WGS 84) latitude/longitude in decimal degrees, and the vertical control will be reference to the North American Vertical Datum 1988 (NAVD1988).

4.0 SAMPLE PACKAGING AND SHIPPING

Samples will be packaged, shipped, and stored in a manner that minimizes potential contamination, ensures sample integrity, and in accordance with the JE-SOP-5500 *Sample Packing*. All samples will be stored in coolers with gel ice packs or in properly monitored refrigerators from immediately after collection until analysis at the project laboratory.

Prior to shipment, samples will be properly packaged on ice between 0 and 6 °C within insulated sample coolers. A separate signed custody record will be enclosed within and secured to the inside top of each sample cooler. Protective packaging will be place around sample bottles to minimize the risk of breakage during transport, prevent cross-contamination in the event of breakage, and to ensure that the samples do not freeze. Shipping containers will then be sealed and secured with strapping tape and custody seals for shipment to the laboratory. All shipping containers will be secured with custody seals for transportation to the laboratory. The exterior of sample coolers will be covered with the appropriate shipping labels, such as "Refrigerate-Do Not Freeze", "Keep Upright", Up Arrows, and/or "Fragile".

The laboratory will be notified by phone and/or email when a sample shipment has been shipped and they will be provided with the following information:

- Air carrier waybill number
- Flight number
- Approximate arrival date/time
- Number of coolers shipped
- A copy of the CoC form

Depending on the laboratory location, samples will be shipped to the project laboratory by Alaska Air Cargo GoldStreak, Ravn Air Cargo Rush, FedEx Overnight, or a similar express air cargo service. If necessary, a laboratory representative will pick up the samples from the appropriate cargo terminal. In addition, a copy of the CoC form will be sent by the laboratory to USACE within 24 hours of sample receipt: receipt.cooler@usace.army.mil. Sample

collection and shipment will be coordinated with the receiving laboratory to ensure that staff is available to process the samples.

5.0 INVESTIGATION-DERIVED WASTE

IDW management will be accomplished by appropriately containing, collecting, packaging, characterizing, and disposing of the waste. Anticipated types of IDW may include PPE and disposable sampling equipment and decontamination water (if wet methods are used).

IDW will be managed in accordance with DG-SOP-2100 *Waste Management Procedure*. PPE and disposable equipment will be bagged and transported to the Kodiak Island Borough Landfill. Generation of decontamination water will be minimized by using dry decontamination methods, where appropriate, and by using disposable sampling equipment when possible.

Table 5-1
Investigation-Derived Waste Disposal

Waste Type	Disposal Location
Disposable PPE	Kodiak Island Borough Landfill
Disposable Sampling Equipment	Kodiak Island Borough Landfill
Decontamination Water	Refer to DG-SOP-2100 *Waste Management Procedure*

Note:
For definitions, refer to the Acronyms and Abbreviations section.

(intentionally blank)

6.0 NONCONFORMANCE/CORRECTIVE ACTIONS

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-limit QC performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, and data assessment. Corrective actions proposed and implemented should be documented in the field log book and in the daily QA reports. Corrective action should only be implemented after approval by the PM or his or her designee.

The USACE PM will be notified of significant issues that potentially impact the achievement of the project objectives. In the event that changes to this FSP are made, ADEC will be notified.

(intentionally blank)

7.0 REFERENCES

ADEC (Alaska Department of Environmental Conservation). 2018a (April). *Water Quality Standards*. Division of Water. 18 AAC 70.

ADEC. 2018b (27 October). *Oil and Other Hazardous Substances Pollution Control*. Division of Spill Prevention and Response, Contaminated Sites Program. 18 AAC 75.

ADEC. 2019 (22 October). *Field Sampling Guidance*. Final. Division of Spill Prevention and Response, Contaminated Sites Program.

DoD (U.S. Department of Defense). 2019 (May). *Department of Defense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories*. Version 5.3.

USACE (U.S. Army Corps of Engineers). 2003 (July). *Clean-up Decision Document, Drury Gulch, Kodiak, Alaska*. Prepared by Jacobs Engineering Group Inc. FRMD No. F10AK100701_05.09_0500_a 200-1e.

(intentionally blank)

Exhibit B1-1
Chain-of-Custody Form

Chain-of-Custody Report

Collection Organization: ECC/Jacobs | **Chain-of-Custody:** | **Cooler ID:** | **NPDL Number:** TBD

Project Number: | **Laboratory:** | **Bill To:** JEGA | **Report To:** JEGA

COC Sample ID	Loc ID	Collection Date	Collection Time	Sampler	Quantity	Container Type	Volume	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes:

Special Instructions:

Relinquish By: _____ Signature/Printed Name _____ Date/Time

Relinquish By: _____ Signature/Printed Name _____ Date/Time

Received By: _____ Signature/Printed Name _____ Date/Time

Received By: _____ Signature/Printed Name _____ Date/Time

ATTACHMENT B-2
Standard Operating Procedures

U.S. Army Corps of Engineers
Alaska District

POST-REMEDIAL ACTION LONG-TERM MONITORING AND MAINTENANCE WORK PLAN

ATTACHMENT B-2
STANDARD OPERATING PROCEDURES

DRURY GULCH
KODIAK, ALASKA

FUDS NO. F10AK1007-01

DRAFT REVISION 1
NOVEMBER 2019

Waste Management Procedure

Document No: DG-SOP-2100	Page: 1 of 3
Effective Date: 23 October 2019	Rev. 0

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
1.1. Waste Characterization 1
1.2. Waste Transportation and Disposal/Treatment 2
1.3. Waste Tracking 3
2.0 HEALTH AND SAFETY 3

ATTACHMENTS

Attachment 1 Waste Tracking Form
Attachment 2 ADEC Transport, Treatment, & Disposal Approval Form for Contaminated Media

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) addresses management of anticipated waste streams generated by maintenance and sampling activities, which may produce soil, wastewater, and/or general garbage containing concentrations of polychlorinated biphenyls (PCBs) greater than the site cleanup levels. The following sections discuss waste characterization, accumulation, temporary storage, and transportation/disposal/treatment.

1.1. Waste Characterization

Similar waste streams will be consolidated and disposed of or treated at an appropriate treatment, storage, and disposal facility (TSDF). Waste transport and disposal/treatment will comply with applicable local, state, and federal regulations. Toxic Substances Control Act (TSCA)-regulated waste may be encountered during field activities; generated waste will be assessed according to TSCA criteria. TSCA states that PCB-contaminated media with concentrations greater than or equal to 50 parts per million (ppm) shall be transported using a Uniform Hazardous Waste Manifest and be treated or disposed of at a Subtitle C TSDF. PCB-contaminated media with concentrations less than 50 ppm are transported using a nonhazardous waste manifest and treated or disposed of at a Subtitle D TSDF. See Table 2 for a list of potential TSDFs.

Waste samples should be collected as total PCBs for the proper waste characterization. The quantity and frequency of waste characterization samples should be determined by type and quantity of waste generated. In general, the TSDF requires one sample per 100 tons of waste; however, the field crew should assess the potential of varying concentrations with the waste stream(s) and adjust the sampling frequency accordingly.

Initially waste will be staged at the maintenance or sampling location in appropriate containers and labeled as shown in Table 1. After initial staging, waste destined for offsite disposal will be packaged and delivered to facility's temporary waste storage area, pending offsite disposal. Investigation personnel will remove and dispose of general garbage.

Table 1
Waste Labeling

Information	Description
Generator	USACE
Type of waste	PCB-containing waste, pending analysis
Container number	2019DG-(Location ID)-(Number of Container)
Product/phase description	Contaminated soil, wastewater, etc.
Contract and Task Order numbers	W911KB-17-D-0017, TO 0117
Project manager/site manager name and contact number	Project and site manager name and phone number
Starting fill date	mm/dd/yyyy
Container weight	(If a scale is available, otherwise estimate)

1.2. Waste Transportation and Disposal/Treatment

Final disposal of general garbage will occur at an appropriate (local) municipal waste receiving facility, and final disposal of the other waste streams will occur at an appropriate offsite TSDF. Potential TSDFs are listed in Table 2.

Table 2
Potential TSDFs

Type	Name	Agency / ID Number	Type of Waste
Class I Municipal Landfill	Kodiak Island Borough Landfill	ADEC / SW1A005-23	General garbage
Subtitle D TSDF	WM Columbia Ridge Arlington, Oregon	EPA / OR DEQ 987 173 457	PCB-contaminated media (PCBs < 50 ppm)
Subtitle C TSDF	CWMNW Arlington, Oregon	EPA / OR DEQ 089 452 353	PCB-contaminated media (PCBs ≥ 50 ppm)
Liquid Waste TSDF	WM Columbia Ridge, Arlington, Oregon	EPA / OR DEQ 987 173 457	PCB-contaminated water

Notes:
CWMNW – Chemical Waste Management of the Northwest
EPA – U.S. Environmental Protection Agency
OR DEQ – Oregon Department of Environmental Quality
WM – Waste Management

Proper documentation will be generated for each waste stream prior to shipment to the final TSDF and will include information required to comply with federal, state, and local regulations for labeling, transport, shipment, and disposal/treatment of waste from the site. This will include bills of lading and hazardous or nonhazardous manifests, if applicable. Manifests will be signed by an U.S. Army Corps of Engineers (USACE) representative. In addition, the Alaska Department of Environmental Conservation (ADEC) requires a *Transport, Treatment, & Disposal Approval Form for Contaminated Media* to be completed and signed prior to removing contaminated media for known Contaminated Sites (Attachment 2). Certificates of disposal/treatment will be generated after deposit of waste streams at the final TSDF, with the exception of general garbage.

1.3. Waste Tracking

Waste will be tracked from the point of origin to the receiving TSDF using the waste tracking form (Attachment 1).

2.0 HEALTH AND SAFETY

Procedures for working with potentially hazardous materials as well as the relevant Safety Data Sheets (SDSs) for each chemical that will be used at the site will be available to all site personnel. Personnel using this SOP must be trained by their respective employer on the information contained in the SDSs, engineering controls, and the use of personal protective equipment.

ATTACHMENT 1
Waste Tracking Form

Waste Tracking Log

Site ID	Generation Date	Initials	Waste Container (ex. Supersack, Drum, etc)	Contents	Volume	Units	Estimated Weight (lbs)	Date Staged	Staging area	Tracking #	Comments	Date Transferred	Transporter	TSDF	Manifest No.

ATTACHMENT 2
ADEC Transport, Treatment, & Disposal Approval Form for Contaminated Media

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites and Prevention and Emergency Response Programs

Transport, Treatment, & Disposal Approval Form for Contaminated Media

DEC HAZARD/SPILL ID #	NAME OF SPILL OR CONTAMINATED SITE	
SITE OR SPILL LOCATION		
CURRENT LOCATION AND TYPE OF CONTAMINATED MEDIA	**SOURCE OF THE CONTAMINATION**	
COMPOUNDS OF CONCERN	**ESTIMATED VOLUME**	**DATE(S) GENERATED**
POST TREATMENT ANALYSIS REQUIRED *(such as GRO, DRO, RRO, BTEX, and/or Chlorinated Solvents)*		
COMMENTS		

Facility Accepting the Contaminated Media

NAME OF THE FACILITY	PHYSICAL ADDRESS/PHONE NUMBER

Responsible Party and Contractor Information

BUSINESS/NAME	ADDRESS/PHONE NUMBER

Name of the Person Requesting Approval (printed) _____ Title/Association _____

Signature _____ Date _____ Phone Number _____

----------DEC USE ONLY----------

Based on the information provided, ADEC approves transport of the above-described media for treatment in accordance with the approved facility operations plan. The Responsible Party or their consultant must submit to the DEC Project Manager a copy of weight/volume receipts of the loads transported to the facility and a post treatment analytical report. If the media is contaminated soil, it shall be transported as a covered load in compliance with 18 AAC 60.015.

DEC Project Manager Name (printed) _____ Project Manager Title _____

Signature _____ Date _____ Phone Number _____

Global Positioning System Surveying

Document No:	Page:
JE-SOP-1000	1 of 14
Effective Date:	Rev.
04 Mar 2016	4.1

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
1.1. RTK-GPS Meets the MED Requirements for TOC Elevations 3
2.0 DEFINITIONS AND ACRONYMS 2
3.0 EQUIPMENT 5
3.1. Mapping-grade GPS 5
3.2. RTK-GPS 5
3.3. Static GPS 5
4.0 PROCEDURES 5
4.1. Ellipsoids, Coordinate Systems, Geoids, and Conversion 5
4.2. Mapping-grade GPS 6
4.3. RTK-GPS 7
4.4. Static GPS 9
4.5. Data Collection and Management 10
4.6. Control Points 11
4.7. Quality Assurance 12
4.8. Logbook Overview 13
5.0 SURVEY DATA REPORT OUTLINE 13
6.0 REFERENCES 14

ATTACHMENTS

Attachment 1. Default Survey Requirements
Attachment 2. Alaska Universal Transverse Mercator Zone Map
Attachment 3. Alaska State Plane Zones NAD83
Attachment 4. Code List Example
Attachment 5. Survey Results Table Example
Attachment 6. Survey Precision Table Example

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure describes the procedures for GPS land surveying:

- Differential GPS or PPC-GPS surveying. This method encompasses single-frequency and dual-frequency data used alone or with SBAS or WAAS to provide raw precision and accuracy of ± 1.5 m (1 SD) to as good as ±0.35 m (1 SD), which may be improved through post-processing to ± 0.5 m (1 SD) to as good as ±0.05 m (1 SD).
- RTK-GPS surveying. This method collects dual-frequency data and uses a real-time correction signal from a nearby control point to provide real-time coordinates with precision and local accuracy as good as ± 1 cm (1 SD). High-quality data meet the requirements of the MED (USACE 2011) for determining top-of-casing elevations (discussed in Attachment 1).
- Static GPS surveying. This method collects dual-frequency data for at least 15 minutes to more than two hours for post-processing to obtain coordinates with precision and accuracy as good as ± 1 cm (1 SD).

Information to be recorded in the field logbook is formatted in *italics*.

This SOP defines procedures that will result in defensible survey data meeting a range of data quality objectives. These procedures may be varied or changed as required by site conditions, equipment

limitations, or other factors, but any variances need to be documented in the field notes. Selection of specific procedures will be guided by data quality objectives, which are described in project contract documents and approved work plans. Other useful guidance documents include:

- *User Guidelines for Single Base Real Time GNSS Positioning* (NOAA 2011).

In the absence of project-specific requirements, the requirements of the MED may be presumed to apply. See the Spatial Reference and Survey Quality tables in Attachment 1.

2.0 DEFINITIONS AND ACRONYMS

accuracy	The degree to which a measurement agrees with the true value of the quantity being measured. For GPS surveying, accuracy can be much worse than precision if uncorrected systematic errors are present. In the absence of uncorrected errors, accuracy is assumed to be the same as precision; accuracy cannot be evaluated explicitly when the “true” value is another GPS measurement of similar precision.
ARP	Antenna reference point. This is the base of the fitting by which the antenna is attached to the rover pole or base-station tripod.
AVERAGE	Microsoft Excel average function
cm	centimeter(s)
CORS	Continuously Operating Reference Station. These permanent stations broadcast correction signals that contain the known coordinates of the reference station along with the instantaneous correction needed for the apparent position of the reference station.
Base Station	A temporary station set up over a control point that collects dual-frequency data and broadcasts the known coordinates of the control point along with the instantaneous correction needed for the apparent position of the control point.
Control Point	A location whose coordinates are known. Control points may range from permanent monuments with published coordinates to temporary markers with locations determined by static GPS, RTK-GPS, or other methods.
COUNT	Microsoft Excel count function
datum	Reference framework for coordinates. Horizontal coordinates have an ellipsoid as their datum, whereas vertical coordinates have either an ellipsoid or a geoid as their datum.
ellipsoid	A flattened oblate spheroid that approximates mean sea level. Geographical coordinates (longitude and latitude) are defined with respect to the ellipsoid.
epoch	A reference point in time. To account for tectonic plate motions, surveyed points need to be transformed from their epochs of measurement to an agreed upon reference epoch.
ERPIMS	Environmental Resources Program. Information Management System (U.S. Air Force system for validation and management of data from environmental projects at all Air Force bases)
ft	foot or feet
GCS	geographic coordinate system or horizontal datum (e.g., NAD83, WGS83, etc).
GdHt	Geoid height: the height of the geoid above the ellipsoid (GdHt > 0) or below the ellipsoid (GdHt < 0). at a specified location.
geoid	A detailed representation of mean sea level that accounts for local variations in gravity. The difference between the ellipsoid and the geoid can be 20 meters or more in some parts of Alaska. Geoid heights are usually referred to as orthometric heights. NGS geoids in use for Alaska include GEOID06, GEOID09, GEOID12A, and

	GEOID12B. All are equivalent for environmental mapping and are considered to provide elevations relative to the NAVD88 datum. Ensure that the GCS of the GEOID matches the GCS of the data; there are separate geoids for NAD83 and WGS84.
GPS	Global Position System. A network of satellites with known orbits whose broadcasts of precise time information allow a receiver to calculate its position on (or above) the surface of the earth.
GRS80	The Geodetic Reference System 1980 was adopted as the first description of WGS84. Although WGS84 has undergone minor refinements over time, for the surveying described in this SOP, these two ellipsoids are functionally identical.
H	Height: the ellipsoid or orthometric height (as indicated by the subscript) at a specified location.
HP	horizontal precision
ITRF or IGS	International Terrestrial Reference Frame. In this SOP, the last two digits are the year of development. ITRF realizations are developed by the International GPS Service and are identified on OPUS datasheets as IGS coordinates.
m	meter(s)
MED	Manual for Electronic Deliverables (USACE 2011).
NAD27	The North American Datum 1927 is an older horizontal datum; NAD27 coordinates may differ significantly from NAD83 coordinates and need to be converted before use.
NAD83	The North American Datum 1983 in conjunction with the GRS80 ellipsoid describes the center of the earth and the ellipsoid that underlies most of the State Plane local grid systems. Because NAD83 is affixed to the stable North American tectonic plate, NAD83 coordinates in Alaska will vary over time as a function of the local tectonic velocity relative to the North American plate. Current NGS data sheets for CORS stations and benchmarks use the NAD83 (2011) realization and list coordinates as of 1 Jan 2010. Differences between NAD83 and WGS84 can be 1.3 m or more in Alaska and must be taken into account for all surveying described in this SOP. For example, at Eielson AFB, UTM 6N NAD83 coordinates can be transformed to UTM 6N WGS84 coordinates by subtracting 1.234 m from eastings and adding 0.213 m to northings. Other locations will require different offsets, which can be obtained from HTDP (NOAA 2014) or via the WGS_1984_(ITRF00)_To_NAD_1983 transformation in ArcMap. The ArcMap transformation is simplified and does not account for the epoch of the survey data but is adequate for most environmental mapping. For Eielson AFB, the difference between the HTDP and ArcMap transformations for NAD83(2011):2010.0 coordinates is only 2.1 cm.
NAVD88	The North American Vertical Datum 1988 is the accepted mean sea level representation for North America. For environmental mapping, geoid heights provided by GEOID06, GEIOD09, GEOID12A, and GEOID12B are all considered equivalent to NAVD88. New work should use the most current geoid available for the post-processing platform.
NGVD29	The National Geodetic Vertical Datum 1929 may be used by older survey data.
NGS	National Geodetic Survey (http://www.ngs.noaa.gov/).
OPUS	Online Positioning User Service (http://www.ngs.noaa.gov/OPUS/). OPUS post-processes static GPS data using nearby CORS data to provide coordinates with precision and accuracy of ± 1 cm (1 SD). OPUS provides coordinates using the NAD83 GCS. Specifically, OPUS provides lat/long and UTM coordinates in NAD83(2011)
PL	prediction limit

PPC	Post-processed correction. Differential (PPC) GPS uses observations from one or more nearby CORS stations to adjust survey data after collection.
precision	Precision is the reproducibility of a measurement, e.g., the agreement among multiple independent surveys of the same point. Although a measurement may be precise, it may still be biased and therefore inaccurate.
RTK	Real-time kinematic. RTK-GPS surveying uses the correction signal from a nearby CORS or base station to find the precise position of the rover. RTK-GPS assumes that the same correction is valid at the position of the rover.
RMS	root mean square (comparable in magnitude to 1 SD)
rover	A mobile dual-frequency GPS receiver that also monitors the correction signal for RTK-GPS.
SBAS	Satellite-Based Augmentation System
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment is the set of standards adopted by the Department of Defense for installation geospatial data (http://www.sdsfieonline.org/).
SD	Standard deviation. The term is used loosely in this SOP, without distinction between sample versus population standard deviations.
SDEV.S	Microsoft Excel sample standard deviation function
SOP	standard operating procedure
SQRT	Microsoft Excel square root function
static	A fixed dual-frequency GPS receiver records raw data for later post-processing.
T.INV	Microsoft Excel one-sided t-statistic function
TOC	top of casing
tribrach	For the base station, the tribrach is attached to the roughly leveled tripod. As its name implies, it has three arms, each of which has a fine adjustment for precise leveling. It also includes a right-angle sight for precise positioning over a control point. The GPS antenna screws onto a pillar, which is clamped into the top of the tribrach
UTM	Universal Transverse Mercator. The globe is divided into a series of UTM projections identified by zone number and position north or south of the equator. Within each zone, coordinates are described by easting and northings in feet. UTM north matches geographical north only at the central meridian of each zone.
VP	vertical precision
WAAS	Wide Area Augmentation System
WGS84	The World Geodetic System 1984 describes the center of the earth, the ellipsoid used by GPS measurements, and the origin for the geographical coordinates (horizontal datum). Unlike NAD83, which is affixed to the North American plate, WGS84 is defined relative to the constellation of GPS satellites in orbit around the earth. Reflecting the motion of the North American plate to the south-southwest in this inertial frame of reference, WGS84 coordinates at Eielson AFB are changing at the rate of 2.5 cm/yr. The system is periodically updated to reflect actual tectonic motions and refinements in the measured geometry of the earth. For surveying described in this SOP, WGS84 is functionally equivalent to ITRF. Common versions include WGS84(G1150)/ITRF00 and WGS84 (G1674)/ITRF08/IGS08, and geometric variations are on the order of centimeters or less. Given the rate of plate motions, however, transformation of coordinates to a reference epoch is essential in order to achieve submeter comparability, See NAD83 for a discussion of coordinate transformation between WGS84 and NAD93.

3.0 EQUIPMENT

3.1. Differential GPS

Magellan® Mobile Mapper™, Trimble® GeoXH6000, Leica Viva Uno are common equipment systems. Equipment needs include:

- Logbook and camera for field documentation.
- Single-frequency GPS receiver to collect raw data at locations to be mapped.
- A second single-frequency GPS receiver to collect raw data at a control point, if no there is no CORS within range (approximately 350 miles).
- Software for post processing.

3.2. RTK-GPS

Leica System 1200, Leica Viva, and Trimble R6/R7 are common equipment systems. Equipment needs include:

- Logbook and camera for field documentation.
- Correction signal. One of the following is needed:
    - Correction signal from a CORS or similar service.
    - Base station over a known location. A base station typically consists of a tripod, tribrach, dual-frequency GPS antenna, GPS controller, and correction-signal transmitter.
- Correction-signal repeater station (optional). A repeater is needed when line of sight to the CORS or base station is obstructed.
- Rover. A rover typically consists of a pole-mounted dual-frequency GPS antenna with correction-signal receiver, and GPS controller.

3.3. Static GPS

The RTK-GPS base station may be configured to collect static GPS data simultaneously as it broadcasts the correction signal. At a minimum, the needed equipment includes:

- Logbook and camera for field documentation.
- Dual-frequency GPS receiver to collect raw data.

4.0 PROCEDURES

4.1. Ellipsoids, Horizontal Datums, Coordinate Systems, Geoids, and Conversion

- Ellipsoids:
    - WGS84. The native coordinate system of GPS measurements uses the WGS84 ellipsoid, which has undergone minor refinements over the years.
    - GRS80. NAD83 coordinates are based on the GRS80 ellipsoid. This ellipsoid was the predecessor of the WGS84 ellipsoid and is functionally equivalent with respect to the surveying discussed in this SOP.
    - Clarke 1866. This ellipsoid underlies NAD27 coordinates.
- Horizontal Datums
    - WGS84 (and ITRF). The WGS84 datum is an inertial frame of reference, defined with respect to the whole earth. Plate motions cause all coordinates to evolve with time. For example, Eielson AFB is moving south-southwest at 2.5 cm/yr in this datum.

- NAD83 This datum is affixed to the North American plate, which minimizes the rate of coordinate change over time. For example, Eielson AFB is moving southeast at 0.3 cm/yr in this datum. Because OPUS results and NOAA data sheets use this datum, it is the datum of choice for most projects.
- NAD27. This datum maybe encountered for older data. Because differences may be large, such coordinates need to be converted before use. Conversion may not be accurate, however, and tectonic motions may have displaced points since they were surveyed.

- Coordinate Systems:
  - Geographic coordinate systems (e.g., longitude/latitude) describe locations on the spheroidal surface of the ellipsoid. There are no distortions, but the surface is not flat.
  - Projected (also known as local) coordinate systems map portions of the spheroidal surface onto a series of flat planes, and points within those planes are described by Cartesian eastings and northings. UTM and State Plane are common projected coordinate systems. UTM zones for Alaska are depicted in Attachment 2, and State Plane zones for Alaska are depicted in Attachment 3. Worldwide UTM zones may be found at http://www.dmap.co.uk/utmworld.htm.
- Geoids (also known as vertical datums):
  - The current representation of mean sea level for the United States is GEOID12B. Previous versions include GEOID03 (contiguous states only), Geoid06 (Alaska only), and GEOID09 (GEOID03 and GEOID06 combined). All are functionally equivalent to NAVD88 for surveying described in this SOP. GEOID12A and GEOID12B are identical for Alaska.
  - Older survey data may use NGVD29.
  - When attempting to use reported elevations from existing survey data or published monuments, it is important to understand the underlying control on those elevations. Height errors are common, and heights among different surveys rarely agree with sufficient accuracy to be useful for water-table contouring.
- Conversion
  - Conversion from one ellipsoid to another, from one local coordinate system to another, or from ellipsoid heights to orthometric heights are complex non-linear problems that require specialized software. Most conversions are handled by the equipment manufacturer's software (e.g., Leica Geo Office). Basic conversions are also available with Corpscon 6 (http://www.agc.army.mil/Missions/Corpscon.aspx), NADCON (http://www.ngs.noaa.gov/TOOLS/Nadcon/Nadcon.shtml), and VERTCON (http://www.ngs.noaa.gov/PC_PROD/VERTCON/), and GEOCON11 (http://www.ngs.noaa.gov/GEOCON11/).
  - Conversions from one epoch to another within or between NAD83 and WGS84/ITRF can be accomplished using NOAA's HTDP software (Horizontal Time-Dependent Positioning, http://www.ngs.noaa.gov/TOOLS/Htdp/Htdp.shtml).

4.2. Differential (PPC) GPS

1. If there is no CORS within range (approximately 350 miles) to provide correction data for post processing, turn on the second GPS receiver, set it to collect raw data continuously, set the vertical offset (typically 0 meters), place it on the control point, ensure that it has acquired enough satellites to calculate a precise position, and begin data acquisition. In the logbook, *record the model and serial number of the receiver, the identity and coordinates of the control point, the name of the raw data file, and the time*.
2. Turn on the mapping receiver, set it to collect raw data point by point, set the vertical offset (typically 1.2 m if handheld, 2.0 m if using an external antenna on a pole) and begin mapping. At each measurement point, ensure that it has acquired enough satellites to calculate a precise position and collect sufficient data to support meaningful precision estimates (30

seconds is typical). In the logbook, record the model and serial number of the receiver, the name of the raw data file, and the identity and time of each point surveyed.

3. Include one or more control points in each mapping session as check shots for quality assurance (see Section 4.7 Quality Assurance).
4. See Section 4.5 Data Collection for guidance in collection SDSFIE-compliant data.
5. At the conclusion of mapping, copy the raw data file to backed up external storage (e.g., a laptop and a flash drive, or a backup-up network).
6. Follow the equipment manufacturer's instructions for post processing. For the Leica Viva Uno, post processing is performed using Leica Geo Office enabled by a dongle provided by the equipment supplier. For the Trimble GeoXH 6000, post processing is performed using Pathfinder Office enabled by a temporary password provided by the equipment supplier.

Potential pitfalls include the following:

- Insufficient number of satellites visible. Even where the horizon is unobstructed, the satellite array can evolve to configurations unsuitable for the receiver. Wait 30 minutes and try again. If using a control-point receiver, loss of satellites will not be known until the raw data file is examined. In this case, the affected points must be re-mapped. Therefore, all acquired data should be examined in time to allow re-mapping before demobilization.
- Satellites visible but no position is calculated. The receiver cannot make sense of the satellite array because it has been moved too far from its last use. Delete the ephemeris data (almanac) and let the receiver observe the satellites for about 30 minutes to rebuild this database.
- Geomagnetic storms. GPS may perform poorly or fail on data sets collected during geomagnetic storms because of ionospheric disturbances. GPS surveying should not be attempted during such storms.
- Coordinate system not available. Geographic coordinates are always available, but the desired local grid translation may need to be loaded into the GPS receiver. Check this before mobilizing; work with the equipment supplier and/or use the manufacturer's software to upload the translation into the receiver.
- Horizontal datum incorrectly identified, and some instrument and software settings have no effect (they are null transformations). Verify the horizontal datum via check shots on control points with known locations. For example, post-processed data from the Trimble GeoXH 6000 at Eielson in 2015 were in NAD83 (probably NAD83(2011):2010.0), whereas the raw SBAS-corrected data were probably in ITRF08 or ITRF14 at the epoch of measurement. The raw data were used to develop project-specific offsets for data that could not be post-processed.

Additional guidance for Leica, Trimble, and other hardware and software can be found on the Jacobs Alaska Operations network at P:\GPS_Tools (\\ancfil03\GPS_Tools) in various doc or docx files.

4.3. RTK-GPS

The base station or CORS should be within approximately 20 kilometers of the area to be surveyed to minimize degradation of precision and accuracy. RTK-GPS coordinates are degraded by approximately 2 parts per million (1 SD) of the distance to the base station or CORS. For a distance of 20 kilometers, accuracy and precision are degraded by approximately 20,000 meters * 0.000002 = ± 0.04 meters (± 4 cm).

RTK-GPS steps are as follows:

7. In the absence of a CORS signal, set up the base station over a convenient control point that meets the following criteria:
    - Within 20 kilometers of the survey area (the closer, the better). The correction signal has limited range and may be blocked by topography, vegetation, and structures. Trees or buildings nearby (less than 30 meters) can cause multipath interference if taller than the

antenna. A repeater or a different control point may be needed in order to reach all desired survey locations.

- Accuracy better than 0.5 meters horizontally and 0.08 meters vertically if using published coordinates for a permanent monument. These are half of the values listed by USACE [USACE 2011] for better accuracy. These should have been updated within the last five years. See Section 4.1 Ellipsoids and Coordinate Systems for further discussion. If possible, confirm or update with a static GPS determination.
- Accuracy and precision better than 1.5 cm horizontally and 3.0 cm vertically if using a static GPS solution for the control point. Static data may be acquired simultaneously during RTK-GPS surveying; approximate coordinates will be entered at the time of surveying, and the RTK-GPS data set will be post-processed using the static GPS solution when it becomes available.
- No detectable disturbance to the control point or surrounding ground.

8. If using a base station, record the following information in the logbook:
   - *The model and serial number of the base station controller and antenna.*
   - *The coordinates entered into the base station controller along with the GCS, projection system, and vertical datum.* NGS data sheets and OPUS solutions use the NAD83 (2011) GCS with coordinates corrected for tectonic velocities to their values on 1 Jan 2010. Beware if working using the WGS84 GCS; the NAD83 GCS must be converted (see NAD83 in Section 2.0 Definitions and Acronyms). Use the ellipsoid height, if available, to avoid the uncertainty inherent in the geoid model at this stage. The rover heights will then be ellipsoid heights. Otherwise, use the orthometric height, and rover heights will then be orthometric heights referenced to the datum of the control point height. This implicitly assumes that the geoid correction is uniform throughout the area encompassing the base station and surveyed points. This assumption can introduce height errors of 10 cm or more, depending on the area, if not corrected in post-processing.
   - *The antenna height above the monument or control point.* For Leica systems, the base station antenna height comprises the tripod height (measured using the tape that hangs from the tribrach), the tripod offset (the distance between tape's reference point and the ARP), and the antenna offset (the distance between the ARP and the effective plane of the antenna).
   - *The name of the data file and the approximate time the base station was initialized.*
9. If using a CORS signal, record the following information in the logbook:
   - *The identity and location of the CORS. For future reference, record the broadcast frequency and controller settings needed for reception.*
   - *The coordinates and ellipsoid height of the CORS entered into the rover.* NGS data sheets for CORS use the NAD83 (2011) GCS with coordinates corrected for tectonic velocities to their values on 1 Jan 2010.
10. Start the rover and ensure that it is receiving the correction signal. In the logbook, record the following information:
    - *The model and serial number of the rover controller and antenna.*
    - *The antenna height*. For Leica systems, the rover antenna height comprises the pole height (typically 1.8 or 2.0 meters) and the antenna offset (the distance between the ARP and the effective plane of the antenna).
    - *The name of the data file and the approximate time the rover was initialized*. Generally, a new data file should be started every day in order to compartmentalize any undetected setup errors. Separate data files may also be desirable if the day's work will span multiple sites or projects.

11. Take an initial check shot on a nearby control point to confirm proper configuration of the base station (if used) and rover. The check shot should agree to within ± 3 cm horizontally and vertically with the average position of the control point as determined by multiple setups of the RTK-GPS system or by static GPS. *Record the check-shot coordinates and agreement in the logbook.*

    - If the check shot disagrees with the average, recheck the base station (level, alignment, all height components, entered coordinates) and the rover (all height components).
    - For one-day projects, no average will be available. Instead, make the check shot on the nearest geodetic monument with high-quality published coordinates, if possible. If there is substantial disagreement, the check shot may be used to develop a correction offset to be applied to all measurements. If no monument is available, a check shot on a temporary control point is still needed for comparison with the final check shot of the day. Static GPS data for the base station should also be collected for one-day projects.

12. Begin surveying.

    - Reported precision should be ± 3 cm or better for both horizontal and vertical coordinates, unless otherwise specified in the contract or work plan. *In the logbook, note any precision failure and its reason (e.g., loss of satellites due to vegetation, loss of correction signal due to building).*
    - See Section 4.5 Data Collection for guidance in SDSFIE-compliant data documentation.

13. *If the rover antenna height needs to be changed, note the change in the logbook* and enter the new height in the controller. *If the pole was collapsed for transport, note the re-extended height in the logbook before surveying the next point*.

14. Take a final check shot at the end of the survey session on the same control point to demonstrate that the system geometry has remained stable during the survey session. *Record the check-shot coordinates and agreement in the logbook.* Check shots can be made at more frequent intervals to reduce the number of observations at risk in the event of disagreement with preceding check shots. Each check shot should be uniquely named to prevent automatic averaging by the controller.

15. At the conclusion of mapping, copy the raw data file to redundant external storage (e.g., a laptop and a flash drive, or a backed-up network).

16. Follow the equipment manufacturer's instructions for extracting the survey data. For Leica systems, the demonstration version of Leica Geo Office is sufficient to display and export the data or adjust the base station location, but a dongle for higher level licensing (typically obtained from the equipment vendor) is required for any post processing.

Potential pitfalls include the following (in addition to those for mapping-grade GPS):

- Check-shot height disagreement. If there are no errors in the current configuration of the base station and rover, there may be systematic errors in previous setups. Check field notes for use of the correct tripod and antenna offsets. For Leica systems, antenna offsets are part of the antenna definition file.
- Lost correction signal or satellites. High-frequency RTK-GPS signals are easily blocked by terrain, buildings, or foliage. If the correction signal cannot reach a survey point, use a repeater or a different base station location. If satellites are lost, try again at least an hour later when the satellite array has changed significantly, or try putting the antenna on an extension pole to put it above the canopy.

4.4. Static GPS

1. Setup the dual-frequency receiver over the point to be surveyed. The physical setup (tripod, tribrach, antenna, and controller) is the same as for the RTK-GPS base station. Record the following information in the logbook:

- *The name of the surveyed point, its approximate location relative to nearby fixed objects, and its appearance (e.g., rebar with cap; survey monument).* Make sketches or take photos of the point and its surroundings.
- *The model and serial number of the controller and antenna.*
- *The antenna height above the surveyed point.* For Leica systems, the base station antenna height comprises the tripod height (measured using the tape that hangs from the tribrach), the tripod offset (the distance between tape's reference point and the ARP), and the antenna offset (the distance between the ARP and the effective plane of the antenna).
- *The name of the data file and the approximate time the base station was initialized.*

2. Collect raw data at 30-second intervals for the desired time interval.
   - A minimum of 15 minutes is needed for OPUS post processing for the rapid-static (preliminary) solution. This is useful for initializing a base station at a new control point, but should not be used for the final coordinates of the point. Internal precision should be better than ± 2 cm horizontally and vertically, but accuracy may be worse because systematic errors may be present in such short data sets.
   - A minimum of 2 hours is needed for standard OPUS post-processing for final coordinates.
3. Save the data in RINEX 2.x format or convert it to that format using the manufacturer's software (e.g., Leica Geo Office [demonstration license]) and submit it to OPUS (http://www.ngs.noaa.gov/OPUS/) for post processing at least an hour after collection.
   - Only ultra-rapid satellite orbits are available for up to 24 hours after data collection. These are adequate for preliminary solutions.
   - Rapid satellite orbits are available within 24 hours to 10 days after data collection. These are adequate for final solutions.
   - Precise satellite orbits are available after 10 days, but offer no significant improvement for RTK-GPS surveying.

For additional discussion, see Bays (2004) or the OPUS web site.

Potential pitfalls include the following:

- Undetected height errors. Because there is no way to make a check shot, proper configuration of the antenna height cannot be independently verified.
- Lost satellites. High-frequency RTK-GPS signals are easily blocked by terrain, buildings, or foliage. If satellites are lost, try again at least an hour later when the satellite array has changed significantly, or try putting the antenna on an extension pole to put it above the canopy.
- No nearby CORS stations. The CORS network covers only approximately two-thirds of Alaska for OPUS post processing (see http://www.ngs.noaa.gov/OPUSI/Plots/Gmap/OPUSRS_sigmap.shtml). In other areas, the best that can be done is to average the data set. Precision and accuracy of the resulting coordinates are beyond the scope of this SOP.
- Geomagnetic storms. OPUS post-processing may perform poorly or fail on data sets collected during geomagnetic storms because of ionospheric disturbances. The data will need to be recollected.
- OPUS provides coordinates using the NAD83 GCS; the coordinates must be transformed for reporting in the WGS84 coordinate system (see NAD83 in Section 2.0 Definitions and Acronyms).

4.5. Data Collection and Management

1. Create a new job in the GPS controller for each project or each day of surveying, depending on the needs of the project.

- Be sure the controller is set to the correct local time.
- Name the job so that data users will be able to identify data contents and applicable dates. The name should include site, project, and start date (which may be appended automatically by the controller). One possibility uses the last two digits of the year followed by a compact project identifier, an underscore, and a compact task identifier, with specific date and time information added by the controller. For Leica systems, an example is "14EI0609STAKE", signifying 2014 Eielson stakeout work beginning on 6/9. The Leica controller will automatically append additional time information to exported files, but that information isn't visible in the controller's job list, so it is worthwhile to embed the date in the user-defined portion of the job name. *Record the job name in the logbook.*

2. Name all points, lines, or areas uniquely and recognizably. *Record in the logbook the name and type of each location surveyed.*
   - Features with identical names in the same job may be averaged by the controller or display software. Be sure to delete any accidental shots; don't just re-shoot with the same name.
   - A code list (see Attachment 4 for an example) may be loaded into the controller to facilitate naming and classification of points. To facilitate data delivery at the end of the project, the code list should be SDSFIE 2.6 or 3.0 compliant. If use of the code list in the field proves too cumbersome, codes may be added later during data compilation. See the MED for further discussion.
3. The survey data should be compiled into a master spreadsheet for the project (see Attachment 5 for an example) on a daily basis.
   - Column names should be Dbase-compatible (no spaces or special characters) to facilitate data use in ArcGIS and data export to ERPIMS.
   - Calculate orthometric heights (if appropriate) using the equipment manufacturer's software or visit the NOAA geoid web page (http://www.ngs.noaa.gov/GEOID/) to look up geoid heights:

     $$H_{Ortho} = H_{EI} - GdHt$$

     Or, use the difference in geoid offsets between the base station and each survey point as a correction factor:

     $$H_{Ortho} = H_{Meas} - (GdHt_{Point} – GdHt_{Base})$$

4.6. Control Points

Control points may be either permanent monuments or temporary markers:

- Permanent monuments typically consist of engraved metal disks affixed to a length of rebar driven into the ground or glued to a large concrete slab or rock outcrop. Documentation may be obtained from NGS data sheets (http://www.ngs.noaa.gov/cgi-bin/datasheet.prl), existing reports, government-furnished material, or previous surveys. If these are unavailable or doubtful, determine new coordinates using static GPS.
- Temporary control points may consist of the following:
  - Rebar with cap
  - Hub (2-inch by 2-inch by 4-inch wooden stake) with tack
  - Magnetic nail
  - Other marking of suitable precision, permanence, and stability

  Keep in mind that control points will shift over time. One source of short-term shifting is freezing and thawing of the active layer, which may change the ground elevation or frost-jack

the control point. Longer term shifts may reflect tectonic movements. Coordinates should be verified annually or if disturbance is suspected.

Control-point coordinates may be established by static GPS or by RTK-GPS.

When establishing a control point, include the following in the field logbook:

- *The name of the control point, its approximate location relative to nearby fixed objects, and its appearance (e.g., rebar with cap, hub with tack, etc.).* Make sketches or take photos of the point and its surroundings.
- *Details of the survey method used to establish the coordinates of the control point.* If using RTK-GPS, refer to or include the base station setup notes or the CORS being used, and note the distance to the base station or CORS. For static GPS, see Section 4.4.
- *Final coordinates of the control point.*

4.7. Quality Assurance

Note any variances from the SOP in the logbook. Describe why the change was made and what the effects will be on data quality.

Quality assurance data collected during surveying consists of the following:

- Check shots on control points with known locations.
- Auxiliary shots on permanent site features (i.e. slab corners, fire hydrants, rock outcrops) and aerially recognizable features (i.e. intersections, bends in roads/rivers, field corners). These may aid future efforts to relocate points without using GPS equipment and may be useful for georeferencing aerial imagery when creating site maps.

At a minimum, tabulate the check shot data and offsets relative to known control points and flag those data that do not meet the acceptance criteria for the method of surveying. An example is provided in Attachment 6 Table 6-1. Default acceptance criteria for reported precision and offsets are as follows:

- PPC-GPS (single frequency): 0.50 m easting and northing,1.0 m height
- PPC-GPS (dual frequency): 0.30 m easting and northing, 0.50 m height
- RTK-GPS: 0.030 m easting and northing, 0.030 m height.

Acceptance criteria may also be derived from the precision of the control-point data themselves as described in the next section.

Control charts may also be constructed for check-shot data to graphically illustrate their consistency. An example is shown in Attachment 6 Figure 6-1.

Precision

Assess the precision of the survey data set by calculating the means and standard deviations of the eastings, northings, and elevations on the daily check shots (NOAA 2011, USACE 2003). Using Microsoft Excel, means may be calculated using the AVERAGE function, and standard deviations may be calculated using the SDEV.S function for the sample standard deviation. An example worksheet is shown in Attachment 6. Filter the check shot data by excluding initial shots that required reconfiguration of the base station, by excluding final shots that led to rejection of data, and by excluding any shot taken within 30 minutes of a preceding accepted shot (measurements separated by shorter periods are relatively correlated).

Precision may be evaluated as follows:

- Vertical precision (VP) is merely the standard deviation:

  VP = SDEV.S(filtered heights)

- Horizontal precision (HP) is the root-mean-square of the easting and northing standard deviations:

  HP = SQRT((SDEV.S(filtered eastings)^2 + SDEV.S(filtered northings)^2)/2)

- 95-percent prediction limits (95%PLs) are calculated using the one-sided t-statistic function:

  ±95%PL = SDEV.S(data) * T.INV(0.975,COUNT(data)-1)

  where data = filtered eastings, northings, or heights.

For RTK-GPS, these precisions will typically be on the order of ± 1 cm for high-quality data sets, but values up to ± 5 cm are considered acceptable for environmental work (NOAA 2011). Check shots are typically within a few tens of meters of the base station; precisions of other points in the data set will be less due to longer baselines (precision is degraded by approximately 2 parts per million of the distance to the CORS or base station).

Accuracy

If the CORS or base station is considered “truth”, then the local accuracy of the control point measurements is the same as their precision (NOAA 2011), but many potential systematic effects can degrade the global accuracy somewhat (NOAA 2011) and are not evaluated by the simple check-shot quality assurance presented here. Based on the survey classes discussed in NOAA (2011), the extent of such degradation is probably on the order of ± 4 cm (1 SD).

Global accuracy can best be assured by using a CORS signal or by obtaining a good static GPS OPUS solution for the base station. Additionally, the base station may be placed on a well-documented control point, or one or more well-documented control points may be included in the survey. When such control points are surveyed, it is common practice to use the residuals between documented and measured coordinates to develop correction factors for other points in the data set (NOAA 2011 Appendix D). Such control points also provide redundancy in the event of OPUS failure, which may not be known before demobilization if the field effort is short.

4.8. Logbook Overview

These bullets summarize the italicized logbook entries in the preceding procedures. In simplified form, the logbook should contain the following:

- *Description of the equipment*. Include serial numbers in case questions arise or a data file needs to be retrieved after the equipment has been returned to the vendor.
- *Description of the reference point* (CORS signal or second receiver on control point for mapping-grade GPS; base station or CORS signal for RTK-GPS).
- Description of the survey.
    - *Names of all data files.*
    - *Equipment setup* (vertical offset, rover pole height, antenna height parameters for static GPS).
- *Initial check-shot results* (for RTK-GPS).
- *Points surveyed* (along with any changes in equipment setup)
- *Final check-shot results* (for RTK-GPS).

5.0 SURVEY DATA REPORT OUTLINE

The survey report should include a narrative covering the following:

- Date(s) of the survey
- General description of the features surveyed
- Methodology and equipment
- Local coordinate system and units (usually UTM meters)
- Underlying datum (ellipsoid) for horizontal coordinates (usually WGS84)
- Datum for orthometric heights (usually NAVD88 via GEOID12A)
- Corrections applied to the horizontal or vertical data
- Precision of check-shot data for each base station location
- Any limitations of the data with respect to data quality objectives
- The survey data should be presented in tabular format. In general, a summary of the survey results table (Attachment 5) should be used.

6.0 REFERENCES

Bays, K. 2004. Using NGS Online Positioning User service (OPUS). http://www.blm.gov/or/gis/geoscience/files/OPUS_cook_book.pdf

NOAA (National Oceanic and Atmospheric Administration). 2014 (October). *HTDP (Horizontal Time-Dependent Positioning), Version 3.2.5*. http://www.ngs.noaa.gov/TOOLS/Htdp/Htdp.shtml.

NOAA. 2011 (August). *User Guidelines for Single Base Real Time GNSS Positioning.* http://www.ngs.noaa.gov/PUBS_LIB/NGSRealTimeUserGuidelines.v2.1.pdf

USACE. (U.S. Army Corp of Engineers). 2012 (March). *Survey Markers and Monumentation.* Engineering Manual (EM) 1110-1-1002.

USACE. 2011 (October). *Manual for Electronic Deliverables*. Prepared by U.S. Army Corps of Engineers – Alaska District, Environmental Engineering Branch, Joint Base Elmendorf Richardson, Alaska.

USACE. 2007 (January). *Control and Topographic Surveying*. EM 1110-1-1005.

USACE. 2005 (September). *Geospatial Data and Systems*. EM 1110-1-2909.

USACE. 2003 (July). NAVSTAR Global Positioning System Surveying. EM 1110-1-1003.

USAF (U.S. Air Force). 2005 (December). *Contractors Guide*.

Attachment 1. Default Survey Requirements

In the absence of project-specific requirements, the requirements of the MED (USACE 2011) should be applied. The following tables are adapted from Section 5 of the MED.

Spatial Reference

Program	Horizontal Datum[1] and Coordinate System	Vertical Datum
Formerly Used Defense Site (FUDS)	WGS84 latitude/longitude in decimal degrees	NAVD88 in feet
IIS	WGS84 latitude/longitude in decimal degrees	NAVD88 in feet
U.S. Air Force	WGS84 UTM (applicable zone), in meters	NAVD88 in meters
U.S. Army	WGS84 UTM (applicable zone), in meters	NAVD88 in meters

[1] The epoch for reporting is not specified. Use 2000.0 because the ArcMap transformation WGS_1984_(ITRF00)_To_NAD_1983 is most likely to be applied if the data are re-projected to NAD83.

Survey Quality

Feature Type	Minimum Horizontal Quality	Minimum Vertical Quality
General Field Data Collection		
Photograph Location (standing location); if specifically required in the scope of work	9.8 feet / 3 meters	No elevation data required
Features intended for georeferencing imagery – e.g., building corners, intersections	3.3 feet / 1 meter	No elevation data required
Monument Location Found - monument used to evaluate survey accuracy; tie in elevation survey; comparison to published data	Equal to most stringent accuracy for features surveyed during project. Verify published accuracy of monument meets project needs during project planning.	Equal to most stringent accuracy for features surveyed during project. Verify published accuracy of monument meets project needs during project planning.
Monument Location New - project monument installed by Contractor (non-published)	Equal to most stringent accuracy for features surveyed during project. (OPUS Solution may be necessary.)	Equal to most stringent accuracy for features surveyed during project. (OPUS Solution may be necessary.)
Monument Location New - project monument installed by Contractor (published)	As required by EM 1110-1-1002 / EM 1110-1-1005	As required by EM 1110-1-1002 / EM 1110-1-1005
Features Not Listed in this table	Establish agreement on approach during negotiation and/or project planning.	Establish agreement on approach during negotiation and/or project planning.
SI Level Field Data Collection		
Photograph Location (standing location)	9.8 feet / 3 meters	No elevation data required
Sample Location (SI) – surface soil, subsurface soil, sediment, surface water	3.3 feet / 1 meter	No elevation data required

Survey Quality (continued)

Feature Type	Minimum Horizontal Quality	Minimum Vertical Quality
Field Screening Location (SI) – e.g., PID	3.3 feet / 1 meter	No elevation data required
CON/HTRW Items – e.g., transformer, drum, battery etc.	3.3 feet / 1 meter	No elevation data required
HTRW feature – e.g., soil stain	3.3 feet / 1 meter	No elevation data required
Debris Item	3.3 feet / 1 meter, or as needed to find item upon return	No elevation data required
Debris Pile or Area with multiple items (4 corners or surrounding polyline)	3.3 feet / 1 meter	No elevation data required
RI Level Field Data Collection		
Soil Boring Location (RI) – auger drilled, hand auger, UVOST probe, ground surface level	3.3 feet / 1 meter	0.5 foot / 0.15 meter
Test Pit (RI) – center, ground surface level	3.3 feet / 1 meter	0.5 foot / 0.15 meter
Sample Location (RI) – surface soil, sediment, ground surface level, subsurface soil	3.3 feet / 1 meter	0.5 foot / 0.15 meter
Groundwater Sampling Location (RI) – monitoring well, microwell, temporary push-point, ground surface and top of casing levels	3.3 feet / 1 meter	Close level loop at 0.01 foot per setup or better[1]. Tie elevation survey to existing or new monument.
Field Screening Location (RI) – e.g., PID, immunoassay…	3.3 feet / 1 meter	No elevation data required
Confirmation Sample (RI) – e.g., soil sample establishing completion	3.3 feet / 1 meter	0.5 foot / 0.15 meter
IRA and RA Level Field Data Collection		
Confirmation Sample (IRA, RA) – e.g. soil sample from excavation establishing completion	3.3 feet / 1 meter	0.5 foot / 0.15 meter
Field Screening Location (IRA, RA) – e.g., PID, PetroFlag, UVOST, etc.	3.3 feet / 1 meter	No elevation data required
Remediation System Component (RA) – e.g., SVE enclosure corner	3.3 feet / 1 meter	No elevation data required
Excavation Limits (IRA, RA) – for contracts with measurement and payment using tonnage	3.3 feet / 1 meter	0.5 foot / 0.15 meter
Excavation Limits (IRA, RA) – for contracts with measurement and payment using excavation volume	Per contract	Per contract

[1] High quality (1 cm) RTK-GPS data meets this requirement, as discussed below.

RTK-GPS Meets the MED Requirements for TOC Elevations

High quality TOC elevations are essential for water-table mapping. The MED envisions the use of optical level loops for TOC elevations and requires the following:

> *Close level loop at 0.01 foot per setup or better. Tie elevation survey to existing or new monument. (USACE 2011 Table 5-2)*

To relate this requirement to the data quality provided by RTK-GPS, the error associated with a representative level-loop elevation must be evaluated. Consider an optical level loop with five setups (turning points), such as might be needed for a complex site. The allowable error of closure is 0.05 ft or 1.5 cm, but the distribution of this error is unknown. Following standard practice, the closure error is apportioned to each turning point. By treating the 1.5 cm error of closure as the RMS of the errors associated with the five individual setup elevations, the average error (1 SD) associated with each setup is:

SQRT((1.5^2)/5) = 0.67 cm (0.02 ft)

This value is larger than the MED standard because the standard simply adds the errors, whereas this detailed analysis applies Gaussian error propagation.

Next, consider the worst case in this level loop: the elevations of the third setup depends on the elevations of the first two setups or the last two setup, depending on whether calculations are made in the forward or reverse direction around the level loop. In either case, the error expression for this setup is:

SQRT(3*0.67^2) = 1.2 cm (0.04 ft).

Additional error is associated with level shots from this setup to nearby wells. If this error is assumed to be 0.30 cm (0.01 ft) and included in the above calculation, the result changes from 1.16 cm to 1.21 cm, both of which round to 1.2 cm for two significant figures of precision. Therefore, the level shot error is not considered further.

This analysis shows that a level loop that meets but does not exceed the MED requirement provides elevations with errors that are essentially the same as the 1-cm uncertainty inherent in high-quality RTK-GPS data. Therefore, TOC elevations surveyed by RTK-GPS with reported height quality on the order of (rounding to) 1 cm are considered to meet the MED requirement.

Additional Considerations for RTK-GPS versus Level Loops

As noted in the second sentence of the MED requirement, level loops are tied to control monuments. To cover a large site such as a military base, multiple control points are typically used in order to minimize the size of each level loop. As mentioned elsewhere in Table 5-2 of the MED (the fourth item in the Survey Requirements table above), control point elevations are expected to be determined by OPUS solutions (static GPS), which have approximately 1-cm quality. In general, then, the error associated with a level-loop elevation is the RMS of the level loop error (1.2 cm) and the control point error (1 cm):

SQRT(1.2^2 + 1.0^2) = 1.6 cm

For the difference in water table elevation in two wells surveyed on level loops tied to separate control points, the total error will be the RMS of the two individual errors:

SQRT(1.6^2 + 1.6^2) = 2.3 cm

In comparison, RTK-GPS can cover a large site from a single base station, which means that the same control point elevation is common to all elevations, and any error in the control point elevation cancels in the difference calculation. In this case, the total error is only:

SQRT(1^2 + 1^2) = 1.4 cm

Selection of RTK-GPS or Optical Level Loops for TOC Elevations

RTK-GPS surveying is recommended for the following cases:

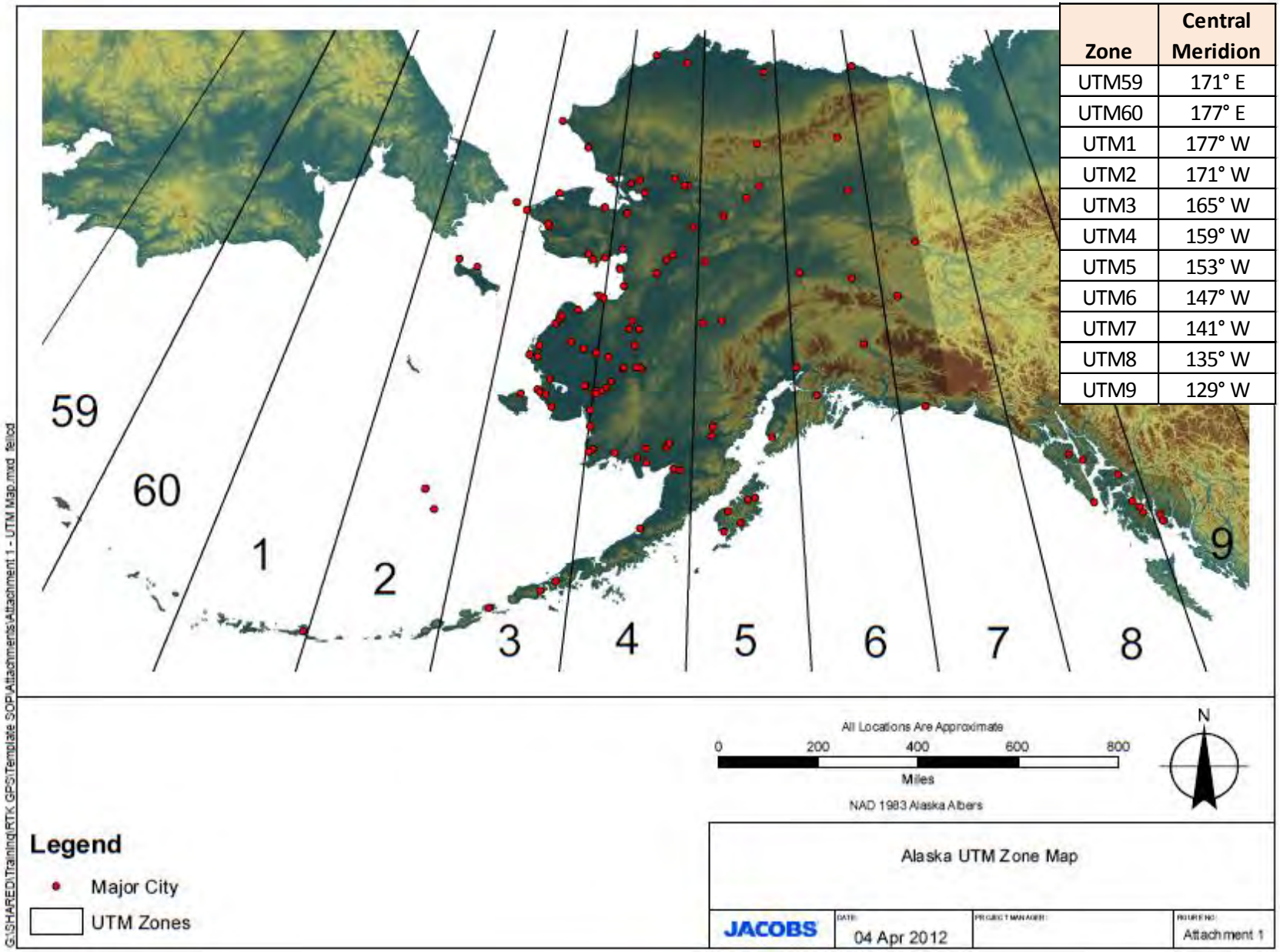
- The site is large and would require multiple level loops from separate control points.
- The water table gradient is steep enough to produce groundwater elevation changes of 3 cm or more at the scale of interest.
- The water table gradient is shallow, but groundwater flow directions will be determined from other evidence (e.g., plume trajectories, tracer studies).

RTK-GPS may not provide high-quality data for heavily wooded sites because satellite signals may not penetrate the canopy. A 5-m extension pole for the rover antenna is a great help, but such conditions may require level shots from temporary control points set by RTK-GPS, or even level loops from control points in clear areas.

Optical level loops can be measured with substantially better quality than the minimum required by the MED, with errors of closure approaching 0.001 ft per turning point. The additional cost and effort of optical level loops is worthwhile when the following conditions are met:

- All level loops can originate from the same control point.
- The water table gradient is so shallow that there will be less than 3 cm of groundwater elevation change at the scale of interest.
- Data quality objectives require determination of groundwater flow directions from the water table contours.

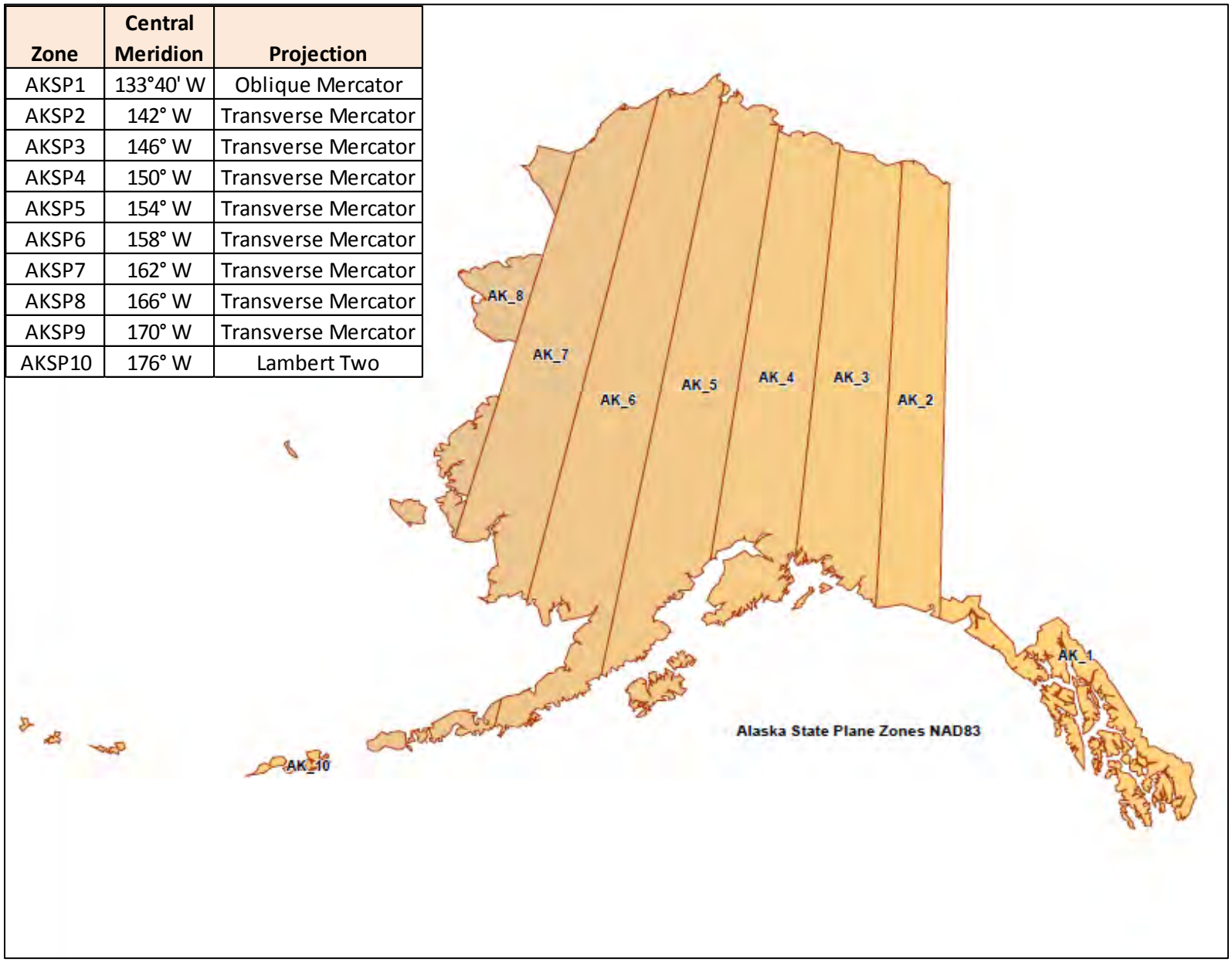
Attachment 2. Alaska Universal Transverse Mercator Zone Map



Zone	Central Meridion
UTM59	171° E
UTM60	177° E
UTM1	177° W
UTM2	171° W
UTM3	165° W
UTM4	159° W
UTM5	153° W
UTM6	147° W
UTM7	141° W
UTM8	135° W
UTM9	129° W

Attachment 3. Alaska State Plane Zones NAD83

Zone	Central Meridion	Projection
AKSP1	133°40' W	Oblique Mercator
AKSP2	142° W	Transverse Mercator
AKSP3	146° W	Transverse Mercator
AKSP4	150° W	Transverse Mercator
AKSP5	154° W	Transverse Mercator
AKSP6	158° W	Transverse Mercator
AKSP7	162° W	Transverse Mercator
AKSP8	166° W	Transverse Mercator
AKSP9	170° W	Transverse Mercator
AKSP10	176° W	Lambert Two



Attachment 4. Code List Example

CodeGroup	Coc	CodeDescr	Typ	Annotation
BuildingEtc	BBC	BuildingCorner	Point	Actual, Offset, Other
BuildingEtc	BF	Fence	Line	Metal, Wood, Plastic, Other
BuildingEtc	BUL	UtilityLocation	Point	Proposed Excavation, Temporary Survey Marks, Power, Natural Gas, Communication, Water, Reclaimed Water, Sewer and Drains, Other
BuildingEtc	BW	Wall	Line	Stone, Brick, Wood, Concrete, Soldier Pile, Soil Nail, Unknown
BuildingEtc	BSW	WaterSuppyWell	Point	Water supply well
Environmental	ETA	AST	Point	Gasoline, AvGas, Diesel, Arctic Diesel, Lube Oil, Used Oil, Bunker C, Sewage, Water, Chemicals, Other
Environmental	ETU	UST	Point	Gasoline, AvGas, Diesel, Arctic Diesel, Lube Oil, Used Oil, Bunker C, Sewage, Water, Chemicals, Other
Environmental	EX	EnvOther	Free	Other environmental feature
BuildingEtc	BX	StructureOther	Free	Other structural feature
Investigation	IBH	Borehole	Point	Borehole
Investigation	IMW	MonWell	Point	Monitoring Well, Lysimeter, Water Well
Investigation	IMZ	LandManageZone	Point	Excavation, Stockpile, Storage Area, Staging Area, Area of Interest, Other
Investigation	IPW	PiezoWell	Point	Piezometer
Investigation	ISS	SurfaceSoilPt	Point	Surface soil sampling point
Investigation	ISW	SurfaceWaterPt	Point	Surface water sampling point
Investigation	ITW	TempWellPt	Point	Temporary well point
Investigation	IX	InvOther	Free	Other investigation feature
Observation	OSL	SampleLocation	Point	Pre-Construction, Post-Construction, Waste Characterization, Soil Characterization, Water Characterization, Work Exposure, Field Screening, Other
Observation	OX	ObservationOther	Point	Photo, Sketch, Wildlife, Notes, Other
Survey	SCP	ControlPoint	Point	NGS Monument, Other Monument, Temp Control Point, Check Shot
Survey	SG	GridPoint	Point	Sampling, Excavation, Archaeological, Other
Survey	SX	SurveyOther	Free	Other survey feature
Survey	STS	Transect	Line	Geophysical Survey, Excavation Sidewall, Observation Traverse
Topographic	TBL	TopoBreakLine	Line	
Topographic	TGS	GroundShot	Point	Ground surface point
Topographic	TSL	StationLine	Line	Base Line, Sub-Line, Centerline, Other
Topographic	TS	Shoreline	Line	Lake, Pond, River, Stream, Ocean, Sea, Former, Other
Topographic	TTR	TransRoute	Line	Highway, Primary Road, Gravel Road, Dirt Road, Railroad, Trail, Other
Topographic	TWF	WaterFeature	Line	Lake, Pond, River, Stream, Ocean, Sea, Former, Other
Topographic	TX	TopoOther	Free	
Other	XX	Other	Free	Other feature

Attachment 5. Survey Results Table Example

PointID	PointClass	DateTime	Easting	Northing	QualXY	HtEll	HtOrth	GdSep	QualH	ProjectID	RawDataID	UnitsXY	UnitsHt	Code	Description	SrvyMthd	SrvyEquip	Projection	DatumGeo	DatumHt
StkdB1	Measured	8/4/14 15:48:26	495728.915	7171184.362	0.005	174.908	165.175	9.733	0.008	EI_140804	0804EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB2	Measured	8/4/14 16:13:25	495741.868	7171184.368	0.010	174.929	165.196	9.733	0.019	EI_140804	0804EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB3	Measured	8/4/14 10:51:21	495711.752	7171137.475	0.007	174.760	165.027	9.733	0.011	EI_140804	0804EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB4	Measured	8/4/14 10:53:42	495713.260	7171127.539	0.008	174.980	165.246	9.734	0.012	EI_140804	0804EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
B5	Measured	8/4/14 14:05:08	495720.152	7171133.959	0.007	175.155	165.421	9.734	0.013	EI_140804	0804EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB5	Measured	8/9/14 15:40:00	495709.532	7171144.963	0.006	175.050	165.317	9.733	0.011	EI_140809	0809EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB5	Measured	9/4/14 10:29:18	495708.734	7171146.519	0.006	175.146	165.413	9.733	0.012	EI_140904a	0904 EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB6	Measured	6/17/14 11:00:26	495368.073	7173413.702	0.012	172.924	163.212	9.712	0.020	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB7	Measured	6/17/14 10:59:18	495371.296	7173406.406	0.010	173.061	163.349	9.712	0.017	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB8	Measured	6/17/14 10:57:06	495375.568	7173416.681	0.015	173.222	163.510	9.712	0.023	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB9	Measured	6/17/14 10:55:54	495384.327	7173411.233	0.007	173.113	163.401	9.712	0.011	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB10	Measured	6/17/14 10:53:59	495384.066	7173420.675	0.016	172.861	163.149	9.712	0.024	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB11	Measured	6/17/14 10:51:33	495392.276	7173382.140	0.006	173.622	163.909	9.713	0.010	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB12	Measured	6/17/14 10:49:48	495389.219	7173386.280	0.005	173.614	163.901	9.713	0.008	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB13	Measured	6/17/14 10:48:22	495388.504	7173370.131	0.005	173.695	163.982	9.713	0.008	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB14	Measured	6/17/14 10:46:25	495397.522	7173373.272	0.005	173.716	164.003	9.713	0.008	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB15	Measured	6/17/14 10:42:48	495406.557	7173376.595	0.005	173.697	163.984	9.713	0.007	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB16	Measured	6/17/14 11:03:23	495395.656	7173391.235	0.005	173.611	163.898	9.713	0.008	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB17	Measured	6/17/14 11:05:36	495383.100	7173390.586	0.006	173.583	163.871	9.712	0.009	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB18	Measured	6/17/14 11:08:21	495364.994	7173359.410	0.006	173.562	163.849	9.713	0.010	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB19	Measured	6/17/14 11:09:53	495369.982	7173350.012	0.005	173.614	163.901	9.713	0.009	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB20	Measured	6/18/14 11:06:29	495573.469	7172823.545	0.005	174.784	165.065	9.719	0.009	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB20	Measured	8/9/14 12:08:44	495573.048	7172823.387	0.007	174.772	165.053	9.719	0.013	EI_140809	0809EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB21	Measured	6/18/14 10:51:17	495595.499	7172811.489	0.015	174.385	164.666	9.719	0.025	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB21	Measured	8/9/14 11:52:15	495595.179	7172810.766	0.008	174.367	164.648	9.719	0.016	EI_140809	0809EAFB_00	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB178	Measured	6/18/14 11:13:04	495560.647	7172792.322	0.006	174.115	164.396	9.719	0.010	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB23	Measured	7/2/14 20:31:38	496354.890	7168955.528	0.007	178.436	168.669	9.767	0.009	EI_14CTL20(	CTL200_6142_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB24	Measured	7/2/14 20:27:07	496359.777	7168953.120	0.008	178.415	168.648	9.767	0.011	EI_14CTL20(	CTL200_6142_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB25	Measured	7/2/14 20:25:23	496365.182	7168950.887	0.007	178.399	168.632	9.767	0.010	EI_14CTL20(	CTL200_6142_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB26	Measured	7/2/14 20:36:26	496353.705	7168960.403	0.008	178.521	168.754	9.767	0.011	EI_14CTL20(	CTL200_6142_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB27	Measured	7/2/14 20:21:49	496374.509	7168937.309	0.006	178.297	168.529	9.768	0.010	EI_14CTL20(	CTL200_6142_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB28	Measured	7/10/14 13:41:54	496347.784	7168940.010	0.011	177.913	168.146	9.767	0.019	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)
StkdB29	Measured	7/10/14 13:37:11	496341.048	7168945.423	0.006	177.934	168.167	9.767	0.009	EI_14STAKE	EI STAKEOUT_	meters	meters	IBH	Borehole	RTK-GPS	Leica Viva	UTM 6N	WGS84	G12a(NAVD88)

Attachment 6. Survey Precision Table Examples

Table 6-1. Tabulation of Control Point Data and Offsets Relative to Known Coordinates

Location	Method	Date and Time	Easting[1] (m)	Northing[1] (m)	XY Quality (m)	XY Offset[2] (m)	Orthometric Height[3] (m)	Height Quality (m)	Height Difference[4] (m)
CTL201	Nominal	9/2/14	496134.254	7170192.310	0.006	—	166.804	0.010	—
CTL201	PPC-GPS	9/11/15 9:47	496134.266	7170192.184	0.10	0.13	166.79	0.10	-0.02
CTL201	PPC-GPS	9/11/15 15:15	496134.302	7170192.290	0.10	0.05	166.80	0.10	0.00
CTL201	PPC-GPS	9/12/15 8:02	496134.215	7170192.308	0.10	0.04	166.82	0.10	0.01
CTL201	PPC-GPS	9/12/15 15:22	496134.269	7170192.357	0.10	0.05	166.73	0.10	-0.07
CTL201	PPC-GPS	9/19/15 7:33	496134.244	7170192.292	0.10	0.02	166.80	0.10	0.00
CTL201	PPC-GPS	9/21/15 10:16	496134.282	7170192.249	0.10	0.07	166.85	0.10	0.05
CTL201	PPC-GPS	9/21/15 16:02	496134.247	7170192.316	0.10	0.01	166.76	0.10	-0.05
CTL201	PPC-GPS	9/22/15 7:45	496134.22	7170192.27	0.10	0.05	166.89	0.13	0.09
CTL201	PPC-GPS	9/22/15 16:51	496132.010	7170190.818	2.11	2.69	165.84	3.78	-0.96
CTL201	PPC-GPS	9/23/15 11:20	496134.232	7170192.350	0.10	0.05	166.81	0.10	0.01
CTL201	PPC-GPS	9/23/15 16:56	496134.221	7170192.250	0.10	0.07	166.59	0.10	-0.22
CTL201	PPC-GPS	9/24/15 7:11	496134.222	7170192.311	0.10	0.03	166.74	0.10	-0.06
CTL201	PPC-GPS	9/24/15 16:12	496134.220	7170192.321	0.10	0.04	166.80	0.10	0.00
CTL201	PPC-GPS	9/26/15 12:18	496134.292	7170192.641	0.48	0.33	167.29	0.90	0.49
CTL201	PPC-GPS	10/5/15 9:18	496134.231	7170192.335	0.10	0.03	166.71	0.10	-0.09
CTL201	PPC-GPS	10/5/15 16:06	496134.185	7170192.315	0.10	0.07	166.77	0.10	-0.04
CTL201	PPC-GPS	10/6/15 9:25	496134.242	7170192.318	0.11	0.01	166.74	0.10	-0.07
CTL201	PPC-GPS	10/7/15 6:20	496134.235	7170192.295	0.10	0.02	166.79	0.15	-0.02
CTL201	PPC-GPS	10/9/15 8:26	496134.265	7170192.175	0.29	0.14	166.90	0.64	0.10
RCC-2	Nominal	10/8/15	495670.602	7172797.880	0.015	—	165.455	0.019	—
RCC-2	PPC-GPS	9/19/15 15:55	495670.571	7172797.896	0.10	0.035	165.443	0.10	-0.012

[1] Horizontal datum is WGS84, projection is UTM Zone 6 North. WGS84 coordinates for the Eielson area are calculated from NAD83 coordinates as follows:
Easting(WGS84) = Easting(NAD83) -1.234
Northing(WGS84) = Northing(NAD83) + 0.213
All values are in meters. Offsets are from the WGS_1984_(ITRF00)_To_NAD_1983 transformation in ArcMap 10.2.

[2] XY Offset is the geometric distance in the horizontal plane between the check shot and the nominal location of the control point.

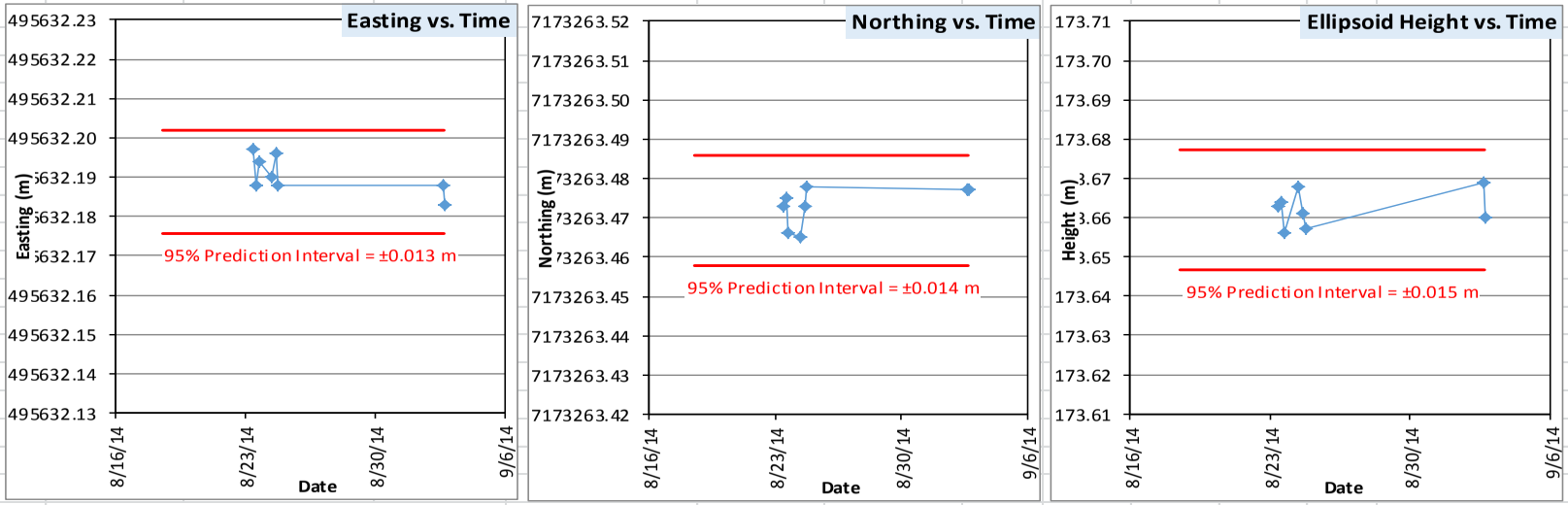
[3] Vertical datum is NAVD88 mean sea level as implemented in GEOID12A.

[4] Height Difference = (check shot height) – (nominal height).

Bold values do not meet acceptance criteria: 0.30 m or less for XY Quality and XY Offset, 0.50 m or less for Height Quality, and Height Difference.

— = not applicable for nominal locations.

SiteID	LocID	PointID	PointClass	DateTime	Easting	Northing	Quality	HtEll	HtOrt	GdSep	Quality	NoteUsability
SS67	CSSS67	CS SS67 082314-1	Measured	8/23/14 10:15:12	495632.197	7173263.473	0.006	173.663	163.947	9.716	0.009	
SS67	CSSS67	CS SS67 082314-2	Measured	8/23/14 14:33:17	495632.188	7173263.475	0.005	173.664	163.948	9.716	0.010	
SS67	CSSS67	CS SS67 082314-3	Measured	8/23/14 17:21:37	495632.194	7173263.466	0.006	173.656	163.940	9.716	0.010	
SS67	CSSS67	CS SS67 082414-1	Measured	8/24/14 10:25:56	495632.190	7173263.465	0.005	173.668	163.952	9.716	0.008	
SS67	CSSS67	CS SS67 082414-2	Measured	8/24/14 15:20:41	495632.196	7173263.473	0.005	173.661	163.945	9.716	0.007	
SS67	CSSS67	CS SS67 082414-3	Measured	8/24/14 18:50:50	495632.188	7173263.478	0.005	173.657	163.941	9.716	0.009	
SS67	CSSS67	CSSS67 CHK1	Measured	9/2/14 16:03:21	495632.188	7173263.477	0.006	173.669	163.953	9.716	0.010	
SS67	CSSS67	CSSS67 CHK2	Measured	9/2/14 18:01:09	495632.183	7173263.477	0.005	173.660	163.944	9.716	0.009	
Insert rows of new observations above this row.												
				Average:	495632.189	7173263.472		173.662	163.946			
				Nominal (8/14/13):	495632.186	7173263.480		173.659	163.943			
				Delta (avg-nom):	0.003	-0.008		0.003				
				Standard Deviation (SD):	0.006	0.007		0.007				
				Precision (1 SD):	± 0.006			± 0.007				
				95% Prediction Interval	± 0.013	± 0.014		± 0.015				



Horizontal gridline interval = 1 cm in all plots.

Figure 6-1. Control Charts for Check Shot Data

JACOBS

Standard Operating Procedure

Differential Global Positioning System Surveying

Document No: JE-SOP-1001	Page: 1 of 5
Effective Date: 29 October 2015	Rev. 1

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
2.0 EQUIPMENT 1
3.0 PROCEDURES 1
3.1. Initializing a Survey Session 2
3.2. Quality Assurance/Quality Control 3
4.0 SURVEY DATA REPORT 4
5.0 REFERENCES 5

ATTACHMENTS

Attachment 1 Alaska Universal Transverse Mercator Zone Map
Attachment 2 Alaska State Plane Zones NAD83
Attachment 3 Template Survey Table

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures for land surveying utilizing a differential global positioning system (DGPS) instrument. This SOP defines a standard set of procedures that will result in defensible survey data meeting data quality objectives for the Drury Gulch Formerly Used Defense Site. These procedures may be varied or changed as required by actual site conditions, equipment limitations, or other factors, but any variances will be documented in the field notes in accordance with the quality assurance/quality control (QA/QC) requirements (Section 3.4). Project contract documents define the specific data quality objectives that must be met, and project work plans should describe the general nature of the surveying to be performed. Other potentially useful guidance documents are listed in the references section.

2.0 EQUIPMENT

Global positioning system (GPS) surveying involves the following equipment:

- Level D personal protective equipment
- Differential GPS (e.g., Leica Viva Uno, Trimble® GeoXH6000)

3.0 PROCEDURES

Position measurements recorded using GPS instruments will be referenced to continuously operating reference stations (CORS) and/or survey monuments. Preferably, locations of reference survey monuments or control points will be recorded by DGPS to verify reference location and position accuracy. Preferably, monument and control point coordinates will meet the following criteria:

- Provide accuracy better than 0.5 meters horizontally,
- Horizontal coordinates will be referenced to World Geodetic System 1984 (WGS 84) or North American Datum 1983 (NAD 83) (avoiding the complications of North American Datum 1927 [NAD 27])
- No detectable disturbance to the monument or surrounding ground

Monument and control point locations may be obtained from National Geodetic Survey (NGS) data sheets, existing reports, government-furnished material, or previous surveys. If NGS monuments are unavailable, alternate control points may be established at stable locations and will consist of one of the following:

- Rebar with cap (in soil)
- Hub (2-inch-by-2-inch-by-4-inch wooden stake) with tack (in soil)
- Magnetic nail (in asphalt)
- Etching on a permanent surface (e.g., rock outcrop or concrete slab)

Newly established control points may be utilized if repeat measurements taken over the course of one or more hours meet QA/QC and accuracy specifications described in Section 3.4.

3.1. Initializing a Survey Session

A new survey job will be created in the DGPS datalogger for each project, preferably for each day of surveying. The name of the job will include site, project, and time-specific information enabling subsequent survey data users to identify data contents and applicable dates. Survey quality control check shots and other QA/QC tasks will be collected in accordance with Section 3.4.

All points, lines, or areas collected will be named in a consistent fashion, preferably using a pre-loaded code list (preferably SDSFIE 2.6 or 3.0 compliant) as shown in Table 1, a group of shorthand names for features from an industry standard data set, or a key for the shorthand will be included in the survey team logbook (e.g., Point ID equals location ID) (USACE 2011).

Table 1
Survey Code List

Code	Code Name	Survey Feature Attributes
Structure Codes		
BBC	BuildingCorner	Actual, Offset, Other
BF	Fence	Metal, Wood, Plastic, Other
BUL	UtilityLocation	Proposed Excavation, Temporary Survey Marks, Power, Natural Gas, Communication, Water, Reclaimed Water, Sewer and Drains, Other
BW	Wall	Stone, Brick, Wood, Concrete, Soldier Pile, Soil Nail, Unknown
Observation Codes		
OL	Observation	Photo, Sketch, Wildlife, Notes, Other
OSL	SampleLocation	Pre-Construction, Post-Construction, Waste Characterization, Soil Characterization, Water Characterization, Work Exposure, Field Screening, Other
Survey Codes		
SCP	ControlPoint	NGS Monument, Other Monument, Temp Control Point, Check Shot
SG	Grid	Sampling, Excavation, Archaeological, Other
SM	MiscPoint	OPEN TEXT
STS	Transect	Geophysical Survey, Excavation Sidewall, Observation Traverse
Topographic Codes		
TBL	BreakLine	OPEN TEXT
TGS	GroundShot	OPEN TEXT
TSL	StationLine	Base Line, Sub-Line, Centerline, Other
TS	Shoreline	Lake, Pond, River, Stream, Ocean, Sea, Former, Other
TTR	TransRoute	Highway, Primary Road, Gravel Road, Dirt Road, Railroad, Trail, Other
TWF	WaterFeature	Lake, Pond, River, Stream, Ocean, Sea, Former, Other
Exploration		
XBH	Borehole	OPEN TEXT
XMW	Well	Monitoring Well, Lysimeter, Water Well
XMZ	LandManageZone	Excavation, Stockpile, Storage Area, Staging Area, Area of Interest, Other
XPW	PiezoWell	OPEN TEXT
Environmental Codes		
AST	AST	Gasoline, AvGas, Diesel, Arctic Diesel, Lube Oil, Used Oil, Bunker C, Sewage, Water, Chemicals, Other
UST	UST	Gasoline, AvGas, Diesel, Arctic Diesel, Lube Oil, Used Oil, Bunker C, Sewage, Water, Chemicals, Other
UXO	UXO	OPEN TEXT

3.2. Quality Assurance/Quality Control

Quality of survey data will be assessed based on the horizontal and vertical quality reported by the GPS system for each point collected and comparison of survey check shots. Quality assurance

measures will include the collection of check shots on known monuments or other control points during each survey session (National Oceanic and Atmospheric Administration [NOAA] 2011, USACE 2003).

The surveyor will document setup and operations in the field logbook, preferably as follows:

- Sketch of each monument or control point set or occupied (non CORS setups)
  - Include distance and direction to a fixed object
- Sketch of the survey with point numbers in areas with high point density
- Coordinates and coordinate system entered into the base station each time it is set up
- Any change in rover height and the time of the change
- Variance from the SOP
  - Description of why the change was made
  - An assessment of the impacts to survey quality.

The following procedures will be conducted and noted in the field logbook for each survey session (if applicable):

- Take check shots on a known control point or monument:
  - Prior to data collection (1 location)
  - Post data collection (1 location, same as initial locations)

Survey accuracy will be estimated as described below:

Two Standard Deviation Estimated Accuracy

$$Easting(E) Accuracy: Acc_E = 2 * \sqrt{|E_a - E_m|^2{}_1 + |E_a - E_m|^2{}_2 + \cdots + |E_a - E_m|^2{}_n}$$

$$Northing(N)\ Accuracy: Acc_N = 2 * \sqrt{|N_a - N_m|^2{}_1 + |N_a - N_m|^2{}_2 + \cdots + |N_a - N_m|^2{}_n}$$

$$Elevation(V)\ Accuracy: Acc_V = 2 * \sqrt{|V_a - V_m|^2{}_1 + |V_a - V_m|^2{}_2 + \cdots + |V_a - V_m|^2{}_n}$$

Combined Positional Estimated Accuracy

$$Positional(P)\ Accuracy: Acc_P = \sqrt{Acc_E{}^2 + Acc_N{}^2}$$

a = actual/published value
m = measured value
Acc = Accuracy

The following additional features will be collected as needed to assist quality assurance evaluation:

- Permanent site features (e.g., slab corners, fire hydrants, rock outcrops)
- Aerially recognizable features (e.g., intersections, bends in roads/rivers, field corners)

4.0 SURVEY DATA REPORT

Northing, easting, and vertical (if applicable) coordinates will be reported in the systems outlined below unless a different system is required by the project statement of work:

- Projection: Universal Transverse Mercator (UTM) in UTM Zone 7N (Attachment 1) and Alaska State Plane Zone 2 (Attachment 2)
- Horizontal Datum: WGS 84

- Vertical Datum: NAVD 88 (orthometric heights from Geoid 09)

A summary survey table will report survey data with the at least the following fields:

- Point ID
- Description
- Northing Coordinate (Y)
- Easting Coordinate (X)
- Orthometric Elevation (Z)
- Ellipsoid Height
- Date and Time Taken
- Survey Duration
- Survey Method
- Survey Equipment Used
- Spatial Reference
- Positional Precision
- Height Precision
- Positional Accuracy
- Height Accuracy

Attachment 2 is provided for Alaska State Plane zone reference as this coordinate system was often used for previous surveys. X, Y, and Z coordinates will be reported in the survey table using the units specified in the project statement of work. A template survey table is included as Attachment 3.

5.0 REFERENCES

NOAA (National Oceanic and Atmospheric Administration). 2011 (August). NGS (National Geodetic Survey). *User Guidelines for Single Base Real Time GNSS Positioning*

USACE. (U.S. Army Corp of Engineers). 2012 (March). *Survey Markers and Monumentation.* Engineering Manual (EM) 1110-1-1002.

USACE. 2011 (October). Alaska District. *Manual for Electronic Deliverables*.

USACE. 2009 (October). Alaska District. *Manual for Electronic Deliverables*.

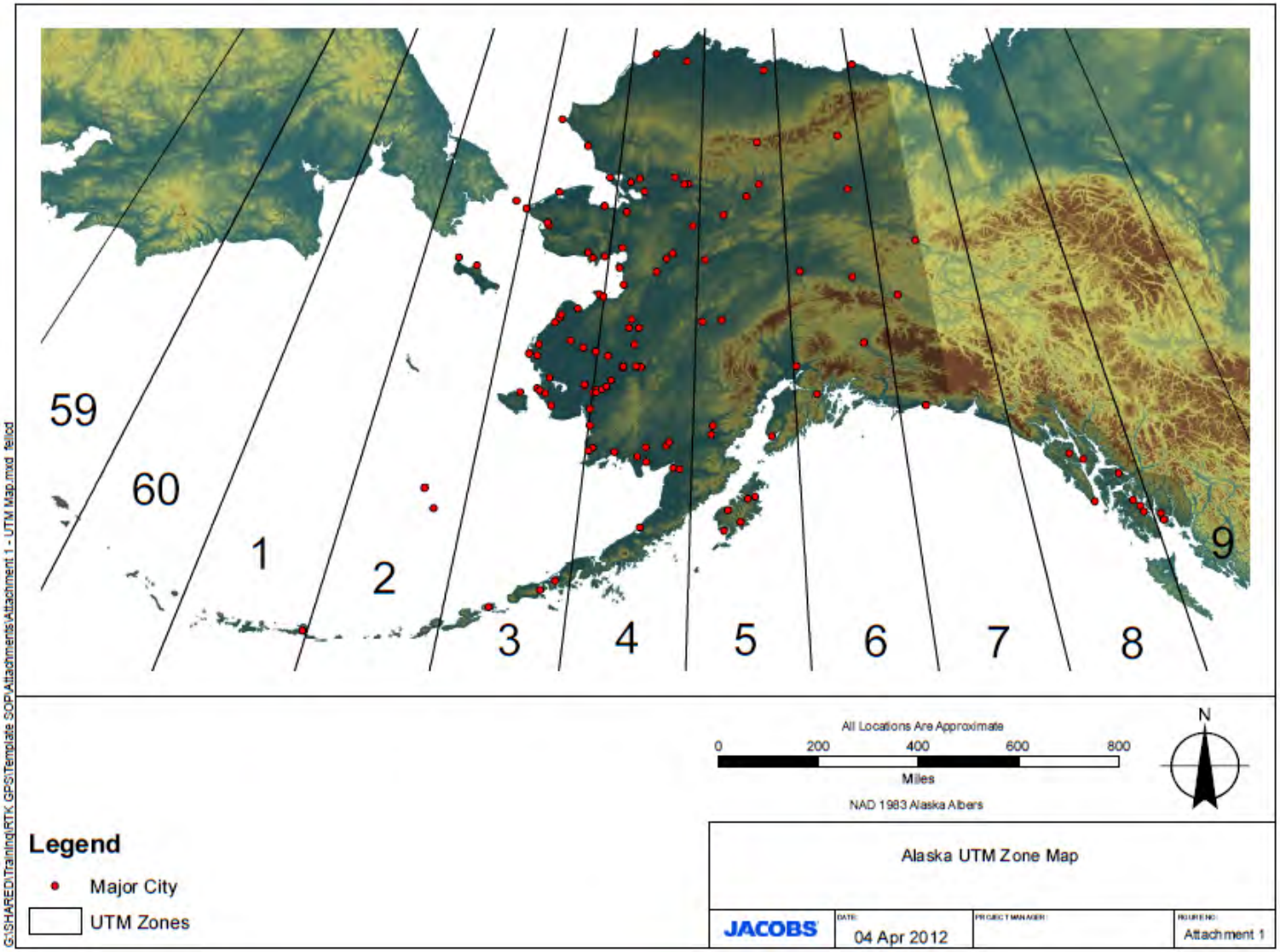
USACE. 2007 (January). *Control and Topographic Surveying*. EM 1110-1-1005.

USACE. 2005 (September). *Geospatial Data and Systems*. EM 1110-1-2909.

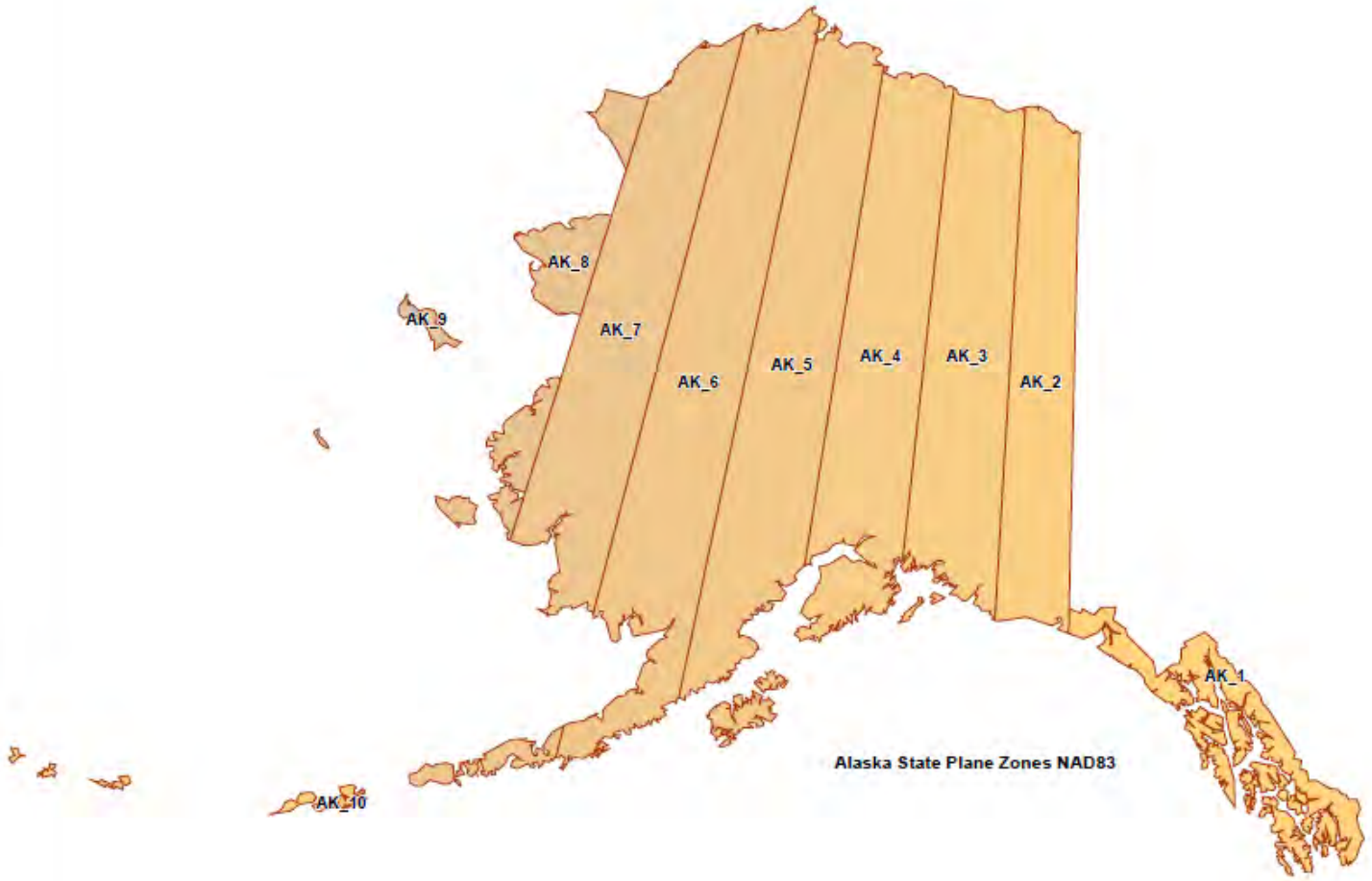
USACE. 2003 (July). *NAVSTAR Global Positioning System Surveying*. EM 1110-1-1003.

USAF (U.S. Air Force). 2005 (December). *Contractors Guide*.

Attachment 1 Alaska Universal Transverse Mercator Zone Map



Attachment 2 Alaska State Plane Zones NAD83



Attachment 3 Template Survey Table

Point ID	Northing	Easting	Orthometric Height	Ellipsoid Height	Description	Date Time Taken	Survey Duration	Survey Method	Survey Equipment	Projection	Geographic Datum	Position Accuracy	Height Accuracy	Position Precision	Height Precision	Position UOM	Elevation UOM	Quality UOM
Example1	1111000.00	256897.00	59.50	50.50	Test data point	3/2/2012 10:15	3/2/2012 to 8/2/2012	RTK-GPS	Leica Viva	UTM Zone 4 North	WGS 1984	0.05000	0.11000	.0023	.0056	Meters	Meters	Meters

JACOBS

Standard Operating Procedure

Document No: JE-SOP-1400	Page: 1 of 2
Effective Date: 14 March 2013	Rev. 0

Contaminated Soil Removal

Table of Contents

1.0 SCOPE AND APPLICATION 1
1.1. Contaminated Soil Waste Containers, Handling, and Disposal 1
1.2. Potential Interferences 1
2.0 EQUIPMENT 1
3.0 PROCEDURES 2
4.0 HEALTH AND SAFETY 2

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures for excavation and removal of contaminated soils. Field and analytical samples will be collected from locations designated in the site-specific Work Plan were contaminants have been detected or are suspected to be in concentrations above the Alaska Department of Environmental Conservation (ADEC) cleanup levels per the Alaska Administrative Code (AAC), Title 18, Chapter 75 (18 AAC 75).

Field screening (e.g. photoionization detector [PID], Niton x-ray fluorescence [XRF], Ultra-Violet Optical Screening Tool [UVOST], PetroFLAG hydrocarbon detection device, etc.) may be conducted to determine contamination and excavation boundaries. Excavation will continue vertically and horizontally until the field screening readings are less than their specific screening criteria. Analytical samples will then be collected from the floors and sidewalls. This SOP defines a standard set of procedures that may be varied or changed as required by site conditions, equipment limitations, or other factors. Actual collection procedures and variances from this SOP will be documented in the field logbook.

Analytical soil samples will be collected as described in the Attachment B-1, Field Sampling Plan of the LTMM plan.

1.1. Contaminated Soil Waste Containers, Handling, and Disposal

All waste will be handled in accordance with the site-specific Work Plan and Waste Management Plan. Anticipated solid waste includes personal protective equipment (PPE) and disposable sampling equipment. Waste that has come into contact with potentially contaminated material will be placed into Super Sacks and transported offsite for disposal. If grossly contaminated soil containing free product is encountered, then the truck beds will be lined to prevent contamination from leaking during transport. General trash will be segregated and transported a local landfill for disposal. The most appropriate onsite staging location will be determined upon arrival at the sites.

1.2. Potential Interferences

If the volume of contaminated soil was underestimated and more soil is in need of removal than anticipated, then the Project Managers will assess the need for additional Super Sacks, waste-transportation support, and field time. In the unlikely scenario that buried waste is encountered during the excavation, further investigation will need to take place.

2.0 EQUIPMENT

Soil removal equipment may include, but will not be limited to, the following:

- Appropriate PPE (at a minimum, steel-toed safety boots, safety glasses, hard hats, high visibility safety vests, and nitrile gloves). Additional PPE may be required depending on site-specific contaminants of potential concern. Refer to the site-specific Accident Prevention Plan or Health and Safety Plan.
- Backhoes, flat bed trailers, all-terrain vehicles, and other heavy equipment, as needed

- Heavy-duty polyethylene bags (Super Sacks)
- Non-sparking tools
- Sorbent pads and sorbent booms
- Field sampling equipment (e.g. PID, XRF, UVOST, PetroFLAG)
- Analytical sample equipment, including sample jars and coolers
- Global Positioning System survey equipment
- Survey stakes, pin flags, or something similar to mark excavation locations
- Tape measures
- Shovels, trowels, or other digging tools
- Buckets
- Chain-of-custody labels and forms
- Cameras
- Logbooks

3.0 PROCEDURES

Removal actions will include the following definable features of work:

- Mobilize all equipment and personnel to the site and install adequate temporary fencing around the excavation area as needed. Safety signage and truck-crossing signs will be installed prior to and during excavation activities.
- Plot and mark area for excavation.
- Excavate the sample locations as described in Attachment B-1, Field Sampling Plan of the LTMM plan.
- Achieve cleanup levels by creating lateral clean boundaries surrounding contaminated soil as determined by field screening, analytical samples, and field observations.
- Segregate contaminated soil to be treated or disposed of offsite.
- Verify soil contamination boundary using the appropriate field screening device (the number of readings per excavation will vary based on the excavation size).
- Collect analytical confirmation samples from the floor and sidewalls from the highest of the field screening readings, if applicable.
- Once a clean boundary in the excavation is achieved, as determined by the field screening device or analytical sample results, the excavation will be backfilled using uncontaminated soil.
- Record in the field logbook the dimensions of the soil removal plot, depth, estimated volume, Global Positioning System location, sample identification numbers, and other observations.

4.0 HEALTH AND SAFETY

Procedures for working with potentially hazardous materials, as well as the relevant Material Safety Data Sheets for each chemical that will be used at the site, are included in the site-specific Accident Prevention Plan or Health and Safety Plan. Personnel using this procedure must be trained on the information contained in the Material Safety Data Sheets, engineering controls, and the PPE outlined in this procedure.

All soil will be treated as potentially containing contaminants of potential concern. Care must be used when handling soil samples to prevent the possible spreading of contaminants in the work area.

JACOBS

Standard Operating Procedure

Underground Utility Clearance for Drilling and Test Pitting

Document No:	Page:
JE-SOP-1600	1 of 6
Effective Date:	Rev.
12 July 2016	1.0

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
2.0 TYPICAL WORK FLOW 1
3.0 MARKING AND REVISING WORK LOCATIONS 1
4.0 REVIEWING UTILITY MARKINGS FOR COMPLETENESS 2
5.0 MAINTAINING UTILITY MARKINGS 3
6.0 OFFSETS FROM MARKED UTILITIES FOR UNRESTRICTED DRILLING 4
7.0 HAND-CLEARING PROCEDURES FOR ALASKAN SOILS 5
8.0 SITE RESTORATION 6
9.0 REFERENCES 6

ATTACHMENTS

Attachment 1. Figures
Attachment 2. HSEP 7.3.3 *Utility Clearance*

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the Alaska-specific procedures for utility clearance prior to drilling (or test pitting or excavation; test pitting or excavation is implied throughout this SOP as drilling is discussed). This SOP builds on Health, Safety, and Environmental Procedure (HSEP) 7.3.3 *Utility Clearance* (Attachment 2) and provides additional detail regarding:

- Marking and revising work locations (stakeout)
- Maintaining utility markings
- Guidance for offsets from utility markings for drilling without hand clearing

In cases where hand clearing is required, this SOP supplants Section 4.3 *Clearance Step 3* in HSEP 7.3.3 with alternative and equally or more protective procedures describing:

- Hand clearing in Alaskan soils where hand augering frequently meets refusal.

Variances from HSEP 7.3.3 have been reviewed and approved by Jacobs corporate Health and Safety. Approval correspondence is on file on the Anchorage Operations network in the home folder for this SOP.

2.0 TYPICAL WORK FLOW

Prior to beginning drilling activities, utility clearance of the proposed boring locations will be completed. Proposed boring locations will be marked as described in Section 3.0.

Utility locate procedures will be performed in accordance with the Alaska Statute Section 42.30 and will include, at a minimum, an Alaska Digline locate request and procedures in HSEP 7.3.3. Military installations generally require their own form to be completed (e.g., Eielson AFB and JBER use a Base Civil Engineering Work Clearance Request, whereas Fort Wainwright uses an Excavation Clearance Request), which requires coordination with potentially affected entities. The exact process varies from installation to installation. Work with the civil engineering detachment to determine all necessary actions and approvals prior to breaking ground.

Utility locators typically provide services that fulfill Clearance Step 2 (HSEP 7.3.3 Section 4.2) with respect to geophysical methods and marking paint. Jacobs may choose to augment these services with its own geophysical surveys. Jacobs reviews the markings for conflicts with drilling locations

and makes adjustments as described in Section 3.0. Jacobs also reviews the utility markings for completeness (Section 4.0). As conflicts and omissions become apparent, it may be necessary to request additional site visits by locators.

Jacobs completes the Utility Clearance Permit for Alaska Operations (Attachment 1) and includes a map of the site prepared as described in Section 5.0.

The Site Manager personally inspects and approves each location before drilling. The Site Manager conducts a final review of utility markings for completeness. In the event that prescribed offsets from marked utilities (Section 6.0) cannot be achieved, hand clearing is conducted in accordance with Section 7.0, and the Site Manager will inspect and approve the identified drilling location.

After drilling and final surveying is complete for a site, all whiskers and pin flags are pulled and all markings in frequently used areas are covered with black or gray paint to minimize aesthetic impacts (Section 8.0).

3.0 MARKING AND REVISING WORK LOCATIONS

Figure 1 (in Attachment 1) illustrates markings for planned, rejected, and approved drilling locations.

Mark planned drilling locations with a location circle (an open circle approximately 1 foot in diameter) of white paint. Label the location by writing on the ground with white marking paint. If the ground surface is not amenable to painting (e.g., grass, forest), drive a labeled piece of lath, a nail with white whiskers and a scribable metal-foil tag, or something similar to mark the location. Include an open circle as part of the label.

Paint a clearance circle (not shown in Figure 1) around the location in white with a radius of approximately 15 feet. This is the area to be cleared by utility locators.

If there is a utility conflict with the planned location after the utilities have been marked, (see Section 6.0 for required offsets), the location can be moved to any clear point within the clearance circle without requiring a new utility locate. Consult the LTMM plan and the project technical lead to determine whether the location may be moved. If movement is permitted, paint a new location circle and label it (move any lath, whiskers, or tags), and paint a white wavy line through the old location to indicate its rejection while preserving it as a point of reference during fieldwork. If movement is not permitted, hand clearing (Section 7.0) will be required.

If drilling within the clearance circle is not possible, a new location will need to be identified with concurrence from the project technical lead and stakeholder approval as required by the LTMM plan, and new utility locates will be required. Paint the new location circle (move any lath, whiskers, or tags) and clearance circle, paint a white wavy line through the old location circle, and paint out the old clearance circle with black or gray paint (whichever best matches the surrounding surface). At a minimum, locators from each of the utilities present at the site must revisit the site and mark utilities within the new clearance circle. If location adjustments are extensive, initiating a new dig permit/Work Clearance Request may be the best course of action to assure ourselves and the facility and utility owners that due diligence has been pursued.

The Site Manager is responsible for final approval of all locations before drilling. The Site Manager will indicate approval by initialing and adding crosshairs to the location circle using white paint (or similarly annotating the lath or tag, or writing on a white pin flag). If the approval marking becomes illegible or is disturbed, the Site Manager must reapprove the location before drilling can begin.

If refusal occurs during drilling and the LTMM plan allows offsets, the revision process outlined above must be followed before an offset location may be drilled.

4.0 REVIEWING UTILITY MARKINGS FOR COMPLETENESS

Unmarked utilities present the greatest likelihood for inadvertent encounters with potentially disastrous consequences if contact is made with high voltage or high-pressure gas. Locators may

overlook some lines on complex sites, and some utility managers may be resistant to putting paint on the ground.

In order to identify unmarked utilities, Jacobs will review the marked site and take appropriate actions until the following questions can be answered affirmatively:

- Electrical: Do all buildings, transformers, lights, and vehicle plug-ins have marked lines or overhead connections?
- Gas: If natural gas is used for heating buildings in the area, have the main and distribution line been marked or determined to lie outside the area of drilling?
- Fuel: If liquid fuel lines are in the area, have they been marked or determined to lie outside the area of drilling?
- Water and sewer: If a building or fire hydrant or irrigation system is present, have the water and sewer/septic system lines been marked or determined to lie outside the area of drilling?
- Communications: If a building is present, have all exterior conduits heading underground been marked or determined to pass outside the area of drilling?
- Other utilities: Examples of other utilities are steam, hot water, and ethylene glycol from a central heating plant. If other utilities are in the area, have they been marked or determined to lie outside the area of drilling?
- Culverts and storm drains: Have all ditches and depressions been checked for culverts and storm drains? Have all culverts and storm drains been marked or determined to lie outside the area of drilling?
- Manholes (or monuments or other utility markers). Have the utilities relating to these features been marked or determined to lie outside the area of drilling?
- As-built drawings. Have all utilities been marked that are shown on the drawings to lie within the area of drilling?

As a final check, the Site Manager will sweep each location with a Schonstedt (or similar) magnetic anomaly detector and make any necessary adjustments in coordination with the project technical lead to avoid anomalies. If the anomaly is suspected to be a utility, then the utility offsets in Section 6.0 apply. If the anomaly is believed to be unrelated to utilities (e.g., rebar, buried debris, or buried drums), an offset of at least three feet will be used. This step does not fulfill Clearance Step 2 of HSEP 7.3.3; that service is provided by the utility locators and by any specific additional geophysical work deemed necessary by Jacobs.

5.0 MAINTAINING UTILITY MARKINGS

Industry best practices (CGA 2016) and USAF (2016) guidance state that the contractor is responsible for maintaining utility markings by staking, sketch mapping, or photographing them. Jacobs will fulfill this responsibility as follows:

- Markings around each drilling location will be photographed when fresh.
- Markings will be mapped site-wide with sufficient detail to support their maintenance until drilling is complete. A sketch map is sufficient for simple sites, whereas complex sites will require additional effort such as swing ties for critical segments or surveying using the real-time kinematic (RTK)-global positioning system (GPS) equipment to support the production of accurate maps.

Markings will be periodically repainted before they fade or are erased by normal wear and tear. If doubts subsequently arise about the exact location of a mark, another site visit by the appropriate locator to re-mark the utility will be requested.

Even when markings are well maintained, dig permits generally state that work must begin within 30 days of final approval, or a new dig permit will be needed. A new dig permit may also be needed

after a hiatus in work of more than 30 days. Discuss these situations with the Base Civil Engineer, who may elect to extend the existing dig permit.

6.0 OFFSETS FROM MARKED UTILITIES FOR DRILLING WITHOUT HAND CLEARING

Commercial and military locators typically instruct that marked utilities should be given a minimum clearance of 2 to 6 feet, depending on the nature of the utility, for drilling without first hand clearing. HSEP 7.3.3 *Utility Clearance* is vague on this point, stating only that hand augering must be done "when there is a potential to impact buried utilities". Table 1 provides minimum offsets from marked utilities based on potential lethality, mission criticality, and depth of burial. These offsets exceed the minimums established by industry best practices (CGA 2016) and the USAF (2014), and they are equal to those of ENSTAR (2016). Table 2 provides modification factors based on risk factors that reduce the confidence with which a utility's location can be determined. Adherence to the minimums and modification factors is not an absolute guarantee that utilities will be avoided; locators can make mistakes or omit features, paint on the ground does not necessarily indicate a positive delineation, and utilities can follow unexpected paths.

If drilling at the minimum offset, call the locator and discuss the quality of the locate.

Table 1.
Minimum Offsets from Marked Utilities Positively Delineated by Geophysical Methods

Potential Lethality or Mission Criticality	Type of Buried Utility	Default Depth	Minimum Offset*
High	Electric >240V - 50kV	3 feet	8 feet
	Fuel Main		
	Gas Main		10 feet
Medium	Communications	3 feet	5 feet
	Electric <=240V		
	Gas Distribution		
	Sewer (pressurized)		
	Water	8 feet	10 feet
	Water (insulated), Steam, Ethylene Glycol	4 feet	6 feet
Low	Culvert	3 feet	3 feet
	Sewer (gravity flow)	8 feet	10 feet
	Storm Drain	3 feet	3 feet
	Utilidor		
Other	Unknown non-utility Schonstedt response	–	3 feet

Notes
* Use of the minimum offset requires positive geophysical delineation adjacent to the proposed drilling location and reported depth less than or equal to the nominal depth. Otherwise, apply the modification factors in Table 2.
V = volts, kV = kilovolts

Table 2.
Modification Factors for Minimum Offsets Based on Additional Risks

Additional Risk Factor	Offset Increase
Geophysics not definitive but utility daylights within 50 feet both directions	2x
Geophysics not definitive but utility daylights within 50 feet one direction	3x
Geophysical methods not definitive, no surface manifestations	4x
Depth greater than the default	1 foot per foot

7.0 HAND-CLEARING PROCEDURES FOR ALASKAN SOILS

If drilling is required closer to a marked utility than permitted by Tables 1 and 2, hand clearing must be employed to a depth at least 1 foot deeper than the expected depth of the utility or must encounter the utility. Hand clearing tools and their limitations include (but are not limited to) the following:

- Shovel – 1-foot-wide hole to 2 feet deep, stopped by compacted gravel
- Post-hole digger – 0.5-foot-wide hole to 2 feet deep, stopped by cobbles
- Hand auger – 0.25-foot-wide hole to 8 feet or more, stopped by loose or compacted gravel
- Vacuum truck (or similar, e.g., Tornado Jumbo air-powered vacuum) and air knife -- 0.75-foot-wide hole to 8 feet or more, stopped by large cobbles

Hand clearing should not be attempted for direct-buried utilities in compacted soil because the force necessary to penetrate the soil will also be sufficient to penetrate the utility. Electric lines must be de-energized before hand clearing unless protected by a conduit. Gas distribution lines should have shutoffs identified before hand clearing. Fuel and gas mains are generally strong enough to withstand the forces of hand clearing. Determine the nature of the line before digging and adjust the force of digging appropriately.

Hand digging can proceed following one of three strategies:

- Utility daylighting. Positively identify the utility by exposing it. Dig multiple holes extending to native soil (if identifiable) or 1 foot (or 25 percent, whichever is greater) deeper than the expected depth of burial until the utility is discovered and its exact trajectory can be discerned. Drill at a sufficient distance (generally at least 1 foot plus half the burial depth) so that any wandering of the drill bit does not risk striking the utility.
- Overclearing. Select a location that is not expected to directly overlie the utility and dig a hole extending to native soil (if identifiable) or 1 foot (or 25 percent, whichever is greater) deeper than the expected depth of burial. Enlarge the hole to 120 percent of the typical diameter of a boring with the utilized drilling tooling. Scan the hole with a Schonstedt magnetic anomaly detector and proceed with drilling if free of anomalies.
- Side clearing. When the LTMM plan requires shallow soil cores (e.g., for samples for volatile organic compounds in the vadose zone), drilling takes place adjacent to one or more cleared holes and is offset from those holes parallel to the marked utility. Select a location as far from marked utilities as possible and dig one or more holes extending to native soil (if identifiable) or 1 foot (or 25 percent, whichever is greater) deeper than the expected depth of burial until a width of at least twice the borehole diameter has been cleared perpendicular to the marked utility. Scan the holes with a Schonstedt magnetic anomaly detector and proceed with drilling if

free of anomalies. Use the minimum offset necessary to avoid having the drill bit wander into the clearance holes.

- Figure 2 (in Attachment 1) shows the spatial relationships between the marked utility, hand clearance holes, and cleared areas for drilling for each of these strategies. Daylighting is the preferred method of hand clearing and allows for continuous soil coring from the surface, but multiple holes may be needed to discover the utility. Overclearing requires only a single large hole but precludes soil coring from the dug interval and does not positively locate the buried utility. Side clearing allows for continuous soil coring from the surface but does not positively locate the buried utility and is recommended only for shallow utilities (no more than 4 feet deep) because of the chance for drill bit wandering at greater depths.

8.0 SITE RESTORATION

After drilling and final surveying is complete for a site, all whiskers and pin flags should be pulled and all markings in frequently used areas should be covered with black or gray paint to minimize aesthetic impacts.

9.0 REFERENCES

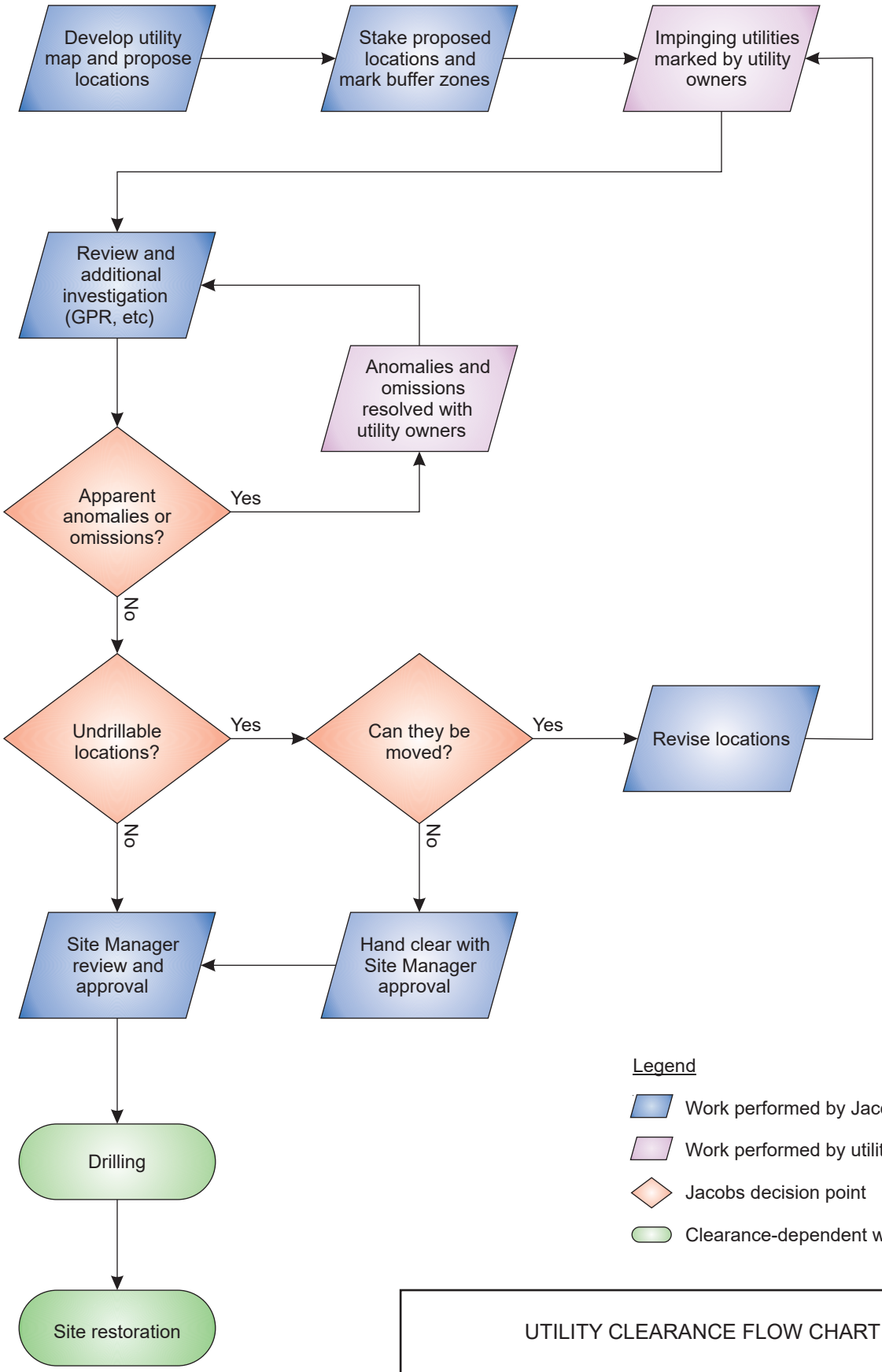
CGA (Common Ground Alliance). 2016. *Best Practices 13.0*. https://www.digalert.org/pdfs/bestpractices.pdf. Accessed 25 March 2016.

ENSTAR. 2016 (March). *Excavators & Contractors*. https://www.enstarnaturalgas.com/safety-education/natural-gas-safety/safety-for-excavators-contractors/. Accessed 25 March 2016.

Jacobs (Jacobs Engineering Group Inc.). 2012 (September). *HSEP 7.3.3 Utility Clearance*.

USAF (US Air Force). 2014 (July). *Safeguarding Utilities from Damage*. 673d Air Base Wing Instruction 673-ABWI-32-1007.

Attachment 1. Figures

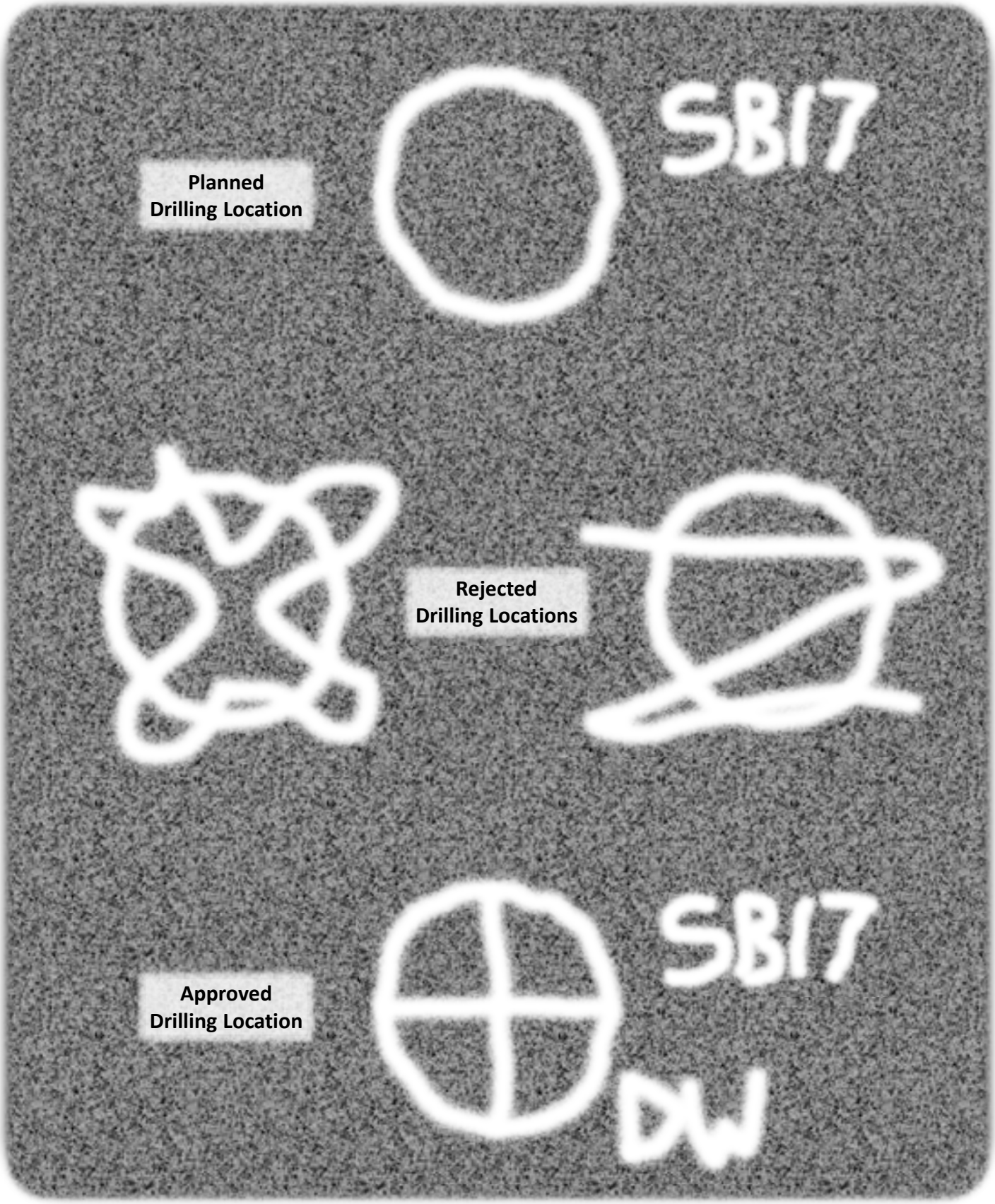


UTILITY CLEARANCE FLOW CHART

ALASKA OPERATIONS

JACOBS	DATE: 06 Jun 2017	SAFETY MANAGER: K. McGovern	FIGURE NO: 1

G:\SHARED\SOPs\UE-SOP-1600 UtilityClearance\Attachments\Att 1 Fig 1 Flowchart.cdr



~ 1 foot

Scale

MARKING AND APPROVAL OF DRILLING LOCATIONS

ALASKA OPERATIONS

JACOBS	DATE: 22 APR 2016	SAFETY MANAGER: K. MCGOVERN	FIGURE NO: 2

I:\G\SHARED\SOPs\JE-SOP-1600 Utility Clearance\Attachments\Att 1 Fig 1 Marking&Approval.pptx

Attachment 2. HSEP 7.3.3 *Utility Clearance*

JACOBS

HSE Procedure		Document No: HSEP 7.3.3	Page: 1 of 6
Utility Clearance		Supersedes: Rev. 4	Rev. 5
Issuing Department: Corporate HSE	Approval: Vice President HSE	Previous Rev. Date: 10-May-11	Current Revision Date: 01-Sep-12

Table of Contents

1.0 PURPOSE AND SCOPE 1
2.0 RESPONSIBILITIES 1
3.0 DEFINITIONS 1
4.0 PROCEDURE 1
4.1. Clearance Step 1 2
4.2. Clearance Step 2 2
4.3. Clearance Step 3 3
4.4. Trenching and Excavations 4
4.5. Other Requirements 4
4.6. Above Ground Utility Lines 4
4.7. Approval 5
4.8. Existing Utility Repair 5
5.0 REFERENCES 5
6.0 FIGURES 5
Utility Clearance Permit 6

1.0 PURPOSE AND SCOPE

To establish Health, Safety, and Environment (HSE) requirements to minimize, and to the extent possible, eliminate the risk to personnel and property from contact with buried or aboveground utility service lines.

This Work Instruction applies to all field activities where there could be contact with aboveground utilities or sub-surface utilities or related service lines.

2.0 RESPONSIBILITIES

Specific HSE Program implementation responsibilities are stated in HSEP 1.5. Additional management, staff, employee, and subcontractor responsibilities are stated in individual procedures that address responsibilities specific to the HSE topic.

3.0 DEFINITIONS

None

4.0 PROCEDURE

For work involving buried utilities and service lines:

- All three of the following Clearance Steps shall be utilized prior to drilling.
- Follow clearance Steps 1 and 2, in addition to the requirements set forth below for trenching and excavation, before any trenching or excavation work is done.

Copyright © 2012 Jacobs Engineering Group Inc.
All rights reserved. The contents of this document are proprietary and produced for the exclusive benefit of Jacobs Engineering Group Inc and its affiliated companies. No part of this document may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written approval of Jacobs Engineering Group Inc.

The applicable version of this document resides in the Business Practices section of http://JNet.jacobs.com.. All copies are considered to be uncontrolled.

4.1. Clearance Step 1

Prior to field activities, appropriate property maps, blue lines, and/or as-builts will be examined in an effort to locate underground utility and service lines. Such reviews shall be supplemented by interviews of knowledgeable facility engineering and maintenance personnel.

During the project site walk, any discrepancies or new information regarding utility locations will be added to project maps.

For projects on Federal land, facility-engineering personnel will be asked to provide utility clearance and sign off. The Site Manager shall obtain and submit proper facility utility service clearance request forms.

For projects within local government jurisdiction, the Site Manager shall request the services of the local utility locater service.

If the project occurs in a state or location, which has an agency that conducts utility clearances, they will be notified. The services of State Underground Service Alert (USA), DigAlert, or other appropriate service will be used. The utility locater service will assign a "ticket" number to your site, which shall be recorded. This ticket number is valid for a limited time.

4.2. Clearance Step 2

4.2.1. Sub-surface Survey

Following map reviews, personnel interviews, and use of locater services, one or more of the most appropriate of the following geophysical sub-surface survey methods shall be used to locate underground utility or service lines.

- Electromagnetic (EM) methods,
- Ground penetrating radar (GPR),
- Magnetic survey, and/or
- Pipe locator.

4.2.2. Finding Pipes and Other Objects via Metal Detection

Magnetic detection can be used to find the following:

- Iron, steel, and copper water lines
- Metal gas lines
- Surveying pins (property markers)
- Copper tracer wire
- Copper and aluminum electrical wires
- Steel cables
- Telephone and TV cables
- Aluminum conduit
- Any continuous metal pipe or line

For magnetic detection to work, the target must contain some iron or steel or have an electrical current flowing through it so that a magnetic detector can find it. Nonferrous objects or objects not carrying an electrical current, such as polyvinyl chloride or high-density polyethylene pipe, must be detected by other means.

The strongest signals come from the ends of an object, as this is where the magnetic fields of force tend to concentrate. Therefore, if an object is oriented vertically, it will produce a stronger

Copyright © 2012 Jacobs Engineering Group Inc.

signal than one oriented horizontally. This can make a relatively small object, such as a steel drum, easier to find than a long, cast-iron water main.

The same object buried horizontally will likely produce two weaker signals, one directly above each end—one signal being positive and one being negative. Cast-iron or steel water pipe laid end-to-end will produce a strong signal at each joint, even if the pipes are welded together. Magnetic detection of metal pipes often results in a series of peak signals designating the locations of welded end joints.

Electric cables must be energized to be detected magnetically.

4.2.3. Ground-Penetrating Radar

Ground-penetrating radar (GPR) uses an electromagnetic (radio wave) antenna tuned to a frequency that can penetrate soils, rock, concrete, ice, and other common natural and manmade materials. Such capabilities make radar a prime technique in obtaining geotechnical information and evaluating hazardous-waste sites. As such, it is more suited for use outside of urban areas where natural conditions predominate. Furthermore, a GPR unit requires considerably more time to process than do simpler magnetic detection techniques.

GPR functions in a manner similar to standard aerial radar. A GPR determines subsurface conditions by sending pulses of high-frequency radio waves into the ground from a transmitter antenna located on the surface. Subsurface structures cause some of the wave energy to be reflected back to the surface, while the rest of the energy continues to penetrate deeper. The result is a series of radio "echoes" that delineate underground interfaces such as bedding, cementation, changes in moisture and clay content, voids, fractures, and intrusions as well as manmade objects.

Resolution of radar reflections can be increased by increasing the frequency of the radar waves transmitted into the ground.

GPR is best suited for determining a region’s hydrogeology, which is its main function. Smaller manmade objects such as individual drums and utilities are harder for a GPR to delineate, though a sensitive unit can reveal their locations as part of a general survey.

4.2.4. Marking Utilities

The following color code is recommended for marking utility locations.

- white work location
- red electrical
- yellow gas or oil
- orange telephone
- blue water
- green sewer

4.3. Clearance Step 3

When earth drilling or borings are to be done, hand auger (not to be done with a power auger) will be done to a minimum of seven feet for all locations where there is a potential to impact buried utilities.

Prior to drilling, the hole shall be reamed by hand to a diameter of 120% of the drill bit to be used.

For soil gas surveys, the survey probe shall be placed as close as possible to the hand auger.

In cases where hand augers meet refusal at depths less than seven feet, the following steps will be taken to ensure the cause of the refusal is not an underground utility.

- A geologist or other individual qualified to classify soil shall examine the substrate to ensure it appears to be native and/or undisturbed material.

Copyright © 2012 Jacobs Engineering Group Inc.

- Two additional step-out hand-augered borings shall be drilled approximately two feet laterally from the original boring. The borings shall be located such that a right triangle is formed, with the original boring forming the apex of the 90-degree angle. If these borings also meet refusal at a similar depth to the first boring, and a qualified person determines the soil is native material, hand auger to the total depth of 7 feet will not be required.

4.4. Trenching and Excavations

Prior to groundbreaking, where trenching or excavating will be done, the soil must be probed with a magnetometer. (Magnetometers sense ferrous metallic objects, or iron-rich rock such as basalt, but give no information about objects such as fiberglass or concrete tanks.)

To assist the equipment operator in locating any underground obstructions, a spotter will observe the excavation.

Additional requirements for trenching and excavating activities can be found in HSEPs on this subject.

4.5. Other Requirements

The Project Manager and HSE Manager will determine methods for utility clearance for horizontal and slant boring.

All uncovered utilities must be supported. If support is not required, so indicate under “Deviations From HSEP Approval”, Paragraph 8, on the attached Utility Clearance form.

Utility lines shall be locked-out and/or tagged-out prior to repairs or modifications.

4.6. Above Ground Utility Lines

4.6.1. Working Near Above-Ground Power Lines

Note: This section applies to motorized equipment other than cranes and derricks such as track-hoes, extendable boom forklifts, aerial lifts, etc. Refer to HSEP 17.1 for information on Mobile Crane proximity to power lines.

Minimum clearances for working in proximity to overhead power lines are

Nominal Voltage	Minimum Clearance
0 – 50 kV	10 ft. for any part of the equipment
50 kV+	10 feet + 4 in for each 10 kV over 50 kV, or twice the length of the line insulator, but never less than 10 feet for any part of the equipment

If it is necessary to work within the minimum clearance, the overhead line must be de-energized and grounded or re-routed by the utility company or a qualified electrician or insulating barriers must be installed to prevent contact with the lines. The barriers must be rated for the voltage of the line being guarded and can not be part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

Any work performed within the minimum clearances must have HSE and Site manager review and approval.

4.6.2. Equipment Transit

If the vehicle/equipment is in transit with its structure lowered, the clearance may be reduced to 4 ft. (122 cm). If the voltage is higher than 50kV, the clearance shall be increased 4 in. (10 cm) for every 10 kV over that voltage.

For all other non-electrical utility lines, there must be a minimum of 1.5 feet vertical clearance. If the clearance is less than 1.5 feet, the lines must be rerouted or a spotter must assist the execution of this activity.

Copyright © 2012 Jacobs Engineering Group Inc.

Refer also to HSEP 17.1, Mobile Cranes, and HSEP 19.4, Energized and Potentially Energized Electrical Equipment.

4.7. Approval

The attached Utility Clearance Permit must be completed and signed by the Site Manager or the Project Manager's designee prior to commencement of relevant site work.

The Project Manager after collaboration with the site HSE Officer or HSE Manager must approve deviations from this HSEP. Approval via telephone is acceptable in the event the Project Manager is not on site.

4.8. Existing Utility Repair

Prior to field work, locate the utility shut-offs. Obtain keys and/or tools (or arrange a means to promptly summon the contact person) to access the shut-offs.

Plan other appropriate steps necessary to reduce the emergency response time in the event of a damaged underground line incident, to limit property damage from the leak, and to minimize personnel exposure to a potentially hazardous environment.

When repairing existing utilities, refer to the HSEP for Lock-Out and Tag-Out. Repairs should be made only as directed by utility owners.

5.0 REFERENCES

29 CFR 1926.650 –1926.652, Excavations

29 CFR 1910.333, Selection and Use of Work Practices in Sub-part S – Electrical

29 CFR 1926.955, Provisions for Preventing Accidents Due to Proximity to Overhead Lines

6.0 FIGURES

Figure 1: Utility Clearance Permit

Copyright © 2012 Jacobs Engineering Group Inc.

Figure 1

Utility Clearance Permit

Project: _____ Completed by: _____

Site Location: _____ Date: _____

Reason for Clearance: _____

DESCRIPTION OF ACTIVITY	YES	NO	N/A	DATE	INITIALS
1. Review of Existing Maps					
2. Interviewed Personnel Familiar With Area?					
3. Above Ground Utilities					
a) marked on site maps					
b) necessary to lockout					
c) document procedures used to lockout or re-route					
d) necessary to install insulating barriers					
4. Underground Utilities					
a) State Agency called: (specify)					
Ticket Number:					
b) State name of additional utility called:					
Ticket Number:					
c) Specify geophysical clearance method used:					
Done By:					
d) Utility locations marked with appropriate color code?					
Done By:					
e) Utilities marked on site map (please attach)					
Done By:					
5. Hand auger to _____ feet done by :					
6. Trench/Excavation probed by:					
a) Hand Clearance required:					
7. Clearance Approval Site Manager: HSE Manager: Client Representative:					

Note: Any deviations require Senior HSE and Operations Manager written approval.

Describe Deviations: _____

_____

Justification: _____

_____

Copyright © 2012 Jacobs Engineering Group Inc.

JACOBS

JACOBS

Standard Operating Procedure

Decontamination

Document No: JE-SOP-2000	Page: 1 of 2
Effective Date: 7 May 2018	Rev. 0.1

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
2.0 INTERFERENCES 1
3.0 EQUIPMENT 1
4.0 PROCEDURES 1
1.1. Gross Decontamination 2
1.2. Decontamination of Sampling Equipment 2
1.3. Quality Control 2
5.0 HEALTH AND SAFETY 2
6.0 REFERENCES 2

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for decontamination of re-usable equipment used during sampling activities. Non-disposable equipment shall be decontaminated between sampling locations and at the end of the work shift.

This SOP defines a standard set of procedures that may be varied or changed as required by site conditions, equipment limitations, or other factors. Actual decontamination procedures and variances from this SOP will be documented in the field logbooks.

2.0 INTERFERENCES

Improper decontamination may cause cross-contamination of field screening and analytical samples. To prevent cross-contamination of samples, sampling equipment will be disposable and used only once, or reusable but decontaminated before each use. Manufacturer and/or laboratory-certified clean glassware will be used to contain analytical samples.

3.0 EQUIPMENT

Decontamination equipment may include, but is not limited to, the following:

- Appropriate personal protective equipment (PPE) (at minimum, safety glasses and nitrile gloves)
- 5-gallon buckets
- Potable water
- Distilled water or organic free deionized (DI) water
- Liquinox or similar detergent
- Stiff bristle brushes
- Other hand tools for gross decontamination (e.g. shovels and brooms)
- Logbook

4.0 PROCEDURES

Procedures for decontamination include gross decontamination and decontamination of sampling equipment.

1.1. GROSS DECONTAMINATION

Heavy equipment used onsite will undergo decontamination prior to leaving the site to eliminate contaminant migration from the site as well as the potential for cross-contamination of sites. Gross decontamination includes the removal of potentially contaminated materials with a shovel or other hand tools and stiff bristle brushes for equipment contaminated by soil, and wiping visible contamination from equipment contaminated by water or free product. Materials removed during gross decontamination will be accumulated and managed with similar waste streams according to *Waste Management* standard operating procedure (JE-SOP-2100).

1.2. DECONTAMINATION OF SAMPLING EQUIPMENT

Contaminant-free disposable sampling equipment will be used whenever possible. Non-disposable equipment that may directly or indirectly contact samples (e.g., shovels, buckets, drill stem and tooling, sampling devices, and instruments) shall be decontaminated prior to sampling. Decontamination will take place over catch basins (e.g., wash tubs and buckets) to minimize the spread of contaminants. Re-usable sampling equipment that may be exposed to the samples will be decontaminated with the following steps:

- Scrub and rinse the equipment using a solution of potable water and laboratory-grade detergent (Liquinox or similar product).
- Rinse the equipment with distilled or deionized water until free from suds.

Decontamination water will be accumulated and managed according to the *Waste Management* standard operating procedure (JE-SOP-2100).

1.3. QUALITY CONTROL

The following QC sample may be collected to verify equipment utilized was properly decontaminated before subsequent use.

- Equipment rinsate blank
- Equipment wipe sample

5.0 HEALTH AND SAFETY

Procedures for working with potentially hazardous materials as well as the relevant Material Safety Data Sheets (MSDS) for each chemical that will be used at the site are included in the Site Safety and Health Plan. Personnel using this procedure must be trained on the information contained in the MSDSs, engineering controls, and the PPE used for this procedure.

6.0 REFERENCES

ADEC. 2019 (October). *Field Sampling Guidance*. Division of Spill Prevention and Response Contaminated Sites Program.

JACOBS

Standard Operating Procedure

STOCKPILE CONSTRUCTION AND MAINTENANCE

Document No:	Page:
JE-SOP-2110	**1 of 6**
Effective Date:	Rev.
16 May 2011	**1**

TABLE OF CONTENTS

1.0 GENERAL 1
1.1. Regulations, Guidance, and Resources 1
1.2. Submittals 2
1.3. Delivery, Storage, and Handling of Factory-Manufactured Liners and Covers 3
2.0 PRODUCTS 3
2.1. Equipment 3
2.2. Non-woven Geotextile Liner 3
2.3. Bottom Liner and Top Cover 3
2.4. Netting 4
2.5. Stakes 4
3.0 EXECUTION 4
3.1. General 4
3.2. Preparation of Ground Surface 4
3.3. Geotextile and Liner Installation 4
3.4. Ramps 6
3.5. Final Berming and Closeout 6
3.6. Stockpile Maintenance 6

1.0 GENERAL

The subcontractor shall provide labor, materials, equipment, and incidentals needed to construct and maintain soil stockpiles in accordance with the specifications presented in subsequent text.

1.1. Regulations, Guidance, and Resources

Subcontractor shall ensure that equipment and materials satisfy the specifications, as measured by the stated test methods, and shall verify that the containment system, including the bottom liner and top liner, is adequately installed and sealed to minimize the migration of contaminants.

The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

Alaska Department of Environmental Conservation	
18 AAC 78	*Underground Storage Tank Regulations*
U. S. Environmental Protection Agency	
EPA-5601	*Verification of PCB Spill Cleanup by Sampling and Analysis* (EPA-560/5-85-026). 1985.
Federal Aviation Administration	
	Quality Assurances Program Plan
American Society for Testing and Materials (ASTM) standards	
D4873	Identifications, Storage and Handling of Geosynthetics
D3776	Weight
D1777	Thickness
D4632	Grab Tensile Strength
D4533	Grab Tensile Elongation
D4833	Trapezoid Tear Strength
D4491	Puncture Resistance
D4751	Permeability
D1603	Apparent Opening Size
D2136	Cold Crack
D1603	Black Carbon Content
D3015	Carbon Dispersion
D751A	Tensile Strength for Coated Fabric Liner
D882	One-Inch Tensile Strength
D471	Oil Resistance

1.2. Submittals

The following submittals are required by this specification and shall be submitted in accordance with Section 5 of the Subcontract. Jacobs must approve submittals with a “JA” designation. Submittals having an “FIO” designation are for information only. The following shall be submitted:

Specification Paragraph No.	Description	Designation	Comments
02302-2.2	Cut sheet for nonwoven geotextile	JA	Required to be submitted and approved before Subcontractor’s mobilization to the job site
02302-2.3	Cut sheet for high-density polyethylene liner	JA	Required to be submitted and approved before Subcontractor’s mobilization to the job site
02302-2.3	Cut sheet for high-density polyethylene cover	JA	Required to be submitted and approved before Subcontractor’s mobilization to the job site

1.3. Delivery, Storage, and Handling of Factory-Manufactured Liners and Covers

Factory-manufactured liners and covers shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.

Rolls of factory-manufactured liners and covers shall be marked or tagged in accordance with ASTM D4873 and with the following information:

- Manufacturer's name
- Production date
- Product identification
- Roll number
- Roll dimensions

Jacobs will inspect all factory-manufactured liners and covers for damage.

Subcontractor shall store and protect factory-manufactured liner rolls from dirt, excessive temperatures, water, exposure to ultraviolet light, and other potential sources of damage, in accordance with ASTM D4873.

Subcontractor shall protect from damage the rolls of factory-manufactured liners during unloading or handling.

2.0 PRODUCTS

2.1. Equipment

Equipment proposed shall be capable of properly installing liners and placing soil to avoid damage to the liner materials. Equipment must also comply with Specification Section 0351, Safety, Health, and Emergency Response.

2.2. Non-woven Geotextile Liner

Prior to mobilization, Subcontractor shall **submit** a **cut sheet for the nonwoven geotextile** to be provided. The nonwoven geotextile liner material shall meet the following minimum specifications:

- Weight (ASTM D3776): 8 ounces per square yard
- Thickness (ASTM D1777): 110 mil
- Grab tensile strength (ASTM D4632): 150 pounds
- Grab tensile elongation (ASTM D4632): 20 percent
- Trapezoid tear strength (ASTM D4533): 80 pounds
- Puncture resistance (ASTM D4833): 130 pounds
- Permeability (ASTM D4491): 0.10 centimeters per second (cm/sec)
- Apparent opening size (AOS) (ASTM D4751): 70 U.S. standard sieve size

2.3. Bottom Liner and Top Cover

Prior to mobilization Subcontractor shall **submit** a **cut sheet for the high-density polyethylene liner and the high-density** polyethylene **cover** to be provided. The reinforced high-density polyethylene (or equivalent) liners and covers shall meet the following minimum specifications:

- Cold crack (ASTM D2136): -60 degrees Fahrenheit (°F) or less
- Black carbon content (ASTM D1603): 2 percent
- Carbon dispersion (ASTM D3015): A-2 range
- Tensile strength (ASTM D751A) (for coated fabric liner only): 300 pounds (warp)
- Mullen burst (ASTM D751A) (for coated fabric liner only): 500 pounds per square inch

- One-inch tensile strength (ASTM D882) (for extruded fabric liner only): 45 pounds (warp)
- One-inch elongation MA (machine direction) (for extruded fabric liner only): 625 percent
- Nominal thickness: 20 mil for bottom liner; 12-mil minimum for top liner
- Oil resistance (ASTM D471): No signs of deterioration and more than 80 percent retention of tensile and seam strength after immersion for 30 days at 73 °F

2.4. Netting

For its defined application, the netting material shall be capable of withstanding 100-mile-per-hour (mph) winds. The material shall be UV-resistant and shall not significantly degrade if used for as long as 2 years. All netting shall be secured by sandbags or other means to prevent removal by high winds. Subcontractor shall be responsible for providing and maintaining this anchoring system throughout the project.

2.5. Stakes

Stakes shall be a minimum of 2 feet in length, a minimum of 2 inches by 2 inches with a square cross-section and have a sharpened end to allow insertion into earthen materials.

3.0 EXECUTION

3.1. General

Subcontractor shall comply with the requirements of Chapter 18 of the Alaska Administrative Code (AAC), Chapter 78, Section 311 (18 AAC 78.311; Soil Storage and Disposal) for the long-term storage of soils contaminated with petroleum, oil, and lubricants.

A field decision for the precise location of the storage area and stockpile cell locations will be made.

The bottom liner and top cover will be sized to ensure that liner material extends at least 4 feet beyond the external bermed boundary.

3.2. Preparation of Ground Surface

The area that will provide the foundation for the bottom liner shall be relatively level. All pointed rocks and other pointed materials that may puncture the liner shall be removed.

The external boundary of the containment cell shall be made of berms approximately 18 inches high and 36 inches wide.

A minimum of 3 inches of sand or other suitable material shall be placed on the ground surface inside the berms as a foundation for the bottom liner.

3.3. Geotextile and Liner Installation

Subcontractor shall handle geotextiles in a manner to ensure they are not damaged and are used in accordance with manufacturer's instructions. Subcontractor shall comply with the following:

- Non-woven geotextile liner
  - Anchor geotextile liner and deploy in a controlled manner to prevent damage or slippage and maintain adequate overlap of adjacent geotextile sections.
  - Place geotextile liner within the perimeter of the constructed berm and on top of foundation layer.
  - In the presence of wind, weight geotextile liner with sandbags or equivalent. Do not remove weight from geotextile liner until it is replaced with bottom liner.
  - Prevent damage to underlying layers during placement of geotextile.
  - During geotextile deployment, do not entrap stones or excessive fine material that could cause clogging of drains or filters in or beneath geotextile fabric.

  - Visually examine entire geotextile surface. Ensure that no potentially harmful foreign objects are present. Remove foreign objects encountered or replace geotextile.
  - Overlap adjacent edges at least 12 inches. Top edges shall face downgrade. Seaming is not required.
  - Repair holes or tears in geotextile as directed by manufacturer's instructions.
  - When placing soil materials on top of geotextile, ensure that geotextile and underlying liner materials are not damaged, minimal slippage of geotextile on underlying layers occurs, no excess tensile stresses occur in the geotextile, and overlapping of adjacent edges is maintained.
- Bottom Liner
  - Handle bottom liner in a manner to ensure it is not damaged and is employed in accordance with manufacturer's instructions.
  - Use a single piece of bottom liner that has been pre-seamed by the manufacturer. No seaming shall be performed in the field. Place bottom liner on top of nonwoven geotextile liner and surrounding berm.
  - Anchor bottom of liner securely and deploy in a controlled manner to keep liner bottom continually in tension to prevent overlap.
  - In the presence of wind, weight bottom liner with sandbags or equivalent.
  - Ensure bottom liner extends a minimum of 4 feet over the containment cell berms and beyond the external berm boundary on all sides.
  - During deployment of bottom liner, do not entrap stones or excessive fine material that could damage the bottom liner.
  - Visually examine entire surface of bottom liner. Ensure no potentially harmful foreign objects are present. Remove foreign objects encountered or replace bottom liner.
  - Place at least 3 inches of clean sand on top of bottom liner in a manner that prevents damage to liner. Colored warning tape (at least 1-inch in length) may be placed on top of clean sand to mark boundary.
  - Place contaminated soil in stockpile-containment cell in a manner that prevents damage to the liner system.
  - Lift edges of bottom liner from berm and place onto reposed surface of stockpiled soil.
  - Repair holes or tears in bottom liner as directed by manufacturer's instructions.
- Top Cover
  - Anchor top cover securely and deploy it in a controlled manner to keep cover continually in tension. To cover soil and the lifted bottom liner, extend cover to footing of stockpiled soil.
  - Until the netting material has been placed and anchored, weight top liner with sandbags or equivalent.
  - Overlap adjacent edges of the top liner according to manufacturer's instructions. Unsecured overlaps shall have sandbags or equivalent placed every 5 feet to prevent wind damage to liner.
  - Repair holes or tears in top liner as directed by manufacturer's instructions.
- Netting
  - Netting shall be placed over top liner to hold the top liner in place during periods of high winds (as much as 100 mph) and to mitigate any wind damage to the high-density polyethylene (HDPE) liner.
  - Netting seams shall be overlapped by at least 1 foot.
  - Sandbags shall be secured at 5-foot intervals along the entire perimeter of the netting.

3.4. Ramps

If heavy equipment is needed to construct or maintain a stockpile, subcontractor shall ensure that the ramp for driving into the containment area is constructed following the same placement sequence and materials described in the preceding paragraphs of this specification section.

3.5. Final Berming and Closeout

Subcontractor shall place clean soil to surround the perimeter of the bermed stockpile area. Following placement of the top liner against the sides of the bottom liner lying against the stockpile, subcontractor shall use equipment to place the berm against the outer side of the top liner in a manner that forces the top liner against the bottom liner and maintains the integrity of the top liner.

3.6. Stockpile Maintenance

Subcontractor shall inspect stockpiles for damage or deterioration on a daily basis while contaminated soils are being placed into the cell. Subcontractor shall inspect dormant stockpiles (those not being opened and used) bi-weekly during the period of performance. These inspections shall be documented in the Subcontractor Daily Quality Control Report. Stockpile damage shall be repaired by the Subcontractor as soon as possible after discovery and corrective action implemented to prevent recurrence.

JACOBS®

Standard Operating Procedure

Collection of Soil Samples

Document No: JE-SOP-3000	Page: 1 of 5
Effective Date: 24 April 2018	Rev. 4

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
2.0 EQUIPMENT 1
3.0 PROCEDURES 2
3.1. Sample Management 2
3.2. Sampling Precautions 2
3.3. Preparation 2
3.4. Sample Collection 3
3.5. Sample Handling, Storage, and Transport 4
4.0 QUALITY CONTROL SAMPLES 4
5.0 HEALTH AND SAFETY 5
6.0 REFERENCES 5

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the collection of analytical soil samples from soil obtained by any suitable method from the surface or subsurface. This SOP provides a standard set of procedures applicable under typical site conditions and equipment; they may be varied as dictated by actual site conditions and equipment characteristics. Field notes shall be sufficiently specific to document adherence to these procedures or to record all relevant details of any variances. The procedures described by this SOP are applicable to the following classes of analytes:

- Petroleum, oil, and lubricants (POL), i.e., gasoline-range organics (GRO), diesel-range organics (DRO), and residual-range organics (RRO)
- Volatile organic compounds (VOCs)
- Low-level VOCs preserved in water and frozen
- Semi-volatile organic compounds (SVOCs)
- Polycyclic aromatic hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs)
- Pesticides
- Metals

This SOP is consistent with *Field Sampling Guidance* issued by the Alaska Department of Environmental Conservation (ADEC) 2019. For specific sampling goals, refer to the field sampling plan in the long-term monitoring and maintenance (LTMM) plan (Attachment B-1).

2.0 EQUIPMENT

Soil sampling equipment may include, but is not limited to, the following:

- Appropriate personal protective equipment (PPE) (at the minimum, safety glasses and nitrile gloves)
- Sample containers (with preservative, if required by the analytical method) and sample packing materials

- Sample labels
- Stainless steel spoons, spatulas, shovel, trowel, or other digging/sampling tools
- Low-level VOC sampling coring devices
- Photoionization detector (PID)
- Survey stakes, pin flags, or similar to mark sample locations
- Tape measure
- Aluminum pie pans, decontaminated stainless steel mixing bowl, or re-sealable plastic bags
- Chain-of-custody (CoC) form
- Camera
- Munsell soil color chart
- Logbook
- Field forms (soil boring log)
- Portable balance capable of weighing to 0.01 gram (g)

3.0 PROCEDURES

Sampling procedure includes sample management, potential interference, preparation/sampling frequency, and sample collection.

3.1. Sample Management

Samples will be collected into appropriate containers (with preservative, if required by the analytical method) provided by the analytical laboratory. If multiple methods are to be run per sample, samples for volatiles will be collected first and containerized separately to minimize the potential for loss. Upon collection, containers will be labeled with the sample identification string and date and time of collection, at a minimum. Sample information (sample ID string, location ID, date and time of collection, sampler initials, sample depth, field screening result, and analyses will be recorded in the logbook and/or field forms. Samples will be stored between 0 and 6 degrees Celsius (°C) (if required by the analytical method). Low-level VOC samples will be frozen and stored at less than -7 ºC. Prior to shipment, containers will be labeled with complete documentation (sample identification string, date and time of collection, sampler initials, and requested analysis). Samples will then be packaged and transported to the analytical laboratory for analysis.

3.2. Sampling Precautions

Two potential issues associated with soil sampling are cross-contamination and inadequate sample homogenization. To prevent cross-contamination, sampling equipment will be disposable and used only once, or reusable sampling equipment will be decontaminated before each use. To ensure representativeness and minimize the variance of duplicates, samples for non-volatile parameters (all parameters except VOCs and GRO) will be homogenized to the extent practicable prior to transferring the soil to the sample jar.

3.3. Preparation

- Analytical soil samples will be collected from locations specified in the Work Plan. Quality-control (QC) samples will be collected at the frequency specified in the Work Plan (or in the *Field Sampling Guidance* [ADEC 2019] if not specified in the Work Plan).

- Verify that all equipment and sample containers are properly decontaminated and that the sample containers are new and have been properly prepared.
- Don new disposable nitrile gloves before starting sample collection. These may be worn over other gloves in cold weather

3.4. Sample Collection

- Label all containers and any sample-specific data sheets to be used. DO NOT place a label on a pre-tared container for VOC and GRO analysis. Instead, record the sample information on the outside of the sample container. Place any new or additional labels on the outside of a re-sealable plastic bag.
- Using decontaminated or new disposable sampling equipment, collect soil from the identified location. Collect samples for VOC and GRO analyses first prior to other analyses to minimize loss of volatiles. Do not homogenize prior to the collection of the VOC and GRO samples.
- If low-level VOC analysis is to be performed, complete the following steps:
    - Confirm no liquid has leaked from pre-tarred VOA vials during transport.
    - 5 g of soil will be collected using the low-level VOC sampling coring device and transferred directly into two separate pre-tared 40-milliliter VOA vials with water added.
    - 5 g of soil will also be added to a third dry VOA that does not contain water.
    - A fourth vial will be filled resulting in zero headspace.
    - For QC samples a total of 8 VOAs need to be collected (EPA 2014). 5 g of soil will be collected into 6 vials containing water. Two additional vials, one containing 5 g of soil with no water and one with zero headspace, will be collected
    - Wipe the rim of each sample vial before replacing the cap to ensure a good seal.
    - Wrap the vial in bubble wrap, place into a re-sealable plastic bag, and place in a chilled cooler (at least six gel ice packs are recommended).
    - Place each sample on its side prior to freezing.
    - Freeze each sample to colder than -7 °C within five hours of collection.
- If medium-level VOC and GRO analyses is to be performed, complete the following steps:
    - Transfer approximately 25 g of soil to a pre-tared jar with septum. The quantity of soil is generally estimated visually, but an electronic scale can be used if desired.
    - Add 25 mL of methanol (provided by the laboratory in a separate vial). Depending on the laboratory, methanol for GRO may not be interchangeable with methanol for VOCs due to the presence of a surrogate. If one 25-mL volume does not completely cover the sample, additional volume(s) will be added until the soil is completely submerged and there is some (several milliliters) free liquid. If more than one volume was added, the total added volume will be noted on the CoC. The detection limit suffers if there is a large excess of methanol.
    - Wipe the rim of the sample jar to ensure a good seal and screw on the lid firmly.
    - Mark the bottom of the methanol meniscus, and initial and date the mark. This allows the laboratory to inspect the jar for methanol loss.
- Homogenize the remaining soil in the sampling interval in an aluminum pie pan, decontaminated stainless steel mixing bowl, or re-sealable plastic bag.
- Fill the jars for the remaining analyses completely with homogenized soil in the following order: semi-volatile organic compounds (SVOC), including diesel-range organics, residual-range organics, and polychlorinated biphenyls; followed by metals. As they are filled, wipe their rims and tighten their lids firmly.

- Place samples upright in a pre-chilled cooler immediately after sample collection. Upon return to the field office, samples will be refrigerated (or frozen) until packaged for shipping.
- Record in the field logbook the sample identification (including QC samples, if collected), the depth from which the soil was collected, the date and time of sampling, and the jars filled, including analyses, additives, and preservatives.
- Decontaminate any reusable sampling equipment or discard used disposable sampling equipment between samples. See JE-SOP-2000, *Decontamination*, for decontamination procedures.

3.5. Sample Handling, Storage, and Transport

Samples will be collected using the appropriate sample containers (with preservative, if required by the analytical method) provided by the analytical laboratory. Sample containers will be labeled with the sample identification (ID) number, date and time of collection, sampler initials, and analysis requested. Samples will be maintained between 0 and 6 °C while in storage (if required by the analytical method). Samples will then be packaged and transported to the subcontracted laboratory for analysis. Samples for low-level VOC analysis will be frozen onsite and maintained at less than -7 °C. These samples will be maintained in a frozen state during transport to the laboratory (e.g., freezer storage of cooler when not on an aircraft).

4.0 QUALITY CONTROL SAMPLES

The following QC samples may be collected:

- Field duplicates

  Duplicate samples are collected to evaluate the representativeness and comparability of data obtained during investigation activities. Duplicate samples are to be collected at the same time as primary samples using the same procedure, equipment, and types of containers. The estimated number of duplicate samples to be collected is specified in the field sampling plan of the LTMM (Attachment B-1).

- Matrix spike and matrix spike duplicates (MS/MSD)

  MS/MSD samples are collected to evaluate the precision and accuracy of laboratory procedures and assess any potential affected the sample matrix has on the analyses. These samples are to be collected at the same time using the same procedure, equipment and types of containers as the original sample. The estimated number and frequency of MS/MSD samples to be collected are specified in the field sampling plan of the LTMM (Attachment B-1).

- Temperature Blank

  A laboratory-provided temperature blank will be included with each cooler to document sample receipt temperature. The temperature blank is to remain in the sample cooler from the time the sample cooler is used for containing samples until the cooler is delivered to the laboratory.

- Equipment Blank Samples:

  Equipment blank samples are aqueous samples of ultra-pure water that are poured over decontaminated sampling equipment and used to assess the adequacy of decontamination procedures. It is anticipated that disposable sampling equipment will be used; however, in the event reusable equipment is utilized requiring decontamination, an equipment blank will be collected in accordance with the quality assurance project plan. Equipment blank samples only need to be collected from decontaminated sample equipment that directly contacts the sampled soil/sediment. The estimated number and frequency of equipment blank samples to be collected are specified in the field sampling plan of the LTMM (Attachment B-1).

5.0 HEALTH AND SAFETY

Procedures for working with potentially hazardous materials, as well as the relevant Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) for each chemical that brought to the site, will be available at all times onsite. Personnel using this procedure must be trained on the information contained in the MSDSs/SDSs, engineering controls, and the PPE outlined in this procedure.

All soil samples will be treated as potentially containing chemicals of potential concern. Care must be used when handling soil samples to prevent the possible spreading of contaminants in the work area and exposures. At a minimum, Level D PPE, including nitrile gloves and safety glasses, will be worn while collecting soil samples. Waste soil will be handled and disposed of as described in JE-SOP-2100 *Waste Management Plan*.

6.0 REFERENCES

ADEC (Alaska Department of Environmental Conservation). 2019 (22 October). Field Sampling Guidance. Division of Spill Prevention and Response Contaminated Sites Program.

EPA (U.S. Environmental Protection Agency). 2014 (October). *Contract Laboratory Program Guidance for Field Samplers: Appendix B.* Document number EPA-540-R-014-013.

JACOBS™

Standard Operating Procedure

Document No: JE-SOP-5300	Page: 1 of 4
Effective Date: 25 Nov 2014	Rev. 0

Sediment Sampling

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
2.0 EQUIPMENT 1
3.0 PROCEDURES 2
3.1. Sample Management 2
3.2. Potential Interferences 2
3.3. Preparation/Sampling Frequency 2
3.4. Sample Collection 3
4.0 QUALITY CONTROL SAMPLES 3
5.0 HEALTH AND SAFETY 4
6.0 REFERENCES 4

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the collection of analytical sediment samples. This SOP provides a standard set of procedures applicable under typical site conditions and equipment; they may be varied as dictated by actual site conditions and equipment characteristics. Field notes shall be sufficiently specific to document adherence to these procedures or to record all relevant details of any variances.

This SOP is consistent with *Sediment Sampling Field Guidance Document #1215* issued by the Environmental Protection Agency (EPA 1999). That document may be referred to for an overview of considerations, equipment, and procedures. For specific sampling goals, refer to the project long-term monitoring and maintenance (LTMM) plan.

2.0 EQUIPMENT

Sediment sampling equipment will include but is not limited to the following:

Activity	Type/Name	Quantity	Notes
All	Modified Level D PPE	Per person	See SSHP
All	Camera	1	
All	Logbook, ballpoint pen/felt tip marker	As needed	
Sampling	Survey stakes / pin flags	As needed	Use to mark sampling locations
Sampling	Tape measure	1 per sampling team	Engineer scale (hundredths of a foot), preferable
Sampling	Sample labels	As needed	Information specified in the LTMM plan shall be included.
Sampling	Sampling containers and packing materials	As needed	Preservatives in sample containers, as specified by the analytical method

Activity	Type/Name	Quantity	Notes
Sampling	Clam gun	1 per sampling team	Used to collect near-shore samples
Sampling	Poner grab sampler	1 per sampling team	Used to collect off-shore samples from boat
Sampling	Shovel	1 per sampling team	Used to clear away rocks or vegetation from lake or stream bed
Sampling	Stainless steel spoons or spatulas	As needed	
Sampling	Electronic scale	1 per sampling team	Optional, sensitive to the nearest gram
Sampling	Aluminum pie pans	As needed	
Sampling	Re-sealable plastic bags	As needed	
Sampling	Chain of Custody (CoC) form	As needed	

3.0 PROCEDURES

Sampling procedure includes sample management, potential interference, preparation/sampling frequency, and sample collection.

3.1. Sample Management

Samples will be collected into appropriate containers (with preservative, if required by the analytical method) provided by the analytical laboratory. If multiple methods are to be run per sample, samples for volatiles will be collected first to minimize the potential for loss. Upon collection, containers will be labeled with the sample identification string, at a minimum. Samples will be stored between 0 and 6 degrees Celsius (°C) (if required by the analytical method). Prior to shipment, containers will be labeled with complete documentation (sample identification string, date and time of collection, sampler initials, and requested analysis). Samples will then be packaged and shipped to the analytical laboratory for analysis.

3.2. Potential Interferences

Two potential issues associated with sediment sampling are cross-contamination and inadequate sample homogenization. To prevent cross-contamination, sampling equipment will be disposable and used only once, or reusable sampling equipment will be decontaminated before each use. To ensure representativeness and minimize the variance of duplicates, samples for all parameters other than volatile organic compounds (VOCs) and gasoline range organics (GRO) will be homogenized to the extent practicable prior to transferring the soil to the sample jar.

3.3. Preparation/Sampling Frequency

- Analytical soil samples will be collected from locations specified in the LTMM plan.
- Verify that all equipment and sample containers are properly decontaminated and that the sample containers are new and have been properly prepared.

- Don new disposable nitrile gloves before starting sample collection. These may be worn over other gloves in cold weather

3.4. Sample Collection

- Label all containers and any sample-specific data sheets to be used. DO NOT place a label on a pre-tared container for VOC and GRO analysis. Instead, record the sample information on the outside of the sample container. Place any new or additional labels on the outside of a re-sealable plastic bag.
- Using decontaminated or disposable sampling equipment, collect soil from the identified location. Collect samples for VOC analyses first prior to other analyses to minimize loss of volatiles.
- If low-level VOC and GRO analysis is to be performed, complete the following substeps:
  - Transfer 5 grams (g) of sample directly into a pre-tared 40 milliliter (mL) vial with septum containing 5 mL of sodium bisulfate or deionized water.
  - Wipe the rim of the sample vial before replacing the cap to ensure a good seal.
  - Wrap the vial in bubble wrap and place into a resealable plastic bag.
- If medium level VOC analysis is to be performed, complete the following substeps:
  - Transfer approximately 25 g of soil to a pre-tared jar with septum. The quantity of soil is generally estimated visually, but an electronic scale can be used if desired.
  - Add 25 mL of methanol (provided by the laboratory in a separate vial, possibly containing bromofluorobenzene (BFB) as a surrogate). If one 25-mL volume does not completely cover the sample, additional volume(s) will be added until the soil is completely submerged and there is some (several milliliters) free liquid. If more than one volume was added, the total added volume will be noted on the CoC. The detection limit suffers if there is a large excess of methanol.
  - Wipe the rim of the sample jar to ensure a good seal and screw on the lid firmly.
  - Mark the bottom of the methanol meniscus, and initial and date the mark. This allows the laboratory to inspect the jar for methanol loss.
- Homogenize the remaining soil in the sampling interval after transferring it to a new aluminum pie pan, decontaminated stainless steel mixing bowl, or resealable gallon plastic bag (or similar).
- Fill the jars for the remaining analyses completely (unless the LTMM plan specifies lesser amounts) with homogenized soil in the following order: semi-volatile organic compounds (SVOCs), including pesticides, herbicides, DRO, RRO, and PCBs; total organic carbon (TOC), and metals. As they are filled, wipe their rims and tighten their lids firmly.
- Place samples upright in a pre-chilled cooler immediately after sample collection. Upon return to the field office, samples will be refrigerated until packaged for shipping.
- Record in the field logbook the sample identification (including quality control samples, if collected), the depth from which the soil was collected, the date and time of sampling, and the jars filled, including analyses, additives, and preservatives.
- Decontaminate any reusable sampling equipment or discard used disposable sampling equipment between samples. See JE-SOP-2000 for decontamination procedures.

4.0 QUALITY CONTROL SAMPLES

The following quality control (QC) samples may be collected:

- Field duplicates

  Duplicate samples are collected to evaluate the representativeness and comparability of data obtained during investigation activities. Duplicate samples are to be collected at the same time as primary samples using the same procedure, equipment, and types of containers. The estimated number of duplicate samples to be collected is specified in the field sampling plan of the LTMM plan (Attachment B-1).

- Matrix spike and matrix spike duplicates (MS/MSD)

  MS/MSD samples are collected to evaluate the precision and accuracy of laboratory procedures and assess any potential affect the sample matrix has on the analyses. These samples are to be collected at the same time using the same procedure, equipment, and types of containers as the original sample. The estimated number and frequency of MS/MSD samples to be collected are specified in field sampling plan of the LTMM plan (Attachment B-1).

- Temperature Blank

  A laboratory-provided temperature blank will be included with each cooler to document sample receipt temperature. The temperature blank is to remain in the sample cooler from the time the sample cooler is used for containing samples until the cooler is delivered to the laboratory.

- Equipment Blank Samples:

  Equipment blank samples are aqueous samples of ultra-pure water that are poured over decontaminated sampling equipment and used to assess the adequacy of decontamination procedures. It is anticipated that disposable sampling equipment will be used; however, in the event reusable equipment is utilized requiring decontamination, an equipment blank will be collected in accordance with the QAPP. Equipment blank samples only need to be collected from decontaminated sample equipment that directly contacts the sampled soil/sediment. The estimated number and frequency of equipment blank samples to be collected are specified in field sampling plan of the LTMM plan (Attachment B-1).

5.0 HEALTH AND SAFETY

Procedures for working with potentially hazardous materials as well as the relevant Material Safety Data Sheets (MSDS) for each chemical that will be used at the site are included in the Site Safety and Health Plan (SSHP). Personnel using this SOP must be trained on the information contained in the MSDSs, engineering controls, and the PPE outlined in the SSHP.

All soil samples will be treated as potentially containing contaminants of concern. Care must be used when handling soil samples to prevent the possible spreading of contaminants in the work area. At a minimum, Level D PPE, including nitrile gloves and safety glasses, will be worn while collecting soil samples. Waste soil will be handled and disposed of as described in the waste management section of the LTMM plan.

6.0 REFERENCES

EPA (Environment Protection Agency). 1999 (September). *Sediment Sampling Field Sampling Guidance Document #1215*. Region 9 Laboratory, Richmond, California.

USAF. 2004 (July) *Final Sitewide Monitoring Program Workplan.* Prepared by EA Engineering, Science and Technology, Inc.

Sample Packing

Document No: JE-SOP-5500	Page: 1 of 5
Effective Date: 08 Apr 2019	Rev. 0

These instructions assume that the chain of custody (CoC) and sample labels have already been printed (Be sure to consult the field sampling plan (Attachment B-1) for sample names, turn-around times, analyses, etc.). This document complies with the 2019 IATA Dangerous Goods Regulations, 60th Edition and 49 CFR Regulations for Air Shipments and needs to be reviewed each time these regulations are revised to ensure compliance.

1. Ensure that the cooler you are using is capable of withstanding the requirements of the drop test and stacking test as demonstrated by testing with appropriate documentation. (IATA 2.6.6.1)
2. Place a plastic bag in the cooler (ensure bag thickness is >0.2 mm). Add a layer of absorbent material appropriate to the material being shipped to the bottom of bag. (Absorbent material is only required for liquid sample shipments and for liquid preserved soil sample shipments. The absorbent material must contain sufficient material to absorb the entire contents of the inner packages.)

3. Remove the samples from the fridge/freezer and organize them appropriately. If there are too many samples to process in a relatively short amount of time, take out small batches from the fridge; ensure that samples do not warm considerably while verifying and applying labels.
4. All samples packed in a cooler must be contained on the accompanying CoCs. Samples from more than one CoC may be included per cooler, but samples from one CoC may not be split between multiple coolers. Confirm the presence of all samples listed on the CoC.
5. Ensure that the exteriors of sample jars have been cleaned of any dirt or moisture.

6. Verify the sample IDs against field notes and the CoC. Apply sample labels. Do not apply labels to soil samples that contain a pre-tared weight. All required label information should be handwritten on the labels already affixed to the volatile sample jar. For samples preserved with dangerous goods (methanol, sodium bisulfate, etc.) the lids must be taped with easy release painter's style tape so they are secure (each inner packaging must be held securely in place with wire, tape or other positive means, IATA 2.6.5.1). If shipping samples under excepted quantities, be sure to consider the maximum net quantity per inner packaging and outer packaging. For methanol, you are allowed up to 30 mL (each sample is 25 mL) per inner package and up to 500 mL (20 samples including trip blank) per net outer package.
7. Wrap the samples in bubble wrap, printed labels for the volatile soil samples may be applied to the bubble wrap. Sample labels at a minimum should contain the sample ID and collection date and time. It is preferred for the label to contain the project name, sample ID, initials of sampler, preservative, requested analysis, collection date and time, and type of sample.

8. All samples containing dangerous goods must be wrapped in bubble wrap and then placed in a freezer bag and sealed.

9. Place samples and frozen gel packs inside the plastic bag in the cooler. All liquid samples must be placed in the fully upright position (and ultimately packed in such a manner that they will remain upright, even if the cooler has taken a tumble). Soil samples may be stacked, but only if sufficient packaging is placed between jars to prevent breakage. Water samples should never be stacked on top of one another. Non-liquid preserved soil samples may be placed back into their original box and placed into the plastic bag.

10. Add the temperature blank inside the plastic bag in the cooler. The temperature blank should be at least a 500 ml plastic container filled with water and labeled "Temp Blank-Water". It should be stored in the fridge or freezer with the samples until ready for shipment.
11. Do not freeze the temperature blank prior to use and do not place more ice around the temperature blank than around the samples. The temp blank is meant to be an accurate representation of the temperature of all samples within the cooler. Intersperse frozen gel packs and samples evenly throughout the cooler (typically 6-8 packs depending on travel time and destination). Temperature blanks can be frozen prior to shipping if shipping low-level VOC samples which are to remain frozen during shipping.
12. Once all the samples, temp blank, and gel ice are inside the plastic bag in the cooler, seal the black plastic bag (tie off or tape shut). Tuck the excess around the side.
13. Fill the void space of the cooler with bubble wrap or other packing material to a point just level with the sides of the cooler.
14. Sign (printed full name and signature - initials **are not** sufficient) and enter date and time on the applicable CoC(s). Make a copy to include in the field files where possible. Place the original CoC in a resealable bag and tape to the inside of the lid of the cooler.

15. Close cooler lid. Sign and enter date and time on the custody seals **(time and date must match that recorded on the CoC)**. Apply custody seals to diagonally opposite corners of the cooler. Place in such a manner that the seals are easily taped over, but can still be read.

16. Apply clear tape around the entire cooler at both ends covering each custody seal. Apply 3 wraps of strapping tape to both ends of the cooler, taking care not to cover the custody seals.

17. Apply appropriate shipping stickers. Use stickers applicable to the shipment such as "**Refrigerate, Do Not Freeze", "Keep Frozen", "Keep Upright**", Up Arrows or "**Fragile**". Also include any applicable dangerous goods stickers. Liquid samples require two Up Arrow labels be placed on opposite sides. If the excepted quantities 'E' sticker is placed on the cooler, the primary hazard class number needs to be written on the sticker. If you are shipping samples in limited quantities or greater, additional labels are required in addition to completing a dangerous goods shipper's declaration (candy stripped form).

18. All shipments must comply with Department of Transportation (DOT)/International Aviation Transportation Administrations (IATA) shipping standards as appropriate. If you follow the instructions set forth above, your sample cooler shipment will meet these standards.

Chemical	UN Number	Hazard Class Label
Methanol	1230	3 (6.1)*
Hexane	1208	3
Hydrochloric acid	1789	8
Nitric acid**	2031	8
Sulphuric acid (<51%)	2796	8
Sodium bisulfate	2837	8
Sodium hydroxide	1824	8

Notes:
Include the Hazard Sub Risk label on packaging when required. Some dangerous goods when combined with water samples are no longer considered dangerous goods.
* Subsidiary risk of "(6.1)" is not required on excepted quantity E-sticker.
**Must be <20% for excepted quantity shipment.

19. When shipping from the field site, the Shipper is Jacobs Engineering Group (JEG), Somewhere, Alaska. Use the field office phone number or shipper's cell number. Ship to information: (address of lab with contact name and phone number). When shipping directly to the lab, the lab name and address should be used.

20. Provide the airline with all appropriate information for the air waybill. If shipping excepted quantities, the air waybill should say "Dangerous goods in excepted quantities." If sending a limited quantity or greater shipment, prepare a dangerous goods shipper's declaration and bring two copies to the airport.

21. After taking the cooler to the airport, email a copy of the CoCs and air waybills to the laboratory, Jacobs Anchorage office, (and to the USACE Project Chemist, if applicable) to ensure that they know samples are on their way. Follow up with the lab to ensure that samples arrive at the laboratory. The lab will email the CoCs and completed Cooler Receipt forms to the Jacobs project chemist (and the USACE Project Chemist, if applicable) within 24 hours of sample receipt.

22. If a Dangerous Goods Shipper's Declaration is used, a copy must be retained in the field files for a minimum of two years. Electronic copies are acceptable (IATA USG-01).

JACOBS

Standard Operating Procedure

Document No: JE-SOP-7000	Page: 1 of 3
Effective Date: 26 March 2018	Rev. 0.1

Field Documentation

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
2.0 EQUIPMENT 1
3.0 PROCEDURES 1
3.1. Documentation Format 2
3.2. List of Entries 2
3.3. Entry Changes 3
3.4. Management 3
4.0 HEALTH AND SAFETY 3
5.0 REFERENCES 3

ATTACHMENTS

ATTACHMENT 1 Daily Logbook Checklist
ATTACHMENT 2 Field Change Form

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes procedures for documenting field activities and guidance on types and specificity of data to be recorded. Procedures are included for documentation on logbooks, field forms, and/or photographic record. This SOP provides a standard set of procedures applicable under typical site conditions and equipment; they may be varied as dictated by actual site conditions and equipment characteristics. Field notes shall be sufficiently specific to record adherence to these procedures or to record all relevant details of any variances.

This SOP is consistent with *Field Sampling Guidance* issued by the Alaska Department of Environmental Conservation (ADEC 2019). That document may be referred to for an overview of considerations, equipment, and procedures. For specific sampling goals, refer to the field sampling plan of the long-term monitoring and maintenance (LTMM) plan (Attachment B-1).

2.0 EQUIPMENT

Activity	Type/Name	Quantity	Notes
All	Modified Level D PPE	Per person	See Site Safety Health Plan (SSHP)
All	Camera	1	
All	Logbook	As needed	
All	Waterproof pen	As needed	
All	Field Forms	As needed	

3.0 PROCEDURES

Field documentation procedure includes documentation format, list of entries, entry changes, and management.

3.1. Documentation Format

Field activities shall be recorded using a logbook. Logbooks shall be bound books that are permanently assigned to a specific project. A copy of the daily logbook checklist (Attachment 1) shall be inserted on the backside of the logbook front cover to be used as a reference tool for field documentation.

Field forms and a camera may be used for field documentation in a variety of activities. Field forms may include borehole logs, well construction logs, well sampling logs, site safety and health plan forms, etc. It is not necessary to duplicate information recorded on a field form into the logbook.

3.2. List of Entries

All logbooks and filed form entries shall be printed legibly using a waterproof pen. All form fields shall be completed in full on a daily basis. At the beginning of each daily entry, the following information shall be recorded:

- Project name / Site ID / Client
- Date
- Weather, site conditions, and other salient observations
- Level of PPE used
- Full name of onsite personnel and visitors with their affiliation and project title (e.g., team leader)
- Daily objectives
- Time and location of activity
- Filed observations and comments

For investigation activities, the entry for each day shall contain a complete record of daily activities including, but not limited to, the following information, unless the data is recorded on a field form:

- Deviations from the LTMM plan, including the field sampling plan, quality assurance project plan, and standard operating procedures.
- Photographic log
  - Photographer's name
  - Roll and frame number, or digital photograph number
  - Date and time
  - Description of photograph including sampling point, sample name, depth and other relevant identifying information such as direction faced (e.g., facing north) and relationship of photograph to site features
- Site sketches with reference (i.e. "N" arrow)
- Survey and location i.e., samples or debris (GPS coordinates when possible)
- Field measurements
- Field measurements
- Equipment calibrations and maintenance
- For each sample record:
  - Sample identification numbers
  - Date, time, sampler
  - Media container(s), preservations including the lot number
  - QC samples
  - Analysis

- Chain-of-custody form numbers
- Sample shipments (when, what, destination, shipment air bill numbers)
- Decontamination procedures used
- Waste tracking (when, how much, destination)
- Daily summary of activities (i.e., number of samples collected)
- Time of departure from the site

Logbooks are also used as a daily record for remediation activities. General entries similar to the ones listed above are used in remediation activity logbooks. Additional information shall be documented of remediation activities include but not limited to the following:

- Daily excavation activities
- Waste disposal quantities and methods of transport
- System performance data from any remediation systems (e.g., soil vapor extraction, high vacuum extraction, etc.)
- System or equipment calibration or maintenance performed
- Other pertinent information regarding remediation daily activities

3.3. Entry Changes

Entry changes should be avoided by carefully entering data in the logbook. Data or other information that is entered incorrectly shall be corrected by drawing a single line through the incorrect entry such that the incorrect entry is not obscured and the correct entry/information is placed next to the incorrect entry in the logbook or field form. The lined through entry shall be initialed and dated.

3.4. Management

Logbooks and field forms will be kept in the project file when complete or when not in use. If forms or logbooks are used in the field for an extended period of time, copies of used pages will be made, delivered to the office, and filed in the project file on a periodic basis.

Photograph prints and negatives will be stored in the project file. Digital photographs will be stored in the electronic project file. Digital photographs shall be downloaded from the camera on a regular basis.

4.0 HEALTH AND SAFETY

Procedures for working with potentially hazardous materials as well as the relevant Material Safety Data Sheets (MSDS) for each chemical that will be used at the site are included in the Site Safety and Health Plan (SSHP). Personnel using this SOP must be trained on the information contained in the MSDSs, engineering controls, and the PPE outlined in the SSHP.

Before site activities begin, all personnel onsite including subcontractors and visitors shall either read or be briefed on the information provided in the SSHP and commit to follow applicable procedures by signing the SSHP training record presented in the SSHP.

5.0 REFERENCES

ADEC (Alaska Department of Environmental Conservation). 2019 (22 October). *Field Sampling Guidance*. Division of Spill Prevention and Response Contaminated Sites Program.

EPA (U.S. Environmental Protection Agency). 2013 (May). Field Branches Quality System and Technical Procedures-Quality System Procedures: Logbooks (SESDPROC-010-R5), Region 4, Science and Ecosystem Support Division (SESD), Athens, Georgia, http://www.epa.gov/region4/sesd/fbqstp/Logbooks.pdf.

ATTACHMENT 1
Daily Logbook Checklist

Did you remember ... ???

Daily Logbook Checklist

- ☐ Project name / Site ID / Client
- ☐ Date
- ☐ Weather, site conditions, and other salient observations
- ☐ Level of PPE used
- ☐ Full names of onsite personnel and affiliations (including all visitors)
- ☐ Daily objectives
- ☐ Field measurements and calibrations
- ☐ Time and location of activity
- ☐ Field observations and comments
- ☐ Deviations from the Work Plan
- ☐ Site photographs
- ☐ Site sketches (with reference i.e. "N" arrow)
- ☐ Survey and location i.e. samples or debris (GPS coordinates when possible)
- ☐ For each sample record:
  - Date, time, sampler(s)
  - Sample ID
  - Media, container(s), preservatives
  - QC (dup/MS/MSD)
  - Analysis
  - MeOH lot #
  - Tare weight

- ☐ Sample shipments (when, what, destination)
- ☐ Waste tracking (when, how much, destination)
- ☐ Daily summary of activities (i.e. # of samples collected)

Did you remember ... ???

Daily Logbook Checklist

☐ Project name / Site ID / Client
☐ Date
☐ Weather, site conditions, and other salient observations
☐ Level of PPE used
☐ Full names of onsite personnel and affiliations (including all visitors)
☐ Daily objectives
☐ Field measurements and calibrations
☐ Time and location of activity
☐ Field observations and comments
☐ Deviations from the Work Plan
☐ Site photographs
☐ Site sketches (with reference i.e. "N" arrow)
☐ Survey and location i.e. samples or debris (GPS coordinates when possible)
☐ For each sample record:
– Date, time, sampler(s)
– Sample ID
– Media, container(s), preservatives
– QC (dup/MS/MSD)
– Analysis
– MeOH lot #
– Tare weight

☐ Sample shipments (when, what, destination)
☐ Waste tracking (when, how much, destination)
☐ Daily summary of activities (i.e. # of samples collected)

ATTACHMENT 2
Field Change Form

Field Change Form

Project Name and Location	Project/Task Order Number	Client Name
Date prepared		Prepared by
Title and version of work plan		
Reason for action		
Existing plan or procedure		
Proposed change		
Cost estimate		

Internal Review

Check appropriate box and forward as necessary per project communication pathways:

- ☐ Internal Change: Proceed with Change, in-scope and within approved budget, PM will forward cost estimate to project controls
- ☐ Technical Change: PM to initiate discussion with stakeholders per project communication pathways for approval or concurrence
- ☐ External Scope Change: PM to submit to client's Contracting Officer for approval, coordinate with Jacobs contracts administrator
- ☐ Rejected: take no further action

Jacobs Project Manager:_____ **Date:**_____

External Review

Regulatory or contractual conditions:

JACOBS

Standard Operating Procedure

Project File Management

Document No: JE-SOP-7001	Page: 1 of 2
Effective Date: 01 August 2013	Rev. 0

TABLE OF CONTENTS

1.0 SCOPE AND APPLICATION 1
2.0 EQUIPMENT AND MATERIALS 1
3.0 PROCEDURES 1
3.1. File Security 1
3.2. Paper Files 1
3.3. Electronic Files 1
4.0 REFERENCES 2

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the guidelines to ensure the integrity and preservation of all project records are retained appropriately.

2.0 EQUIPMENT AND MATERIALS

Type/Name	Quantity
Project files including, but not limited to, documents, data, logbooks, photographs, correspondence and maps	As needed
Paper document storage supplies, furniture and facilities	As needed
Permanent electronic file storage equipment (computer hard drives and flash drives/computer disks)	As needed

3.0 PROCEDURES

Project file management procedures for file security, paper files and electronic files.

3.1. File Security

Adequate security will be maintained for both paper and electronic files related to project in accordance with Jacobs corporate record retention and document control operating procedures.

3.2. Paper Files

Paper files containing documents related to the project will be maintained at Jacobs Anchorage office. All paper files will be sorted and filed according to Jacobs internal document control procedures. Paper documents from field activities will be brought from the field to Jacobs Anchorage office for filing. All paper documents will be maintained in the active project files, until final closure of the project.

Upon final closure of the project, all paper files will be achieved in accordance with Jacobs internal project achieving procedures and client-specified file retention or archiving requirements.

3.3. Electronic Files

Electronic files containing documents related to the project will be maintained on Jacobs Anchorage server. All electronic files will be sorted and filed according to Jacobs internal document control procedure. Data saved electronically to field computers will be transferred to Jacobs Anchorage office network either directly or as attachments to electronic mail (email) transmissions. All electronic documents will be maintained in the active project files, until final closure of the project.

Each electronic document produced by Jacobs will be identified by a file path, and saved under a project specific folder on the network. In addition, an email achieve folder will be available I Outlook to act as a repository for important email communications.

Upon final closure of the project, all electronic files will be achieved in accordance with Jacobs internal project achieving procedures and client-specified file retention or archiving requirements.

4.0 REFERENCES

None

ATTACHMENT B-3
Quality Assurance Project Plan

U.S. Army Corps of Engineers
Alaska District

POST-REMEDIAL ACTION LONG-TERM MONITORING AND MAINTENANCE WORK PLAN

ATTACHMENT B-3
QUALITY ASSURANCE PROJECT PLAN

DRURY GULCH
KODIAK, ALASKA

FUDS NO. F10AK1007-01

DRAFT REVISION 1
NOVEMBER 2019

TABLE OF CONTENTS

SECTION		PAGE
ACRONYMS AND ABBREVIATIONS		B3-iii
1.0	INTRODUCTION	B3-1-1
	1.1 DATA QUALITY OBJECTIVES	B3-1-2
	1.2 DATA CATEGORIES	B3-1-2
2.0	PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, COMPARABILITY AND SENSITIVITY	B3-2-1
	2.1 PRECISION	B3-2-1
	2.2 ACCURACY	B3-2-1
	2.3 REPRESENTATIVENESS	B3-2-2
	2.4 COMPLETENESS	B3-2-2
	2.5 COMPARABILITY	B3-2-5
	2.6 SENSITIVITY	B3-2-5
3.0	DETECTION LIMITS, LIMITS OF DETECTION, LIMITS OF QUANTITATION, AND INSTRUMENT CALIBRATION REQUIREMENTS	B3-3-1
	3.1 DETECTION LIMITS	B3-3-1
	3.2 LIMIT OF DETECTION	B3-3-1
	3.3 LIMIT OF QUANTITATION	B3-3-1
	3.4 INSTRUMENT CALIBRATION	B3-3-2
4.0	ELEMENTS OF QC	B3-4-1
	4.1 LABORATORY CONTROL SAMPLE	B3-4-1
	4.2 MATRIX SPIKE/MATRIX SPIKE DUPLICATE	B3-4-2
	4.3 SURROGATES	B3-4-2
	4.4 INTERNAL STANDARDS	B3-4-3
	4.5 RETENTION TIME WINDOWS	B3-4-3
	4.6 METHOD BLANK	B3-4-3
	4.7 EQUIPMENT BLANK	B3-4-4
	4.8 FIELD DUPLICATES	B3-4-4
5.0	QC PROCEDURES	B3-5-1
	5.1 HOLDING TIME COMPLIANCE	B3-5-1
6.0	STANDARD MATERIALS	B3-6-1

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

6.1 SUPPLIES AND CONSUMABLES B3-6-1

7.0 ANALYTICAL PROCEDURES B3-7-1

7.1 PREPARATION METHODS B3-7-1

7.2 ANALYTICAL METHODS FOR CONTAMINANTS B3-7-1

8.0 DATA REDUCTION, REVIEW, VERIFICATION, REPORTING, AND RECORD KEEPING B3-8-1

8.1 DATA REVIEW AND REPORTING REQUIREMENTS B3-8-1

8.2 QA REPORTS B3-8-1

8.3 RECORD KEEPING B3-8-2

8.4 DEFINITIVE DATA PACKAGE B3-8-2

9.0 CORRECTIVE ACTION B3-9-1

9.1 CORRECTIVE ACTION REPORT B3-9-2

9.2 CORRECTIVE ACTION SYSTEM B3-9-2

10.0 CHEMICAL DATA QUALITY REVIEW B3-10-1

10.1 LABORATORY B3-10-1

11.0 REFERENCES B3-11-1

TABLES

Table B3-2-1 Statistical Calculations B3-2-3

Table B3-2-2 Summary of DQOs for Soil/Sediment Samples B3-2-4

Table B3-5-1 Requirements for Soil/Sediment Samples B3-5-1

Table B3-7-1 Sample Preparation Methods B3-7-1

Table B3-10-1 Data Qualifiers B3-10-2

ACRONYMS AND ABBREVIATIONS

%R	percent recovery
°C	degrees Celsius
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
DoD	U.S. Department of Defense
DL	detection limit
DQO	data quality objective
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FRMD	FUDS Records Management Database
FUDS	Formerly Used Defense Sites
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LL	low level
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MED	Manual for Electronic Deliverables
mg/kg	milligrams per kilogram
MS	matrix spike
MSD	matrix spike duplicate
ND	nondetect
oz	ounce
PCB	polychlorinated biphenyl
PQL	project quantitation limit
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
QSM	Quality Systems Manual
RCA	Recommendations for Corrective Action
RPD	relative percent difference
RSD	relative standard deviation
SW	Solid Waste Method
USACE	U.S. Army Corps of Engineers, Alaska District

(intentionally blank)

1.0 INTRODUCTION

This project quality assurance project plan (QAPP) is to be used in combination with the field sampling plan (Attachment B-1) and field standard operating procedures (Attachment B-2), which all together comprise the sampling and analysis plan for the Drury Gulch post-remedial action monitoring and maintenance project on Kodiak Island, Alaska. The site is being addressed under the Formerly Used Defense Site (FUDS) program. These documents were developed in accordance with Alaska Department of Environmental Conservation (ADEC) 18 Alaska Administrative Code (AAC) 75 (ADEC 2018b) and 18 AAC 70 (ADEC 2018a).

This QAPP defines how samples will be analyzed and discusses quality assurance (QA) procedures. Collectively the field and analytical procedures are designed to ensure that data quality objectives (DQOs) defined for this project in the long-term monitoring and maintenance work plan are met and field sampling protocols are documented. The purpose of this QAPP is to describe procedures required to meet project data quality requirements for the sampling task defined for this project and the associated data usability standards. The overall QA policies and quality control (QC) procedures shall be followed as defined in this QAPP and the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) Version 5.3 (DoD 2019) and Environmental Laboratory Accreditation Program (ELAP), to ensure the laboratory and field sampling programs provide the highest data quality for the project. However, laboratory compliance with Version 5.3 of the DoD QSM is not required. Laboratories are accredited under the version used during their most recent audit. DoD-ELAP laboratories should be accredited under Version 5.3 within two and a half years of the issue date.

The laboratory performing analytical chemistry services will be determined at a later date based upon project needs. The selected project analytical laboratory, as well as laboratory certifications and limits, will be communicated to USACE in an addendum to the long-term monitoring and maintenance plan once project needs are identified and a laboratory has been determined.

1.1 DATA QUALITY OBJECTIVES

DQOs represent the minimum acceptable specifications for field and analytical measurements to ensure that project data are usable for their intended purpose. The DQOs are used as comparison criteria during data quality review to determine if the minimum requirements have been met and that data may be used as planned. Quantitative DQOs include precision, accuracy and completeness, while qualitative DQOs include representativeness and comparability. In addition, the analytical data sensitivity must be adequate to compare sample analytical results to remedial action goals.

1.2 DATA CATEGORIES

There are two general categories of data. They are defined as: (1) screening data and (2) definitive data.

Screening data are generated by rapid methods of analysis with less rigorous sample preparation, calibration, and/or QC requirements than are necessary to produce definitive data. These field methods are used to produce real-time quantitative parameters such as temperature and percent moisture, or qualitative parameters such as those determined using a photoionization detector or other field screening instruments and procedures, such as field test kits for nitrogen and phosphorus.

Definitive data are generated using quantitative analytical procedures, such as approved U.S. Environmental Protection Agency (EPA) or ADEC methods. The project laboratory will typically generate these data. These methods define standardized QC and documentation requirements. Definitive data are not restricted in their use unless QC parameters are not met. Section 8.1 discusses data review and usability.

Data shall be sent to the Environmental Compliance Consultants, Inc.-Jacobs Engineering Group Inc. project chemist via email to allow immediate access to the analytical results. The laboratory shall also email a copy of the chain-of-custody, cooler receipt forms, and custody seals to receipt.cooler@usace.army.mil within 24 hours of sample receipt at the laboratory.

Adobe PDF copies of the complete data packages will be included in the draft and final annual post-remedial action report.

(intentionally blank)

2.0 PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, COMPARABILITY AND SENSITIVITY

The basis for assessing the elements of data quality, precision, accuracy, representativeness, completeness, and comparability, is discussed in the following subsections. The data quality indicator acceptance criteria for each method and matrix are described in Section 7.2.

2.1 PRECISION

Precision measures the reproducibility of measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Field duplicate samples and matrix spike (MS)/ matrix spike duplicate (MSD) samples shall be analyzed to assess field and analytical precision, and the precision measurement determined using the relative percent difference (RPD) between the duplicate sample results. The formula for the calculation of precision is provided in Table B3-2-1 as RPD. For replicate analyses, the relative standard deviation (RSD) is determined. The formula for the calculation of RSD is also provided in Table B3-2-1. Batch level precision will meet ADEC criteria defined for all methods.

2.2 ACCURACY

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It therefore reflects the total error associated with a measurement. Laboratory control samples (LCS) and laboratory control sample duplicates (LCSD) shall be analyzed to assess overall method and laboratory performance. MS/MSD recoveries will be used to measure matrix effects as well as method and laboratory performance. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Surrogate compound recoveries are used to assess accuracy and method performance for each sample analyzed as required by methods. The formula for calculation of accuracy is included in Table B3-2-1 as percent recovery (%R).

Accuracy goals for this project are listed for each analyte in Table B3-2-2. Percent recovery calculations will be performed on LCS, surrogates, and MS samples, where applicable. If the accuracy goals for LCS are exceeded, associated project sample results reported above the detection limit (DL) will be qualified as estimated biased high. If an LCS fails recovery criteria with a low bias, associated project sample results will be qualified as estimated biased low. If a MS sample has high recoveries, associated concentrations reported above the DL will be qualified in the parent sample as having possible matrix affects. If MS samples fail recovery criteria with a low bias, associated sample results will be qualified in the parent sample as having possible matrix effects. Note that accuracy control limits do not apply when parent sample concentrations are equal to or greater than the spiked amount in MS samples.

2.3 REPRESENTATIVENESS

Objectives for representativeness are defined for each sampling and analysis task and are a function of the investigative objectives. Representativeness shall be achieved through use of the standard field, sampling, and analytical procedures. Representativeness is also determined by appropriate program design, with consideration of elements such as proper sample locations and sampling procedures. To assure that the sample results are as representative as possible, the field sampling procedures in the field sampling plan will be followed.

2.4 COMPLETENESS

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples. Completeness is calculated and reported for the entire data set (defined for the project) by assessing each result. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not considered rejected (qualified with an “R”). The requirement for completeness is 95 percent and is reported for the entire project data set.

The formula for calculation of completeness is presented below:

$$\% \text{ Completeness} = \frac{\text{Number of valid results}}{\text{Total number of possible results}}$$

Where: valid results are the total number of results minus the rejected results.

Table B3-2-1
Statistical Calculations

Statistic	Symbol	Formula	Definition	Uses
Mean	$\bar{X}$	$\frac{\sum_{i=1}^{n} x_i}{n}$	Measure of central tendency	Used to determine average value of measurements
Standard Deviation	S	$\left(\frac{\sum (x_i - \bar{x})^2}{n-1}\right)^{1/2}$	Measure of relative scatter of the data	Used in calculating variation of measurements
RSD	RSD	$\left(\frac{S}{\bar{X}}\right) \times 100$	RSD, adjusts for magnitude of observations	Used to assess precision for replicate results
Percent Difference	%D	$\frac{x_1 - x_2}{x_1} \times 100$	Measure of the difference of two observations	Used to assess accuracy
RPD	%RPD	$\left(\frac{x_1 - x_2}{(x_1 + x_2)/2}\right) \times 100$	Measure of variability that adjusts for the magnitude of observations	Used to assess total and analytical precision of duplicate measurements
Percent Recovery	%R	$\frac{Found\ Value}{True\ Value} \times 100$	Recovery of spiked compound in pure matrix	Used to assess accuracy
Percent Recovery	%R	$\frac{Found\ Value}{True\ Value} \times 100$	Recovery of spiked compound in sample matrix	Used to assess matrix effects and total precision

Notes:
n - number of observations
For definitions, refer to the Acronyms and Abbreviations section.

Table B3-2-2
Summary of DQOs for Soil/Sediment Samples

Parameter	Analytical Method	LOQ[1]	PQL	Action Level	Precision (RPD)	Accuracy (%)	Completeness
PCBs (Soil and Sediment)	3541/8082A LL	0.01 mg/kg (0.02 mg/kg for Aroclor 1221)	0.02 mg/kg (0.03 mg/kg for Aroclor 1221)	0.031 mg/kg[2] 1 mg/kg[3]	30% (Aroclor 1260 and 1016)	60-130 (Aroclor 1260) 40-140 (Aroclor 1016)	95

Notes:
[1] The LOD is 0.00425 mg/kg for all PCB Aroclors.
[2] Freshwater sediment screening level in the Decision Document (USACE 2003).
[3] Method Two Soil Cleanup Level from Table B1 in 18 AAC 75.341.
For definitions, refer to the Acronyms and Abbreviations section.

2.5 COMPARABILITY

Comparability is the confidence with which one data set can be compared to another data set. The objective for this QA/QC program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms supports the assessment of comparability. Historical comparability shall be achieved through consistent use of methods and documentation procedures throughout the project.

2.6 SENSITIVITY

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. It is important that all laboratory analytical results are reported with adequate sensitivity (less than or equal to the project screening or action level).

Laboratory analytical results are typically reported with a corresponding limit of quantitation (LOQ), limit of detection (LOD), and DL. The DL is defined as the smallest amount of analyte that is statistically different from analytical noise (background) with a 99 percent level of certainty. The LOD is defined as the lowest amount that produces a quantitative result within specified limits of precision and bias. The LOD is typically two to three times the DL and must be verified using a laboratory-spiked sample on a quarterly basis.

Sediment samples typically contain high moisture content, so the LOQs listed in Table B3-2-2 are not likely obtainable. Consequently, project quantitation limits (PQLs) have been estimated using ~50 percent moisture content and will be used to gauge laboratory sensitivity for this project.

(intentionally blank)

3.0 DETECTION LIMITS, LIMITS OF DETECTION, LIMITS OF QUANTITATION, AND INSTRUMENT CALIBRATION REQUIREMENTS

This section defines the DL, LOD, LOQs and instrument calibration requirements. The sensitivity of the instrument and ability to generate LOQs low enough to meet cleanup criteria are critical to the success of this project.

3.1 DETECTION LIMITS

The DL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory shall establish DLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project. The laboratory shall revalidate these DLs at least once every 12 months. The results detected at a concentration below the DL shall be reported as the LOD value and flagged with a "U".

3.2 LIMIT OF DETECTION

The DL is used to establish an LOD defined as the lowest concentration of a substance that must be present in a sample in order to be detected at the DL with 99 percent confidence. At the LOD, the false negative rate (Type II error) is 1 percent. An LOD may be used as the lowest concentration for reliably reporting a nondetect (ND) of a specific analyte in a specific matrix with a specific method at 99 percent confidence. The laboratory will establish the LOD by spiking a quality system matrix at a concentration of at least two times but not greater than four times the DL. The LOD shall be verified quarterly.

3.3 LIMIT OF QUANTITATION

The LOQ is the lowest concentration that produces a quantitative result with known and recorded precision and bias. The laboratory shall establish the LOQ using a procedure that empirically demonstrates precision and bias at the LOQ. The LOQ must be set within the calibration range, including the lowest calibration level. At a minimum the LOQ shall be

verified quarterly. If a method is modified, precision and bias at the new LOQ must be demonstrated and reported.

3.4 INSTRUMENT CALIBRATION

All initial instrument calibrations shall be verified with a standard obtained from a second manufacturer prior to analyzing samples. The LOQ and highest calibration standard of a multi-level calibration curve establish the quantitation range.

Analytical instruments shall be calibrated in accordance with the analytical methods. All analytes reported shall be present in the initial and continuing calibrations. All sample results reported shall be within the calibration range. Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards shall be traceable to the original standard materials.

Instrument calibration shall be checked using all analytes listed in the QC acceptance criteria table in Section 7.2 for the method. All calibration criteria shall comply with the method criteria, the QSM (DoD 2019), or ADEC method requirements at a minimum. The initial calibration shall be checked at the frequency specified in the method using materials prepared independently of the calibration standards. The initial calibration range shall consist of a minimum of five calibration points for organic analytes and three calibration points for inorganic analytes. All analytes and surrogates shall be reported in the calibration. Exclusion of calibration points without documentation and scientifically valid technical justification is not allowed.

4.0 ELEMENTS OF QC

This section presents QC requirements relevant to analysis of environmental samples that shall be followed during all analytical activities for fixed laboratory, mobile, and field laboratories. The purpose of this QC program is to produce data of known quality that satisfy the project objectives and meet the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

Laboratory QC samples (e.g., blanks and LCSs) shall be included in each preparation batch with the client samples. A preparation batch is a number of samples (not to exceed 20 client samples plus the associated laboratory QC samples) that are similar in composition (matrix) and that are extracted or digested at the same time and with the same lot of reagents. MSs and MSDs are considered QC samples. The analytical batch is a group of samples analyzed sequentially that share the same QC. The identity of each analytical batch shall be unambiguously reported with the analyses so that a reviewer can identify the QC samples and the associated environmental samples. The type of QC samples and the frequency of use of these samples are discussed in this section.

4.1 LABORATORY CONTROL SAMPLE

An LCS is a sample matrix free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. LCSs are evaluated to assess overall method performance and are the primary indicators of laboratory performance. In general, LCSs are similar in composition to the environmental samples, contain known concentrations of all the analytes of interest, and undergo the same preparatory and determinative procedures as the environmental samples.

At least one LCS must be reported with each preparation batch of samples per matrix. The performance of the LCS is evaluated against the QC acceptance limits given in the tables provided by the laboratory for each method. If the LCS is outside the QC acceptance limits, the affected analytes in all associated samples shall be qualified.

4.2 MATRIX SPIKE/MATRIX SPIKE DUPLICATE

MSs and MSDs are aliquots of a sample spiked with known concentrations of all target analytes. The spiking occurs during sample preparation and analysis. The MS/MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. Only samples generated for this project shall be used for spiking. The MS/MSD shall be designated on the chain-of-custody. The MS/MSD is used to document the bias attributed to the sample matrix.

MS/MSD samples will be analyzed at an approximate frequency of one per every 20 field samples (5 percent), or at minimum of one per batch per matrix. The performance of the MS/MSD is evaluated against the QC acceptance limits given in the tables provided for each method. If either the MS or the MSD is outside the QC acceptance limits, the analytes in all related samples shall be qualified. The associated LCS recoveries shall be evaluated to determine if the system is in control or if matrix is a factor impacting recoveries.

QC samples such as field blanks will not require an MS/MSD. Samples that require an MS/MSD shall be designated on the chain-of-custody and do not require a separate sample identification number. Field samplers will note in the comment section of the chain-of-custody when an MS/MSD is required for a specific sample.

4.3 SURROGATES

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples. Surrogates are used to evaluate accuracy, method performance, and extraction efficiency. Surrogates shall be added to environmental samples, controls, and blanks, in accordance with the method requirements.

Whenever a surrogate recovery is outside the acceptance limits, corrective action must be performed. After the system problems have been identified and system control has been reestablished, the sample will be re-prepared and reanalyzed. If corrective actions are not performed or are ineffective, the results may require qualification.

4.4 INTERNAL STANDARDS

Internal standards are measured amounts of specific compounds added to the sample extracts. They are used as a reference to control and evaluate the precision and bias introduced during analysis of the sample. These standards shall be added to environmental samples, controls, and blanks, in accordance with the method requirements. Corrective actions shall be performed when acceptance limits are not met. After the system problems have been identified and system control has been reestablished, all effected samples shall be reanalyzed. If corrective actions are not performed or are ineffective, the associated results will be qualified.

4.5 RETENTION TIME WINDOWS

Retention time windows are used in identification of analytes. They are calculated from replicate analyses of a standard on multiple days. The procedure and calculation method are defined in EPA Solid Waste Method (SW)-846 8000B (EPA 2018). The significant shift in retention time of a compound in a daily standard may indicate the system is no longer stable or has changed since the retention time windows were initially established. Corrective action shall be implemented and all associated samples shall be reanalyzed.

4.6 METHOD BLANK

The method blank (MB) should be free from analytes of concern and processed simultaneously with and under same conditions as the associated samples. The MB will be used to evaluate potential cross-contamination occurring during the preparation and testing process and shall be included in every preparation batch.

The presence of analytes in an MB at concentrations equal to or greater than half the LOQ indicates a need for corrective action. Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples in the associated batch shall be re-prepared and reanalyzed. Analytical results shall not be adjusted based on compounds detected in the associated blank. When an analyte is detected in the MB and associated samples, and corrective actions were not

adequate, the results in the impacted samples will be evaluated for the effect of the contamination and qualified accordingly. If an analyte is detected in the instrument blank and the associated samples, the laboratory shall document concentration of the analyte in the case narrative. If the blank contaminant is greater than the established action level, all samples and QC shall be re-prepared and reanalyzed.

4.7 EQUIPMENT BLANK

Equipment blanks are used to assess the effectiveness of equipment decontamination procedures and to document potential cross-contamination. An equipment blank is a sample of analyte-free media that is collected after equipment decontamination and prior to sample collection. Reusable sampling equipment will not be used unless necessary; an attempt will be made to use single use disposable sampling supplies whenever possible. However, should reusable sampling equipment be required, equipment blank samples will be collected to evaluate cross-contamination that may occur during sampling procedures. Equipment blank samples only need to be collected from decontaminated sample equipment that directly contacts the sampled soil/sediment. Equipment blank samples will be handled and tested using the same process as the associated samples.

If necessary, equipment blank samples will be collected and analyzed at a frequency of one per 20 samples per specific sampling task or otherwise every five days of sampling. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the site. If an analyte is detected in an equipment blank sample, the corresponding results in the associated samples will be qualified.

4.8 FIELD DUPLICATES

Field duplicates are two independent samples collected from the same location in immediate succession, using identical recovery techniques. Field duplicates are stored in separate sample containers, analyzed as two separate samples, assigned two unique sample IDs, and submitted “blind” to the laboratory. Specific locations are designated for collection of field duplicate samples prior to the beginning of sample collection.

Field duplicate samples will be collected at a rate of one every 10 samples, or daily, in accordance with ADEC sampling guidance (ADEC 2019). Field duplicate sample results are used to assess precision of the sample collection process.

(intentionally blank)

5.0 QC PROCEDURES

This section presents a discussion of QC procedures, including holding time compliance and qualitative confirmation.

5.1 HOLDING TIME COMPLIANCE

All sample preparation and analysis shall be completed within the method-established holding time criteria. The analysis holding time begins at the time sample preparation is completed and ends with completion of analytical testing, including dilutions, second column confirmations, and any required re-analysis. All results that are reported must be performed within the established holding times. The laboratory shall notify the project chemist within 24 hours of missing a holding time. This prompt notification may allow the project team to evaluate recollection of the sample while the team is still in the field.

Table B3-5-1
Requirements for Soil/Sediment Samples

Matrix	Analysis	Analytical Methods	Sample Containers	Preservative	Holding Time
Soil	PCBs	8082A (LL)	4 or 8oz amber glass, Teflon lined screw caps	0 to 6 °C	365 Days
Sediment					

Note:
For definitions, refer to the Acronyms and Abbreviations section.

(intentionally blank)

6.0 STANDARD MATERIALS

Standard materials shall be traceable to National Institute of Standards and Technology, EPA, American Association of Laboratory Accreditation, or other equivalent approved sources. The laboratory shall monitor expiration dates for all standards and expired standards shall be discarded. Expiration dates shall be established based on manufacturer recommendations, chemical stability, possibility of contamination, and environmental and storage conditions. The laboratory shall label standard and QC materials with expiration dates.

6.1 SUPPLIES AND CONSUMABLES

The laboratory shall inspect supplies and consumables prior to their use in analysis. The materials description in the methods of analysis shall be used as a guideline for establishing the acceptance criteria for these materials. An inventory and storage system for these materials shall assure use before manufacturer's expiration dates and storage under safe and chemically compatible conditions.

All laboratory instrumentation will be inspected, calibrated, and maintained according to manufacturer recommendations and the laboratory QA manual. Preventive maintenance activities will adhere to the laboratory schedules and be performed as needed.

(intentionally blank)

7.0 ANALYTICAL PROCEDURES

This section contains brief descriptions of preparation and analytical procedures.

7.1 PREPARATION METHODS

Extraction procedures for soil/sediment matrix samples are presented in this section and are outlined in Table B3-7-1. The analytical method is also listed.

Table B3-7-1
Sample Preparation Methods

Preparation Method	Matrix	Parameter	Analytical Method
3541	Soil/Sediment	Automated Soxhlet Extraction	8082A (LL) (PCB)

Note:
For definitions, refer to the Acronyms and Abbreviations section.

Automated Soxhlet Extraction (3541): Method SW-3541 uses a commercially available, three stage system to extract and concentrate water insoluble or slightly soluble polychlorinated biphenyls (PCBs) in preparation. The sample and the extracting solvent must be immiscible in order to yield recovery of target compounds. Subsequent cleanup and detection methods are described in the organic analytical method used to analyze the extract.

7.2 ANALYTICAL METHODS FOR CONTAMINANTS

A brief descriptions of the analytical methods to be used during this project are provided below. Control limits are presented in Table B3-2-2.

PCBs (8082A LL): This gas chromatographic method is designed to measure the concentration of PCBs as Aroclors or as individual PCB congeners in extracts from water or solid matrices. Open-tubular, capillary columns are employed with electron capture detectors or electrolytic conductivity detectors for quantification of PCBs.

(intentionally blank)

8.0 DATA REDUCTION, REVIEW, VERIFICATION, REPORTING, AND RECORD KEEPING

The data reduction, review, reporting, and validation procedures described in this section will ensure complete documentation is maintained, transcription and data reduction errors are minimized, the data will be reviewed and documented, and the reported results will be qualified if necessary. Laboratory data reduction and verification procedures are required to ensure the overall objectives of analysis and reporting meet method and project specifications.

8.1 DATA REVIEW AND REPORTING REQUIREMENTS

Data reduction is the process of converting measurement system outputs into an expression of parameters and information from which conclusions about the site can be made. The designated analytical laboratory is responsible for the reduction, validation, and reporting of analytical data. The project chemist will review the laboratory results and procedures to maintain the accuracy of this process. The project chemist will also supervise reduction of field and laboratory data for incorporation into the final project report. All sample data that has not been rejected will be presented in the project report, including blanks, duplicates, and replicates.

8.2 QA REPORTS

Laboratory QA staff shall issue QA reports to laboratory management, laboratory supervisors, and task leaders. These reports shall describe the results of QC measurements, performance audits, systems audits, and confirmation sample comparisons performed for each sampling and analysis task. Quality problems associated with performance of methods, completeness of data, comparability of data (including field and confirmatory data), and data storage shall be documented with the corrective actions taken to correct identified deficiencies.

8.3 RECORD KEEPING

The laboratory shall maintain electronic and hardcopy records sufficient to recreate each analytical event conducted pursuant to the Statement of Work for a minimum of five years. The minimum records the laboratory shall keep contain the following elements:

- Chain-of custody forms
- Initial and continuing calibration records, including standards preparation traceable to the original material and lot number
- Instrument tuning records (as applicable)
- MB results
- Internal standard results
- Surrogate spiking records and results (as applicable)
- Spike and spike duplicate records and results
- Laboratory records (e.g., bench sheets, preparation logs)
- Raw data, including instrument printouts, chromatograms with compound identification, and quantitation reports
- Corrective action reports
- Other method and project required QC samples and results
- Laboratory-specific written standard operating procedures for each analytical method and QA/QC function in place at the time of analysis of project samples

8.4 DEFINITIVE DATA PACKAGE

The project chemist will check each laboratory data package to verify that all necessary data are provided. The packages should contain enough information to demonstrate that the project DQO's have been fulfilled. The pages should be sequentially numbered. Data verification will include (but is not limited to) an examination of the data package to ensure that the following are provided:

- Data for all samples submitted to the laboratory
- All relevant laboratory internal QC data (to include chromatograms for fuel analyses)
- Specified analytical methods utilized by the laboratory

- Narrative cover letter explaining any corrective actions taken on reported data and/or data falling outside the method or QC/QA specifications
- Sample data (matrix, date sampled, date received, date of extraction, and date of analysis)
- Parameter, result, and test method identification
- Results that are uncorrected for any MB contamination
- Sample-specific DLs for each parameter
- Results of laboratory control data, MBs, spikes, and replicates
- Copies of chain-of-custody forms

(intentionally blank)

9.0 CORRECTIVE ACTION

Corrective action will be initiated when potential or existing field or laboratory conditions are identified that may adversely affect data quantity or quality as defined in previous tables for each method. Events that may lead to corrective action include the following:

- Violation of established analytical controls
- Performance, system, or QA audits
- Laboratory/field comparison studies
- Violation of shipping requirements
- Violation of holding times

Corrective action may take several forms, but the following steps generally are included:

- Calculation review
- Verify the instrument for proper setup
- Re-extract and/or re-analyze the control item, as appropriate
- Resample

The project chemist, sampling personnel, and contract laboratory project manager may be involved in the corrective action. The corrective action may be immediate or long-term. An immediate corrective action may be recalculating, reanalyzing, or repeating sample collection. Long-term corrective action may be identified through performance evaluation samples, standards, control charts, or other devices.

Corrective actions, if necessary, are to be completed once. If acceptance criteria were not met and a corrective action was not successful or corrective action was not performed, the appropriate flagging criteria will be applied. Requirements and procedures for documenting the need for corrective actions are described in the following sections. Any significant corrective action shall be reported as soon as possible to the project chemist.

9.1 CORRECTIVE ACTION REPORT

Problems requiring corrective action in the laboratory are documented by the use of a corrective action report. Corrective actions that render data unusable shall be provided to the project chemist within 24 hours so recollection can be evaluated immediately. The QA coordinator or any other laboratory member can initiate the corrective action request in the event QC results exceed acceptability limits, or upon identification of some other laboratory problem. Corrective actions can include re-analysis of the sample or samples affected, resampling and analysis, or a change in procedures, depending upon the severity of the problem.

9.2 CORRECTIVE ACTION SYSTEM

A system for issuing, tracking, and documenting completion of formal Recommendations for Corrective Action (RCA) exists for addressing significant and systematic problems. Each RCA addresses a specific problem or deficiency, usually identified during QA audits of laboratory or project operations. An RCA requires a written response from the party to whom the RCA was issued. An RCA requires verification by the QA group that the corrective action has been implemented before the RCA is considered to be resolved. In the event there is no response to an RCA within 30 days, or if the proposed corrective action is disputed, the recommendation and/or conflict is pursued to successively higher management levels until the issue is resolved.

10.0 CHEMICAL DATA QUALITY REVIEW

The project chemist will perform data verification on all data packages generated for the project from both the field laboratory and the fixed laboratory.

10.1 LABORATORY

Data verification shall include, but is not limited to, examination of the data package to ensure:

- Laboratory procedures used to generate the chemical data were performed in compliance with the most recent DoD QSM version accredited (DoD 2019).
- Data for all samples submitted to the laboratory have been provided, based on the sample summary sheet generated in accordance with the U.S. Army Corps of Engineers (USACE) Manual for Electronic Deliverables (MED) (USACE 2017).
- The complete copy of the chemical data report includes all relevant laboratory internal QC data (to include all laboratory raw data) and is provided in a searchable PDF.
- Data for all samples submitted to the relevant laboratories, based on the sample summary sheet, have been provided.
- Specified analytical and extraction methods were utilized by the laboratories.
- The laboratory supplied electronic data deliverable shall be in Staged Electronic Data Deliverable Version 5.0 Stage 2a format, error free, match the hardcopy data deliverable, and in compliance with the MED.

The project chemist will conduct a data review on all data packages. This review and data verification will be included in the submittals. Included will be a review of the holding time criteria, sample handling, cooler and sample receipt condition, and evaluation of the data based on the acceptance criteria defined in this QAPP. The project chemist will assign flagging based on chemical data review and the criteria of this QAPP.

The data qualifiers to be used to indicate QC deficiencies are defined in Table B3-10-1.

Table B3-10-1
Data Qualifiers

Qualifier	Description
ND (LOD)	Analyte result is less than the LOD.
J	Analyte result is considered an estimated value because the level is below the laboratory LOQ but above the DL (formerly method DL).
B	Analyte result is considered a high estimated value due to contamination present in the method.
QH, QL, QN	Analyte result is considered an estimated value biased (high, low, uncertain) due to a QC failure.
R	Analyte result is rejected and the result is not usable. Note that "R" replaces the chemical result (no result shall be reported with an "R" flag).

Notes:
Data qualification criteria as applicable to the review of each task are provided in the associated Chemical Data Quality Review that is attached to each field report.
For definitions, refer to the Acronyms and Abbreviations section.

A MED-compliant sample summary table will be provided, identifying all samples collected, their associated coolers, and includes the following information:

- Location ID
- Sample depth
- Unique sample ID
- Date/time collected
- Analytical methods
- Matrix
- Container type/volume
- North Pacific Division Laboratory number
- QC type (e.g., trip blank, QA, QC, MS/MSD)
- Laboratory
- Sample data group number
- Field preservation
- Cooler name
- Sampler initials
- Turnaround time

Tables of all qualified project data will be provided, which will include:

- Location ID
- Sample depth
- Client sample ID
- Lab sample ID
- Matrix
- Analytical method
- Analyte
- Concentration units
- Result (with correct significant digits)
- Project action limit
- LOD

Data flags applied during the data review will be included in these tables and elsewhere in the report wherever the results are referenced. Tables of the comparison between QC samples will also be generated. Provided tables will be attached to a report with a cover page, executive summary, and pertinent project information.

LOQs will be reviewed to determine if any ND results exceed the LOQ specified in this QAPP. Where QAPP-specified LOQs are exceeded, a USACE chemist will be contacted to assess the data usability as it pertains to this project. If usability significantly impacts the project, corrective actions will be taken, including possible recollection of impacted samples. A comparison will be made between the laboratory LOD for each sample and the project action limit per method/analyte/matrix. If the laboratory LOD exceeds the project action limits established for the method/analyte/matrix, then the data will be italicized. A comparison will also be made between the laboratory result for each sample and the project action limit per method/analyte/matrix. If the laboratory result exceeds the project action limits established for the method/analyte/matrix, then the data will be bolded.

Rejected data shall be presented in a table with an explanation of the reason(s) for data rejection in the proper text portion of the document.

An ADEC Laboratory Data Review Checklist will be completed for each laboratory data package and will be included in an appendix of the report.

The data quality assessment will include the following tabulated information, if warranted:

- A list of all samples organized by analytical method, including QC samples, indicating which samples were qualified and directing the reader to the qualified results tables
- Identification of general field/laboratory sampling, documentation, and/or reporting discrepancies
- Sample handling/shipping/receipt condition qualifications
- Analytical hold time qualifications
- Surrogate qualifications
- Laboratory blank qualifications
- MS/MSD qualifications
- Serial dilution qualifications
- LCS/LCSD qualifications
- Continuing calibration verification qualifications
- Precision qualifications
- Rejected data
- LOD qualifications
- Comparison of primary/QC samples with USACE comparability criteria
- Comparison of results with project-specific sensitivity requirements

11.0 REFERENCES

ADEC (Alaska Department of Environmental Conservation). 2018a (April). *Water Quality Standards*. Division of Water. 18 AAC 70.

ADEC. 2018b (27 October). *Oil and Other Hazardous Substances Pollution Control*. Division of Spill Prevention and Response, Contaminated Sites Program. 18 AAC 75.

ADEC. 2019 (22 October). *Field Sampling Guidance*. Final. Division of Spill Prevention and Response, Contaminated Sites Program.

DoD (U.S. Department of Defense). 2019 (May). *Department of Defense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories*. Version 5.3.

EPA (U.S. Environmental Protection Agency). 2018 (December). *Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods (SW-846)*.

USACE (U.S. Army Corps of Engineers). 2003 (July). *Clean-up Decision Document, Drury Gulch, Kodiak, Alaska*. Prepared by Jacobs Engineering Group Inc. FRMD No. F10AK100701_05.09_0500_a 200-1e.

USACE. 2017 (April). *Manual for Electronic Deliverables, Requirements for Submittals of Documents, Laboratory, Data, and Other Items*.

(intentionally blank)

APPENDIX C
Accident Prevention Plan

U.S. Army Corps of Engineers
Alaska District

POST-REMEDIAL ACTION LONG-TERM MONITORING AND MAINTENANCE WORK PLAN

APPENDIX C
ACCIDENT PREVENTION PLAN

DRURY GULCH
KODIAK, ALASKA

FUDS NO. F10AK1007-01

DRAFT REVISION 1
NOVEMBER 2019

TABLE OF CONTENTS

SECTION			PAGE
ACRONYMS AND ABBREVIATIONS			C-x
1.0	SIGNATURE PAGE		C-1-1
2.0	BACKGROUND INFORMATION		C-2-1
	2.1	CONTRACTOR	C-2-2
	2.2	CONTRACT NUMBER	C-2-2
	2.3	PROJECT NAME	C-2-2
	2.4	ACCIDENT PREVENTION PLAN AND SITE SAFETY AND HEALTH PLAN IMPLEMENTATION	C-2-2
	2.5	PROJECT DESCRIPTION AND LOCATION	C-2-3
		2.5.1 SITE DESCRIPTION	C-2-4
		2.5.2 Project Site Map	C-2-4
	2.6	PROJECT TASKS AND PROJECT PHASES	C-2-5
		2.6.1 General Site Work	C-2-5
		2.6.2 Equipment to Be Used	C-2-5
		2.6.3 High Risk Activities	C-2-5
		2.6.4 Work Requiring Activity Hazard Analysis	C-2-6
3.0	STATEMENT OF SAFETY AND HEALTH POLICY		C-3-1
	3.1	OBJECTIVE	C-3-1
	3.2	PURPOSE	C-3-1
	3.3	GOALS	C-3-1
	3.4	CONTRACTOR ACCIDENT EXPERIENCE	C-3-2
	3.5	SAFE WORK POLICY	C-3-3
	3.6	POSTING OF HEALTH AND SAFETY INFORMATION	C-3-3
4.0	RESPONSIBILITIES AND LINES OF AUTHORITIES		C-4-1
	4.1	STATEMENT OF EMPLOYER'S RESPONSIBILITY	C-4-1
	4.2	PERSONNEL WITH SAFETY RESPONSIBILITIES	C-4-1
	4.3	PERSONNEL COMPETENCIES	C-4-2
	4.4	RISK MANAGEMENT PROCESS	C-4-3
	4.5	ACTIVITY HAZARD ANALYSIS REVIEW AND ACCEPTANCE	C-4-4
	4.6	WORK AUTHORIZATION	C-4-5

TABLE OF CONTENTS (Continued)

SECTION			PAGE
	4.7	SAFETY COMPLIANCE	C-4-5
		4.7.1 Reporting Unsafe Conditions and Practices	C-4-5
		4.7.2 Standards of Conduct Violations	C-4-6
		4.7.3 Intolerable Offenses	C-4-7
		4.7.4 Enforcement and Discipline	C-4-7
		4.7.5 Intolerable Offenses	C-4-7
	4.8	LINES OF AUTHORITY	C-4-8
	4.9	MANAGERS AND SUPERVISORS SAFETY ACCOUNTABILITY	C-4-8
		4.9.1 Prohibited Behaviors and Actions	C-4-8
		4.9.2 Disciplinary Actions	C-4-9
5.0	SUBCONTRACTORS AND SUPPLIERS		C-5-1
	5.1	PROJECT SUBCONTRACTOR AND SUPPLIER REQUIREMENTS	C-5-1
	5.2	SAFETY RESPONSIBILITIES OF SUBCONTRACTORS AND SUPPLIERS	C-5-1
6.0	TRAINING		C-6-1
	6.1	NEW HIRE TRAINING REQUIREMENTS	C-6-1
	6.2	PROJECT-SPECIFIC TRAINING REQUIREMENTS	C-6-1
	6.3	PERIODIC TRAINING REQUIREMENTS FOR SUPERVISORS AND EMPLOYEES	C-6-2
		6.3.1 Safety Meetings and Toolbox Meetings	C-6-2
		6.3.2 Activity Hazard Analysis Training	C-6-3
		6.3.3 Safety Pre-task Planning and Training	C-6-3
		6.3.4 Vendor Training	C-6-3
		6.3.5 Personal Protective Equipment Training	C-6-3
	6.4	EMERGENCY RESPONSE PLAN TRAINING	C-6-3
7.0	SAFETY AND HEALTH INSPECTIONS		C-7-1
	7.1	INSPECTION DETAILS AND ASSIGNMENTS	C-7-1
		7.1.1 Proof of Inspector's Training/Qualifications	C-7-1
		7.1.2 Inspection Frequency	C-7-1
		7.1.3 Inspection Forms	C-7-1

TABLE OF CONTENTS (Continued)

SECTION			PAGE
	7.1.4	Deficiency Tracking System	C-7-2
	7.1.5	Competent and Qualified Person Inspections	C-7-2
7.2		EXTERNAL INSPECTION AND CERTIFICATIONS	C-7-2
8.0		MISHAP REPORTING	C-8-1
8.1		EXPOSURE DATA (MAN-HOURS WORKED)	C-8-1
8.2		MISHAP REPORTS, INVESTIGATIONS AND DOCUMENTATION	C-8-1
9.0		PLANS REQUIRED BY THE EM 385-1-1 SAFETY MANUAL	C-9-1
9.1		FATIGUE MANAGEMENT PLAN	C-9-1
	9.1.1	Responsibilities	C-9-2
9.2		EMERGENCY PLANS	C-9-3
	9.2.1	Pre-emergency Planning (Fire, Medical, and Inclement Weather)	C-9-4
	9.2.2	Emergency Equipment and Supplies	C-9-5
	9.2.3	Escape Procedures and Routes	C-9-5
	9.2.4	Inclement Weather	C-9-8
	9.2.5	Spill Plan	C-9-9
	9.2.6	Fire Fighting Plan	C-9-10
	9.2.7	Posting of Emergency Telephone Numbers	C-9-10
	9.2.8	Alcohol and Drug Abuse Prevention Plan	C-9-10
9.3		SITE SANITATION PLAN	C-9-10
	9.3.1	Waste Disposal	C-9-10
	9.3.2	Vermin Control	C-9-11
	9.3.3	Housekeeping	C-9-11
9.4		MEDICAL SUPPORT AGREEMENT	C-9-11
	9.4.1	Onsite Medical Support	C-9-11
	9.4.2	Offsite Medical Support	C-9-12
9.5		BLOODBORNE PATHOGEN PROGRAM	C-9-13
9.6		EXPOSURE CONTROL PLAN	C-9-14
9.7		AUTOMATIC EXTERNAL DEFIBRILLATOR PROGRAM	C-9-14

TABLE OF CONTENTS (Continued)

SECTION		PAGE
9.8	SITE LAYOUT PLAN	C-9-14
9.9	ACCESS/HAUL ROAD PLAN	C-9-14
9.10	HEARING CONSERVATION PROGRAM	C-9-15
9.11	RESPIRATORY PROTECTION PLAN	C-9-16
9.12	HEALTH HAZARD CONTROL PROGRAM	C-9-16
9.13	HAZARD COMMUNICATION PROGRAM AND GLOBAL HARMONIZED SYSTEM	C-9-16
	9.13.1 Chemicals Covered by this Project Program	C-9-17
	9.13.2 Training	C-9-17
	9.13.3 Labeling	C-9-18
	9.13.4 Current Onsite Inventory	C-9-18
9.14	PROCESS SAFETY MANAGEMENT PLAN	C-9-18
9.15	LEAD COMPLIANCE PLAN	C-9-18
9.16	ASBESTOS ABATEMENT PLAN	C-9-19
9.17	RADIATION SAFETY PROGRAM	C-9-19
9.18	ABRASIVE BLASTING PROCEDURES	C-9-19
9.19	HEAT STRESS MONITORING PLAN	C-9-19
9.20	COLD STRESS MONITORING PLAN	C-9-26
9.21	INDOOR AIR QUALITY MANAGEMENT	C-9-28
9.22	MOLD REMEDIATION PLAN	C-9-28
9.23	CHROMIUM (VI) EXPOSURE EVALUATION	C-9-28
9.24	CRYSTALLINE SILICA EVALUATION	C-9-28
9.25	LIGHTING PLAN FOR NIGHT OPERATIONS	C-9-28
9.26	TRAFFIC CONTROL PLAN	C-9-29
9.27	FIRE PREVENTION PLAN	C-9-29
	9.27.1 Location of Fire Extinguishers	C-9-29
	9.27.2 Fire Extinguishers and General Fire Prevention Practices	C-9-29
	9.27.3 Dispensing of Flammable and Combustible Liquids	C-9-31
9.28	WILDLAND FIRE MANAGEMENT PLAN	C-9-31

TABLE OF CONTENTS (Continued)

SECTION		PAGE
9.29	ARC FLASH HAZARD ANALYSIS	C-9-32
9.30	ASSURED EQUIPMENT GROUNDING CONTROL PROGRAM	C-9-32
9.31	HAZARDOUS ENERGY CONTROL PROGRAM AND PROCEDURES	C-9-32
9.32	STANDARD PRE-LIFT PLAN – LOAD HAULING EQUIPMENT	C-9-32
	9.32.1 Safe Work Practices	C-9-34
9.33	CRITICAL LIFT PLAN – LOAD-HANDLING EQUIPMENT	C-9-35
9.34	FLOATING PLANT INSPECTION AND EQUIPMENT CERTIFICATION	C-9-35
9.35	SEVERE WEATHER PLAN FOR MARINE ACTIVITIES	C-9-35
9.36	EMERGENCY PLAN FOR MARINE ACTIVITIES	C-9-35
9.37	MAN OVERBOARD AND ABANDON SHIP PROCEDURES	C-9-36
9.38	FLOAT PLAN FOR LAUNCHES, MOTORBOATS, AND SKIFFS	C-9-36
9.39	FALL PREVENTION AND PROTECTION PLAN	C-9-36
9.40	DEMOLITION AND RENOVATION PLAN	C-9-36
9.41	ROPE ACCESS WORK PLAN	C-9-36
9.42	EXCAVATION AND TRENCHING PLAN	C-9-36
9.43	FIRE PREVENTION AND PROTECTION PLAN FOR UNDERGROUND CONSTRUCTION	C-9-37
9.44	COMPRESSED AIR WORK PLAN FOR UNDERGROUND CONSTRUCTION	C-9-37
9.45	ERECTION AND REMOVAL PLAN FOR FORMWORK AND SHORING	C-9-37
9.46	PRECAST CONCRETE PLAN	C-9-38
9.47	LIFT-SLAB PLANS	C-9-38
9.48	MASONRY BRACING PLAN	C-9-38
9.49	STEEL ERECTION PLAN	C-9-38
9.50	EXPLOSIVES SITE PLAN (AVOIDANCE OF MUNITIONS AND EXPLOSIVES OF CONCERN AND/OR MATERIAL POTENTIALLY PRESENTING AN EXPLOSIVE HAZARD)	C-9-38
9.51	EXPLOSIVES OPERATIONS	C-9-38

TABLE OF CONTENTS (Continued)

SECTION		PAGE
9.52	DIVE OPERATIONS PLAN	C-9-38
9.53	SAFE PRACTICES MANUAL FOR DIVING ACTIVITIES	C-9-38
9.54	EMERGENCY MANAGEMENT PLAN FOR DIVING	C-9-38
9.55	TREE FELLING AND MAINTENANCE PROGRAM	C-9-39
9.56	AIRCRAFT AND AIRFIELD CONSTRUCTION SAFETY AND PHASING PLAN	C-9-39
9.57	AIRCRAFT AND AIRFIELD SAFETY PLAN COMPLIANCE DOCUMENT	C-9-39
9.58	SITE SAFETY AND HEALTH PLAN	C-9-39
9.59	CONFINED SPACE ENTRY PROCEDURES	C-9-39
9.60	CONFINED SPACE PROGRAM	C-9-39
10.0	RISK MANAGEMENT PROCESS	C-10-1
10.1	ACTIVITY HAZARDS ANALYSIS	C-10-1
10.2	OPERATIONAL READINESS REVIEW	C-10-1

TABLES

Table 3-1	Jacobs Global Safety Performance, 2014-2018	C-3-3
Table 4-1	Personnel Competencies	C-4-2
Table 5-1	Subcontractors and Suppliers	C-5-1
Table 9-1	Emergency Equipment and Supplies	C-9-5
Table 9-2	Evacuation Signals	C-9-6
Table 9-3	Emergency Contacts	C-9-7
Table 9-4	Symptoms and Treatment of Heat Stress	C-9-21
Table 9-5	Symptoms and Treatment Of Cold Stress	C-9-27

CHARTS

Chart 4-1	Personnel Roles and Lines of Authority	C-4-8
Chart 9-1	Heat Index	C-9-24
Chart 9-2	NOAA Wind-chill Chart	C-9-28

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

FIGURE

Figure C-1 Project Location and Vicinity Map

ATTACHMENT

Attachment C-1 Site Safety and Health Plan

(intentionally blank)

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
AED	automated external defibrillator
AHA	activity hazard analysis
AOC	area of concern
APP	Accident Prevention Plan
ASQ	American Society for Quality
BMP	best management plan
bpm	beats per minute
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CSP	Certified Safety Professional
DART	Days Away, Restrictions, and Transfers
dBA	decibel(s)
DGM	digital geophysical mapping
ECC	Environmental Compliance Consultants, Inc.
EM	Environmental Manager
EMR	Experience Modification Rate
EMT	emergency medical technician
EOD	Explosive Ordnance Disposal
ER	Engineer Regulation
ERC	emergency response coordinator
ESP	Explosives Site Plan
FMP	Fatigue Management Plan
FUDS	Formerly Used Defense Site
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSE	health, safety, and the environment
HSM	health and safety manager
IARC	International Agency for Research on Cancer
Jacobs	Jacobs Engineering Group Inc.
LWD	lost workday
MEC	Munitions and Explosives of Concern
MD	Munitions Debris
MDAS	Material Documented as Safe
mg/kg	milligram(s) per kilogram
mm	millimeter(s)

ACRONYMS AND ABBREVIATIONS (Continued)

MDEH	Material Documented as an Explosive Hazard
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting an Explosive Hazard
MR	munitions response
MRA	Munitions Response Area
MRS	Munitions Response Site
MSD	Marine Safety Detachment
OSHA	Occupational Safety and Health Administration
PIM	potentially infectious material
PM	project manager
POL	petroleum, oil, and lubricant
PPE	personal protective equipment
QAPP	Quality Assurance Project Plan
QC	quality control
RI	remedial investigation
SBO	safe behavior observation
SDS	safety data sheet
SOP	standard operating procedure
SSHO	site safety and health officer
SSHP	Site Safety and Health Plan
TBD	to be determined
TOM	task order manager
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard

1.0 SIGNATURE PAGE

Accident Prevention Plan: Drury Gulch Post-Remedial Action Monitoring and Maintenance

Plan Preparer:	John Culley, CIH Jacobs HSSE Manager Phone: (206) 660-3367	Date:
Plan Approval Jacobs Project Manager:	Greg Rutkowski Phone: (907) 762-1102	Date:
Plan Approval ECC Health and Safety Manager:	Stanley Seegars Phone: (907) 360-0416	Date:
Plan Approval ECC Project Manager:	Andy Larson Phone: (907) 385-0677	Date:
Plan Approval ECC Tiered Subcontractor(s):	Name: Position: Phone:	Date:
Plan Approval ECC Tiered Subcontractor(s):	Name: Position: Phone:	Date:

(intentionally blank)

2.0 BACKGROUND INFORMATION

This Accident Prevention Plan (APP) has been developed to protect and guide the personnel conducting the scope of work for this project.

This APP has been prepared to meet applicable requirements of the following:

- U.S. Army Corps of Engineers (USACE) Safety and Health Requirements Engineering Manual (EM) 385-1-1 (2014)
- Alaska District Engineer Regulation (ER) 385-1-92
- 29 *Code of Federal Regulations* (CFR) 1910.1200 Hazard Communication Standard, Hazardous Waste Operations or emergency response as required by 29 CFR 1910.120 and 29 CFR 1926.65
- Federal Acquisition Regulation Clause 52.236-13 and Unified Facilities Guide Specifications, Section 01 35 26, Governmental Safety Requirements (2015)

This APP has been prepared to directly track with EM 385-1-1 2014 Appendix A, "*Minimum Basic Outline for Accident Prevention Plan*."

Various portions of this work will be conducted under non-hazardous waste site protocols. The site safety and health plan (SSHP) for this project is included as Attachment C-1.

This project-specific APP will be used by ECC and its subcontractors to identify and mitigate task-specific hazards and to select appropriate health and safety protective measures. Project-specific hazards are provided in Sections 8 and 9 of the SSHP (Attachment C-1).

Onsite personnel must review the APP and sign an agreement to comply with its provisions before commencing onsite work. The APP and attached SSHP are considered operational documents that are subject to revisions in response to various site-specific conditions that may be encountered. However, the documents may be modified or updated only with the approval of the health and safety manager (HSM) and project manager (PM). Furthermore, updates to the APP, SSHP, or activity hazard analyses (AHA) may require client approval; the ECC PM will make the client aware of updates to determine if another client review is necessary.

2.1 CONTRACTOR

Environmental Compliance Consultants, Inc. (ECC)

2.2 CONTRACT NUMBER

Contract No. W911KB-17-D-0017

2.3 PROJECT NAME

Drury Gulch Post-Remedial Action Long-Term Monitoring and Maintenance.

2.4 ACCIDENT PREVENTION PLAN AND SITE SAFETY AND HEALTH PLAN IMPLEMENTATION

This Accident Prevention Plan and attached Site Safety and Health Plan were prepared under Subcontract Agreement HTRW-TO0117-JEG-2019-01AG with Environmental Compliance Consultants, Inc. (ECC) and have been developed based on the anticipated work activities to be conducted as part of the Drury Gulch Post-Remedial Action Long-Term Monitoring and Maintenance project. This plan is being made available to third parties including other site contractors. As use of these plans and procedures goes beyond the requirements of the Subcontract and Jacobs has no control over the use by third parties Jacobs makes no guarantees nor warranties, express or implied, related to any information in these plans. Implied Warranties of Merchantability and Fit for Particular Purpose are specifically excluded. By using the information contained in these plans, third parties are agreeing that they assume full and complete responsibility for any and all liabilities that may arise from use of same and expressly waive any and all remedies whether at law or in equity. To the fullest extent permitted by law neither Jacobs, nor its parent company, Jacobs Engineering Group Inc., nor any of its officers, directors, employees; nor subcontractors, agents, or anyone acting on their behalf assumes any liability whatsoever; however, the same may be caused. The limitations and exclusions of liability set forth herein apply regardless of the fault, tort (including negligence), strict liability or otherwise of Jacobs, or Jacobs Engineering Group Inc. All parties utilizing these plans shall review and approve the project-specific plans and procedures by providing signatures on the signature page. It is the responsibility of all parties utilizing these plans to understand the

contents and limitations, and to provide these plans to their employees conducting onsite work along with sufficient oversight to meet current industry standards (including EM 385-1-1 and ER 385-1-92). Due to the changing site conditions expected over time and the currently unknown maintenance and sampling to be conducted, it is the responsibility of all onsite personnel to review their proposed work tasks and the associated risks associated with those tasks prior to completing the work.

2.5 PROJECT DESCRIPTION AND LOCATION

Drury Gulch and the surrounding area were used by the U.S. Navy from 1939 to 1972 as part of the Kodiak Naval Station Reservation. The Navy stored and disposed of a variety of metal and wood debris in Drury Gulch for an unknown period. During the rerouting of the Rezanof Highway in the mid-1970s and the mid-1980s, the majority of metal and debris was removed from the site or buried on site and the surface was subsequently regraded. Site investigations in 1993, 1999, and 2000 showed that elevated levels of PCBs remain in the gulch from past military activities. The presence of PCBs in the area is believed to result from dumping PCB containing metal debris, such as electrical components, or reusing backfill material/soil cover containing PCBs.

In July 2003, a cleanup Decision Document (DD) was finalized which presents the selected RA and supporting rationale for the cleanup at the Drury Gulch FUDS. The 2003 DD references the 2002 remedial investigation/feasibility study (RI/FS) report and summarizes the site features and conditions. In 2013, the Hydrology and Hydraulics Review Report (HHRR) was prepared that further identified important site features associated with the Drury Gulch FUDS.

Terminology used before and after finalization of the DD has not been consistent throughout previous reporting and planning documents. Additionally, as new important features were identified throughout the history at the site, they were labeled but not clearly and consistently defined in previous reports. The terminology used in this LTMM plan will be consistent with that identified in the 2002 RI/FS, the 2003 DD, and the 2013 HHRR. Furthermore, in order to orient the reader to the various sub-areas and important site features, added clarity has been included in Section 2.4 to (1) define the Drury Gulch FUDS sub-areas, (2) define the important

site features included in each sub-area and, (3) list previously used alternative names for reference when reading previous reports and planning documents.

2.5.1 SITE DESCRIPTION

Drury Gulch is a natural drainage basin bounded by shallow bedrock which slopes to the northwest and southeast, and primarily drains toward the northeast. A small, secondary side drainage slopes toward the southeast along the Site Access Road and conveys water from the Drury Gulch Creek through a culvert toward the Rezanof Highway. Figure C-1 shows the location and vicinity of the Drury Gulch FUDS.

The Drury Gulch FUDS is divided into four onsite sub-areas: Upper Gulch Area, Lower Gulch Area, Area North of the Rezanof Highway (ANRH), and the Lower Drainage Channel Area. The entirety of the Drury Gulch FUDS boundary encompasses these four sub-areas. The Rezanof Highway curves around the natural gulch and bisects the Drury Gulch FUDS, separating the Upper and Lower Gulch Areas from the ANRH and the Lower Drainage Channel Area. The Upper and Lower Gulch Areas, including the natural gulch, are located upgradient and are contained within a site perimeter fence. The ANRH and the Lower Drainage Channel Area are located outside the perimeter fence and extend downgradient toward the Kodiak Airport. The water conveyed through the Drury Gulch FUDS predominately flows toward the northeast through aboveground, open drainage channels before entering the Kodiak Airport stormwater drainage system and ultimately discharging into Womens Bay. In addition, to the four onsite sub-areas, Aviation Hill is an offsite area that directly influences onsite conditions at Drury Gulch FUDS.

2.5.2 Project Site Map

A project site map is provided in Figure C-1. Refer to the relevant project work plans for more detailed site maps.

2.6 PROJECT TASKS AND PROJECT PHASES

The following project tasks may be performed in support of the general site and specific operations work in this section:

- Post Remedial Action Monitoring and Maintenance
- Post Storm Event Inspections
- Soil/Sediment PCB Sampling
- IDW management

2.6.1 General Site Work

- Field assessments with low risk activities
- Potential soil/sediment sampling
- Use of various equipment (e.g. hand tools, excavator, loader, drill/DPT rig)

2.6.2 Equipment to Be Used

Anticipated equipment to be used for the project includes the following:

- Shovels and trowels
- Utility locate equipment
- Hand tools
- Utility vehicles
- Earth-moving equipment
- Drilling equipment
- Portable generators

2.6.3 High Risk Activities

Anticipated high-risk activities for the project include the following:

- Heavy Equipment use (if necessary)

2.6.4 Work Requiring Activity Hazard Analysis

Certain planned field tasks for the RI and remedial action require AHAs. The following AHAs are included as Exhibits to the SSHP (Attachment C-1):

- 01, Post Remedial Action and Post Storm Event Monitoring and Management
- 02, Utility Clearance
- 03, Drilling/DPT
- 04, Soil and Sediment Sampling
- 05, Mobilization, Use, and Demobilization of Earthmoving Equipment – To be prepared once the type of maintenance activities and equipment needs have been determined.
- 06, IDW Management

3.0 STATEMENT OF SAFETY AND HEALTH POLICY

3.1 OBJECTIVE

The objective of this safety program is to provide a place of employment free of all recognized hazards that cause or will likely result in death or serious physical harm to employees. The objective can be facilitated by developing and administering an overall health and safety program, which establishes written policies and procedures that will be used to implement program requirements.

3.2 PURPOSE

This project-specific APP, in conjunction with the project-specific or program health and safety documents, is intended to do the following:

- Define the policies, procedures, and requirements that must be implemented
- Establish the requirements, responsibilities, and expectations for management, supervisors, employees, and subcontractors that may participate in the execution of the program projects

This APP addresses the applicable requirements set forth by 29 CFR 1910, 29 CFR 1926, EM 385 1-1

3.3 GOALS

The health and safety goal for this project is to eliminate workplace accidents, gain worker acceptance through cooperation and training, and provide clients with a responsible, well-trained, safety-oriented work force.

ECC considers safety the highest priority during work at all project sites and in its business offices and has established a goal of zero incidents. This program will be conducted in a manner that minimizes the probability of near misses, injury, illness, and equipment or property damage.

All management and employees must strive to meet the project-specific health, safety, and environment goals outlined herein. The team will be successful only if each member of the team

makes a concerted effort to accomplish these goals. The goals allow the project to succeed by staying focused on optimizing the health and safety of all project personnel.

The project has established 11 specific goals and objectives, as follows:

- Create an injury-free environment.
- Have zero injuries or incidents.
- Provide management leadership for health, safety, and environment by communicating performance expectations, reviewing and tracking performance, and leading by example.
- Ensure effective implementation of the SSHP and APP through education, delegation, and teamwork.
- Ensure 100-percent participation in training programs, personal protective equipment (PPE) use, and HSE compliance.
- Continuously improve safety performance.
- Maintain free and open lines of communication.
- Make a personal commitment to safety as a value.
- Focus safety improvements on high-risk groups.
- Continue strong employee involvement initiatives.
- Achieve health and safety excellence.

3.4 CONTRACTOR ACCIDENT EXPERIENCE

Jacobs exceptional safety performance greatly exceeds the industry average. Jacobs' injury and illness rates and Experience Modification Rate (EMR) have averaged 0.49 over the past 5 years, as seen in Table 3-1.

Table 3-1
Jacobs Global Safety Performance, 2014-2018

Category	2014	2015	2016	2017	2018
Employee Hours	128,759,217	118,403,096	103,028,810	98,273,359	143,675,040
EMR	0.49	0.52	0.51	0.51	0.45
Fatalities	0	2	0	0	0
Recordable Incidents	196	151	123	79	142
Recordable Incident Rate	0.30	0.26	0.52	0.16	0.20
Lost Workday (LWD) Incidents (DART)	81	69	53	31	38
LWD Incident Rate (DART)	0.13	0.12	0.10	0.06	0.05

Notes:
DART = Days Away, Restrictions, and Transfers
LWD = lost workday

3.5 SAFE WORK POLICY

For over 15 years ECC has committed to delivering on quality and safety for USACE and its customers. We strive to operate a safe work environment and aim for incident and injury-free performance.

3.6 POSTING OF HEALTH AND SAFETY INFORMATION

Site-specific health and safety information will be posted in onsite in clear view and in a location accessible to all workers. The posted information will be protected from the environment and kept updated as project information changes.

(intentionally blank)

4.0 RESPONSIBILITIES AND LINES OF AUTHORITIES

4.1 STATEMENT OF EMPLOYER'S RESPONSIBILITY

ECC is committed to the prevention of personal injuries, occupational illnesses, and damage to equipment and property in all its operations, employees, subcontractors, and all others on the worksite (includes the strict enforcement of the program). This includes the protection of the general public whenever it comes in contact with the company's work, as well as the prevention of pollution and environmental degradation.

Company management, field supervisors, and employees plan safety into each work task to prevent occupational injuries and illnesses. ECC management extends its full commitment to health and safety excellence.

4.2 PERSONNEL WITH SAFETY RESPONSIBILITIES

Participating personnel are responsible for complying with safety procedures and for proactively making safety awareness part of their day-to-day conduct.

The following positions have specific corporate and project safety responsibilities:

- ECC PM/task order manager (TOM) – Andy Larson; (907) 385-0677
- ECC HSM for ECC controlled tasks – Stanley R. Seegars; (907) 360-0416
- ECC site safety and health officer (SSHO) for ECC controlled tasks - Jessica Bay; (757) 754-9240
- Jacobs PM - Greg Rutkowski; (907) 762-1102
- Jacobs HSM for Jacobs controlled tasks – John Culley, CIH; (206) 660-3367
- Jacobs SSHO for Jacobs controlled tasks – Jeremiah Knuth; (907) 762-1388

Alternate SSHOs may be assigned; however, only one primary SSHO will be assigned at any given time. All staff members are accountable for their own health and safety and have the authority to request a work stoppage when they feel unsafe behaviors, actions, or situations are occurring.

Section 4 of Attachment C-1 includes the duties of each position and additional roles and responsibility details. Table 4-1 presents the qualifications and training histories for the PM, HSM, and SSHO.

4.3 PERSONNEL COMPETENCIES

All work requiring a competent person per the OSHA definition (29 CFR 1926.32(f)), will not be started until that competent person is designated and onsite. *Competent person* means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. For all general tasks, the SSHO is the competent person, unless otherwise noted for specific tasks.

Table 4-1
Personnel Competencies

Name	Role	Competency & Qualifications
Andy Larsen	ECC PM	40-hour HAZWOPER, 8-hour HAZWOPER annual refresher, 8-hour Supervisor HAZWOPER, first aid/ cardiopulmonary resuscitation (CPR), HAZCOM, PPE, hazard-specific training topics as listed in Section 6. HAZWOPER Medical Qualification
John Culley	Jacobs HSM (for Jacobs controlled tasks ONLY)	Certified Industrial Hygienist, Bachelor of Science in Environmental Health and Safety or equivalent, OSHA 500 Trainer Course in OSHA Standards for the Construction Industry. 40-hour HAZWOPER, 8-hour HAZWOPER annual refresher, 8-hour Supervisor HAZWOPER, first aid/CPR, HAZCOM, PPE, hazard-specific training topics as listed in Section 6. 5+ years of experience in health and safety management at remediation projects. Documented experienced supervising professional/technician level personnel, developing worker exposure assessment and air monitoring programs, managing PPE programs and hazard evaluations.
Jessica Bay	ECC SSHO	OSHA 30-hour Construction, 40-hour HAZWOPER, 8-hour HAZWOPER Annual Refresher, 8-hour Supervisor HAZWOPER, first aid/CPR, HAZCOM, PPE, hazard specific training topics as listed in Section 6. Training in respiratory protection, air monitoring instruments, construction safety procedures, confined space entry (if

Table 4-1 (Continued)
Personnel Competencies

Name	Role	Competency & Qualifications
		applicable), and federal and state occupational safety and health regulations. 5 years of continuous safety experience in managing environmental work and implementing health and safety programs at remediation projects. Authorized competent person for site tasks, unless otherwise noted for specific tasks below (for example, excavation and fall protection). HAZWOPER Medical Qualification
Jeremiah Knuth	Jacobs SSHO (for Jacobs controlled tasks ONLY)	OSHA 30-hour Construction, 40-hour HAZWOPER, 8-hour HAZWOPER Annual Refresher, 8-hour Supervisor HAZWOPER, first aid/CPR, HAZCOM, PPE, hazard specific training topics as listed in Section 6. Training in respiratory protection, air monitoring instruments, construction safety procedures, confined space entry (if applicable), and federal and state occupational safety and health regulations. 5 years of continuous safety experience in managing environmental work and implementing health and safety programs at remediation projects. Authorized competent person for site tasks, unless otherwise noted for specific tasks below (for example, excavation and fall protection). HAZWOPER Medical Qualification

4.4 RISK MANAGEMENT PROCESS

A health and safety risk analysis is performed for each task of a given project. Risks and mitigations for each task are detailed in the site-specific AHAs included with the SSHP. Initial activity-specific AHAs are to be submitted and accepted at preparatory meetings before work is performed. ECC will consider various methods for mitigating hazards in the order listed in this section. Employees are trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects.

- Elimination of the hazards (that is, use remote sampling methodology to avoid going into a confined space)

- Substitution (that is, reduce exposure to vapors by using of a geoprobe instead of test-pitting)
- Engineering controls (that is, ventilate a confined space to improve air quality)
- Warnings (that is, establish exclusion zones to keep untrained people away from hazardous waste work)
- Administrative controls (that is, implement a work and warming schedule to reduce chance of cold stress)
- Use of PPE (that is, use respirators when action levels are exceeded)

4.5 ACTIVITY HAZARD ANALYSIS REVIEW AND ACCEPTANCE

All work is conducted under a behavior-based and loss prevention system program. AHAs and pre-task safety planning are a vital part of this work.

An AHA must be developed for each field activity and approved by the HSM. AHAs are to be submitted and accepted at preparatory meetings before any work is performed. The AHA will define the work tasks required for each activity, along with potential HSE hazards and recommended control measures for each hazard, incorporating the hazardous energies described herein. In addition, the AHA will list the equipment to be used to perform the activity, inspection requirements to be performed, and training requirements for the safe operation of the equipment. Workers are briefed on the AHA before performing the work and their input is solicited before, during, and after the work is performed to further identify the hazards posed and control measures required.

Jacobs subcontractors are required to provide Jacobs with AHAs specific to their scope of work on the project, for acceptance. ECC subcontractors are required to provide ECC with AHAs specific to their scope of work on the project, for acceptance Each subcontractor will submit AHAs for their field activities, as defined in their scope of work, along with their project safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

4.6 WORK AUTHORIZATION

No phase of work will begin until a designated SSHO or competent person is present at the job site. Before work beginning, all applicable safety documents and AHAs will be reviewed and signed with each worker acknowledging the tasks to be performed.

4.7 SAFETY COMPLIANCE

All onsite personnel responsible for safety should continue to observe personal safety performance and adherence to the health and safety plans and AHAs. This observation should be reasonable and include looking for hazards or unsafe practices that are both readily observable and occur in common work areas.

4.7.1 Reporting Unsafe Conditions and Practices

Responsibility for effective health and safety management extends to all levels of the project and requires good communication between employees, supervisors, and management. Accident prevention requires a proactive policy on near misses, close calls, unsafe conditions, and unsafe practices. All personnel must report any situation, practice, or condition that might jeopardize the safety of the projects. All unsafe conditions or unsafe practices will be corrected immediately. ECC has zero tolerance of unsafe conditions or unsafe practices.

No employee or supervisor will be disciplined for reporting unsafe conditions or practices. Individuals involved in reporting the unsafe conditions or practices will remain anonymous.

The following reporting procedures will be followed by all project employees:

- Upon detection of any unsafe condition or practice, the responsible employee will attempt to safely correct the condition.
- The unsafe condition or practice will be brought to the attention of the worker's direct supervisor, unless the unsafe condition or practice involves the employee's direct supervisor. If so, the SSHO needs to be notified at once by the responsible employee.
- Either the responsible employee or responsible employee's direct supervisor is responsible for immediately reporting the unsafe condition or practice to the SSHO.
- The SSHO will act promptly to correct the unsafe condition or practice.

- Details of the incident or situation will be recorded by the SSHO in the field logbook. If the subcontractor was involved, the Observed Hazard Form will be used.

4.7.2 Standards of Conduct Violations

All individuals associated with this project (including subcontractors and suppliers) must work injury-free and drug-free and must comply with the standards of conduct, the SSHP and APP, and the site safety requirements. Commonly accepted standards of conduct help maintain good relationships between people. They promote responsibility and self-development. Misunderstandings, frictions, and disciplinary action can be avoided by refraining from thoughtless or wrongful acts. Violations of the standards of conduct include the following:

- Failure to perform work
- Inefficient performance, incompetence, or neglect of work
- Willful refusal to perform work as directed (insubordination)
- Negligence in observing safety regulations, poor housekeeping, or failure to report on-the-job injuries or unsafe conditions
- Unexcused or excessive absence or tardiness
- Unwillingness or inability to work in harmony with others
- Discourtesy, irritation, friction, or other conduct that creates disharmony
- Harassment or discrimination against another individual
- Failure to be prepared for work by wearing the appropriate construction clothing or PPE, or bringing the necessary tools
- Violation of any other commonly accepted and reasonable rule of responsible personal conduct
- Violation of the safety and health requirements of their corporation’s policy or of this APP
- Unauthorized or illegal possession, use, or sale of alcohol or controlled substances on work premises, during working hours, while engaged in corporate activities, or in corporate vehicles
- Use or sale of firearms or explosives on work premises

4.7.3 Intolerable Offenses

Certain employee conduct may be so intolerable as to justify removal from the project. Intolerable offenses and actions include the following:

- Any manager, supervisor, foreman, or other person in charge of the work being performed who requires, requests, asks, threatens an employee's job, allows, or condones employees to work in or around unsafe acts or conditions
- Any employee, supervisor, or manager who knowingly falsifies any investigative documents or testimony involving an investigation
- Any employee, supervisor, or manager who openly exhibits disregard, defiance, or disrespect for the safety program
- Any employee who violates established safety rules, regulations, or codes that endanger themselves or other employees
- Any and all parties involved in workplace violence, including physical encounters (fighting) or threats of violence, theft, or destruction of property
- Any employee, supervisor, or manager failing to comply with procedures contained in the subcontract, SSHP and APP, USACE EM 385-1-1 Manual, or local safety laws and regulations that create the potential for serious or costly consequences
- Any employee who commits repeated minor offenses and shows a lack of responsible effort to correct these offenses

4.7.4 Enforcement and Discipline

ECC's or Jacobs' relevant Enforcement and Discipline procedures, the Standards of Conduct, the Intolerable Offenses, and the Drug-Free Workplace policy will be thoroughly reviewed with each employee during the employee project orientation.

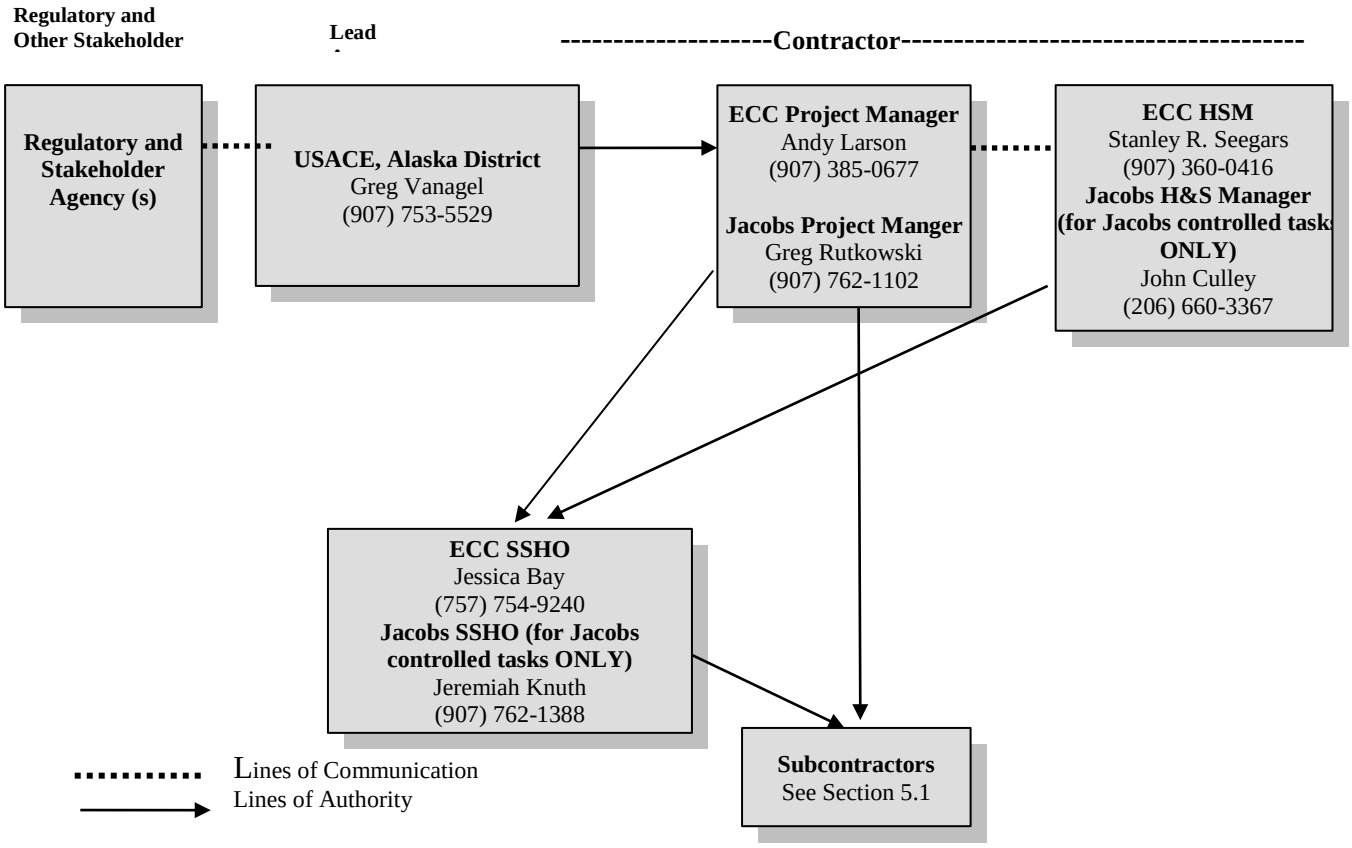
4.7.5 Intolerable Offenses

ECC and Jacobs practice zero tolerance for intolerable offenses. Individuals found participating in such offenses will be dealt with according to applicable corporate policy. Offenses could result in an employee being suspended from work without pay or being immediately discharged from the project and not allowed to return.

4.8 LINES OF AUTHORITY

Chart 4-1 shows the personnel roles and lines of authority.

Chart 4-1 Personnel Roles and Lines of Authority



4.9 MANAGERS AND SUPERVISORS SAFETY ACCOUNTABILITY

4.9.1 Prohibited Behaviors and Actions

Managers and supervisors who openly or recklessly exhibit a disregard, defiance, or disrespect for ECC or Jacobs' HSE programs, rules, procedures, processes, and training, or who violate established HSE programs, rules, procedures, processes or training, endangering themselves or

other employees, will be subject to disciplinary actions. Without limitation, behaviors and actions that warrant disciplinary action include the following:

- Requiring, requesting, demanding, asking, or threatening another person in any manner to entice the person to engage in or work around a patently-unsafe or environmentally-compromising act or condition
- Condoning or knowingly allowing a person to engage in or work around a patently unsafe or environmentally compromising act or condition
- Recklessly, knowingly, or purposely failing to wear required PPE.
- Failing to successfully complete any required HSE training that is scheduled and made available for completion
- Failing to promptly notify a supervisor, project safety manager, coordinator, lead, or the PM when an unsafe condition or behavior is observed, or when an environmentally compromising condition is encountered
- Failing to promptly report to a supervisor, project safety manager, coordinator, lead, or the PM a work-related HSE incident or near miss
- If required of the position, failing to maintain as active and in good standing necessary health, safety, or environmental licenses or permits needed to support work and projects
- Knowingly falsifying any HSE record or investigative document, or providing false testimony, during an HSE or outside agency incident investigation
- Refusing to cooperate in an HSE incident investigation
- Knowingly falsifying any inspection or sampling records
- Performing field work without the required site HSE plan approved by an HSE manager
- Engaging in any form of workplace violence described in Jacobs Policy 201, Workplace Violence Awareness and Prevention, including physical encounters, destruction of property, and verbal threats of violence, harm, or mayhem
- Failing to comply with any HSE procedures contained in any contract, subcontract, site HSE plan, or any federal, state, or local health, safety, or environmental laws and regulations creating actual or potential significant risk (whether monetary or otherwise)
- In addition, no individual may have in their possession or bring to the project site any weapon, firearm, ammunition or instrument that could be used as a weapon.

4.9.2 Disciplinary Actions

- When managers or supervisors neglect to fulfill their responsibilities or project-specific HSE requirements, they may be subject to disciplinary action.

(intentionally blank)

5.0 SUBCONTRACTORS AND SUPPLIERS

5.1 PROJECT SUBCONTRACTOR AND SUPPLIER REQUIREMENTS

Subcontractors and suppliers providing services onsite will be subject to the safety provisions of this APP and those included in the SSHP (Attachment C-1). ECC and Jacobs, and any identified subcontractors (see Table 5-1) will conduct site work in accordance with this APP and associated documents. ECC and Jacobs will address compliance using specific, required health and safety plans, including those listed in Section 9, and through safety meetings at the start of each shift. The specific health and safety requirements and site conditions will be reviewed with field personnel during the meetings. All parties will also comply with the requirements of their respective Injury and Illness Prevention Programs and AHAs.

Table 5-1
Subcontractors and Suppliers

Task	Subcontractor Contact Information
TBD	

5.2 SAFETY RESPONSIBILITIES OF SUBCONTRACTORS AND SUPPLIERS

- Comply with all local, state, and federal safety standards
- Comply with project and owner safety requirements
- Actively participate in the project safety program and either hold or attend and participate in all required safety meetings
- Provide a qualified safety representative to interface with ECC, Jacobs, or both, as required
- Maintain safety equipment and PPE for their employees
- Maintain and replace safety protection systems damaged or removed by the subcontractor's operations
- Notify the SSHO of any accident, injury, or incident (including spills or releases) immediately, and submit reports to ECC within 24 hours
- Install contractually required general conditions for safety (for example, handrail, fencing, fall protection systems, and floor-opening covers)
- Conduct site-specific and job-specific training for all subcontractor employees, including review of the SSHP, subcontractor health and safety plans, and subcontractor AHAs, and sign appropriate signoff forms

- Determine and implement necessary controls and corrective actions to correct unsafe conditions

The subcontractors listed in Table 5-1 may be required to submit their own site-specific health and safety plan and any other sub-plans applicable to their work. Subcontractors are responsible for the health and safety procedures specific to their work and are required to submit their plans to ECC or Jacobs (depending on the subcontractor) for review and acceptance before the start of fieldwork.

Subcontractors are also required to prepare AHAs before beginning each activity posing hazards to their personnel. The AHA will identify the principle steps of the activity, potential health and safety hazards for each step, and will recommended control measures for each identified hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements, and training requirements for the safe operation of the equipment listed must be identified.

6.0 TRAINING

6.1 NEW HIRE TRAINING REQUIREMENTS

New hire safety and occupational health orientation training at the time of initial hire of each new employee is a requirement. Site workers, supervisors, and managers will have training appropriate to their assigned duties and as specified in the SSHP and AHAs that are applicable to the work being performed.

As specified in Section 4.0 of Attachment C-1, the SSHO (who will also conduct the project safety and health inspections), will meet the training and indoctrination requirements prescribed in this APP and Attachment C-1, as well as the HAZWOPER supervisory training. All employees engaging in hazardous waste operations or emergency response will receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65. At a minimum, the training will consist of instruction in the topics outlined in 29 CFR 1910.120 and 29 CFR 1926.65. Because there are tasks planned that require a competent person, competent-person-level training is required. Personnel who have not met these training requirements will not be allowed to engage in HAZWOPER activities.

All SSHOs (primary and alternates) will complete a 30-hour OSHA Construction Safety training, as well as all required internal training courses per company requirements. Required courses may include first-aid/CPR, fire extinguisher, bloodborne pathogens, and others.

The SSHO will also serve as the project competent person for all general tasks not covered by a specialized subcontractor.

6.2 PROJECT-SPECIFIC TRAINING REQUIREMENTS

Before commencing field activities, all field personnel assigned to the project will have completed site-specific training that will address the contents of the APP and applicable AHAs, including the activities, procedures, monitoring, and equipment used in the site operations. Site-specific training will also include site and facility layout, potential hazards, risks associated

with identified emergency response actions, and available emergency services. Training will be verified documented and complete by the SSHO and HSM.

Project-specific training for this project includes the following:

- APP/SSHPs
- AHAs
- 40-hour HAZWOPER / 8-hour refresher (annual)
- Online, computer-based Jacobs worker category training
- Field vehicles
- 30-hour OSHA Construction Training (SSHO only)
- Explosives Usage and Munitions Response Training (for UXO technicians)
- HAZCOM
- PPE
- Hand and power tool training
- Manual lifting
- Fire extinguisher
- Dangerous goods shipping

6.3 PERIODIC TRAINING REQUIREMENTS FOR SUPERVISORS AND EMPLOYEES

Periodic training for supervisors and employees will be provided through the following processes managed by the SSHO. In addition, 8-hour HAZWOPER refresher training will be provided annually before the training expiration date.

6.3.1 Safety Meetings and Toolbox Meetings

Safety meetings provide a method for maintaining safety awareness and providing safety-related information and training to employees. Safety meetings for project supervisory personnel and project employees will be held at least daily and include relevant information for on- and off-the-job safety.

6.3.2 Activity Hazard Analysis Training

Each supervisor will review task-specific AHAs with all workers assigned to perform that task before the beginning of that task anywhere on the job site. All workers will sign the AHA document signifying they have been trained and understand the task steps, hazards, and hazard controls to be used.

6.3.3 Safety Pre-task Planning and Training

Each day, the onsite supervisors will hold informational safety training with each member of their crew. Information discussed and training performed will pertain to current project activities and scope of work. The subcontractor is encouraged to use the time for employee input and task-specific training.

6.3.4 Vendor Training

Vendors that supply equipment to the project will be required to perform a training session to review and explain the safe operation procedures to the parties that will be using or operating the equipment.

6.3.5 Personal Protective Equipment Training

OSHA requires each PPE user to receive training on the proper care, maintenance, limitations, and instructions on how to wear and adjust PPE. The proper use of PPE will also be included in project safety briefings and toolbox meetings.

6.4 EMERGENCY RESPONSE PLAN TRAINING

Emergency Response Plan training will occur during the employee site orientation and retraining will occur periodically in safety meetings. The Emergency Response Plan training will include evacuation alarms, site evacuation, designated assembly areas, and procedures for evacuation to an emergency medical facility. The SSHO will review site specific emergency procedures with the project team before the start of onsite work.

(intentionally blank)

7.0 SAFETY AND HEALTH INSPECTIONS

7.1 INSPECTION DETAILS AND ASSIGNMENTS

The project SSHO will provide daily onsite safety and health inspections for this project while work is being performed. Deficiencies will be identified in the deficiency tracking log and tracked to completion as identified below. The SSHO will meet the training and indoctrination requirements as prescribed in this APP and Attachment C-1, including HAZWOPER supervisory and OSHA 30 Hour Construction training for the SSHO. The SSHO will also have hands-on experience overseeing these types of tasks.

The following safety and health inspections and audits will be completed:

- Daily field inspection and report – Daily by SSHO
- Project activity self-assessment checklists – Initially when task is initiated, then weekly by SSHO
- Safe Observation Reports (SORs) – Once weekly by the Jacobs SSHO for Jacobs controlled tasks
- Equipment Inspections – Daily inspections performed by subcontractor equipment operators/competent persons/qualified persons, documented according to company policy

7.1.1 Proof of Inspector's Training/Qualifications

- The project SSHO resume and training documentation will be provided upon request.

7.1.2 Inspection Frequency

Daily onsite safety and health inspections will be completed for this project while field work is being performed. Other inspection frequency is noted in Section 7.1.

7.1.3 Inspection Forms

Inspection forms are provided as Exhibit C-5 to the SSHP (Attachment C-1).

7.1.4 Deficiency Tracking System

Identified safety and health issues and deficiencies, and the actions, timetable, and responsibility for correcting those deficiencies, will be recorded using a deficiency tracking log. Follow-up inspections to ensure correction of any identified deficiencies should be conducted and documented in a like manner.

The deficiency tracking log will list the status of deficiencies in chronological order, be incorporated into the weekly inspection reports, and be posted on the project safety bulletin board. The posted log will be updated daily and will provide the following information:

- Date deficiency identified
- Description of deficiency
- Name of person responsible for correcting deficiency
- Projected resolution date
- Date resolved

7.1.5 Competent and Qualified Person Inspections

For all general field tasks, the ECC SSHO, or Jacobs SSHO for Jacobs controlled tasks, are the competent persons conducting inspections, unless otherwise noted in Section 4. Subcontractor equipment operators, competent persons, or qualified persons will conduct daily inspections of their equipment, and document according to company policy.

7.2 EXTERNAL INSPECTION AND CERTIFICATIONS

External inspections or certifications will not be required for this work.

8.0 MISHAP REPORTING

8.1 EXPOSURE DATA (MAN-HOURS WORKED)

Man-hours worked for the project will be collected by the ECC quality control (QC) manager for the project and reported in the daily QC report. The hours will be tabulated weekly and entered on the Weekly Report. The project work hours for the month will be reported to the PM by the fifth calendar day of the following month.

8.2 MISHAP REPORTS, INVESTIGATIONS AND DOCUMENTATION

Report all accidents per the requirements covered in Section 01.D of EM385-1-1 (2014). All mishaps should be reported immediately to the supervisor, SSHO, and the ECC and Jacobs HSMs (for Jacobs controlled tasks). Mishaps should be reported as soon as possible but not more than 24 hours afterwards to the client PM and the Contracting Officer or Contracting Officer's Representative. ECC, Jacobs, or both will report, thoroughly investigate, and analyze all mishaps occurring incidentally to an operation, project, or facility for which this manual is applicable. Corrective actions will be implemented as soon as reasonably possible and notice provided to the Contracting Officer or Contracting Officer's Representative when corrective actions are completed. Documentation, including incident reports, investigation, analysis, and corrective measures taken, will be kept by the SSHO and will be maintained onsite for the duration of the project.

A near miss is defined as a mishap resulting in no personal injury and zero property damage, but where, given a shift in time or position, damage or injury might have occurred (for example, a worker falls off a scaffold and is not injured, or an operator swings his crane swings around to move its load and narrowly misses a parked vehicle).

(intentionally blank)

9.0 PLANS REQUIRED BY THE EM 385-1-1 SAFETY MANUAL

Plans required by the EM 385-1-1 Safety Manual are presented in the following subsections. Plans and procedures that are not applicable to this project are indicated as such with the non-applicability rationale.

9.1 FATIGUE MANAGEMENT PLAN

A Fatigue Management Plan (FMP) is required because the project work may exceed the following standards:

- 10 hours a day for more than 4 consecutive days
- 50 hours in a 7-day work week
- 12 hours a day for more than 3 consecutive days

Specific work-hour limitations and affected workers are as follows:

- Equipment operators: Operators of equipment, such as the mobile construction equipment to be used on this project, will not be permitted to exceed 12 hours of duty time in any 24-hour period, including time worked at another occupation. A minimum of 8 consecutive hours of rest between shifts in a 24-hour period is required.
- Motor vehicle operators: No employee, while on duty, may operate a motor vehicle after being in a duty status for more than 12 hours during any 24-hour period. A minimum of 8 consecutive hours will be provided for rest in each 24-hour period.
- Other affected workers: No employee may perform field work for more than 12 hours during any 24-hour period. A minimum of 8 consecutive hours will be provided for rest in each 24-hour period.

Rest Periods

- Rest is defined as a period of time during which the person concerned is off duty, is not performing work (including administrative tasks), and is afforded the opportunity for uninterrupted sleep. This does not include time for breaks, meals, or travel time to and from work.
- Rest periods may be interrupted in case of emergency, drill, or other overriding operational necessity.

Training

- All site workers will be trained on the following: symptoms of fatigue, habits and actions the worker may take to avoid fatigue, actions workers should take if they observe fatigue in a co-worker, and controls in place to prevent fatigue.

Controls

- Controls for fatigue will include a discussion of driving to and from work and any possible mitigation of driving as a factor of fatigue.
- Additional controls for fatigue will include work scheduling, rotating jobs to prevent repetitive work, breaks at critical times in the work cycle, control of environmental factors (for example, heat, cold, or use of PPE), buddy check-in for individuals working alone, and alternate transportation for long commutes

9.1.1 Responsibilities

Project Managers

- Implement the elements of the FMP and monitor and manage the delegation of work and the potential for fatigue-related deterioration of performance.
- Ensure sufficient resources are provided to enable the project to manage staff workloads and work hours to prevent fatigue related incidents.
- Monitor the effectiveness of the FMP and identify, assess, and monitor fatigue risks. Verify that the site employees or project team (including staff, agency employees, and site contractors) are not adversely affected by fatigue because of excessive work hours, lack of suitable rest and recovery periods, exposure to extreme environmental conditions, or other factors.
- Ensure project staff receive fatigue management awareness training at the beginning of their assignment and when revisions or updates occur and are refreshed at least annually.
- Promote positive fatigue management practices and demonstrate visible support for those practices.
- Review the need to work extended hours.

Site Supervisors

- Implement fatigue management control measures and actions, and continuously monitor and assess fatigue risks in the area of their control.
- Monitor and manage the delegation of work for the potential for fatigue-related deterioration of performance.
- Reinforce fatigue management control measures and actions during department or group meetings.

SSHO

- Assist the PM and HSM with implementation of the FMP.
- Review fatigue management guidelines as part of the pre-task safety briefing.
- Periodically assess site workers for signs of fatigue during their work shift.

Responsible HSM

- Assist the PM with developing and updating the FMP.
- Include fatigue management as applicable, in the AHA/Job Hazard Analysis, pre-task safety plan, and the SBO program.
- Periodically assess the effectiveness of the fatigue management plan.

Employees

- Comply with the site or project fatigue management initiatives.
- Practice lifestyle choices that minimize personal fatigue and enable fitness for duty, such as getting sufficient sleep and recovery time to complete their work duties safely and responsibly and managing any personal, medical, or health issue that may affect their fitness for work.
- Identify, monitor, and report fatigue-related issues to supervisor or SSHO.
- Report to supervisor or SSHO any fatigue risk situation applying to themselves or a coworker (apply discretion and respect when reporting concerns about another person).
- Attend the fatigue training and education sessions and apply the information.

Subcontractor Management

- Comply with the project fatigue management requirements
- Ensure subcontractor employees are engaged and fit for work.
- Manage resources, work schedules, and worker levels to avoid creating risks arising from fatigue-related issues.
- Monitor and supervise work for the signs and symptoms of fatigue among the workers.

9.2 EMERGENCY PLANS

The following addresses emergency plan components for fire, medical services, and inclement weather. The emergency plan should be tested at the start of field work and annually thereafter:

- Procedures and tests

- Spill plans
- Firefighting plan
- Posting of emergency contacts
- Medical support

9.2.1 Pre-emergency Planning (Fire, Medical, and Inclement Weather)

The emergency response coordinator (ERC), typically the SSHO or designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with onsite parties, the facility, and local emergency-service providers as appropriate, and is the person to be contacted for information or clarification. Pre-emergency planning activities performed by the ERC include the following:

- Determine what onsite communication equipment is available (radios and vehicle horn).
- At initiation of field work, drill or test emergency communications use. Emergency communications should consist of verbal communication or hand signals amongst field team, use of vehicle horn to signal crew, and radio communications to summon emergency responders or other assistance.
- Review the facility emergency and contingency plans where applicable.
- Clearly communicate emergency telephone numbers and reporting instructions for ambulance, physician, hospital, fire, and police to all employees and post conspicuously and clearly at the work site.
- Confirm and post the emergency contacts information in Table 9-3 at the project base camp. Communicate the information to onsite personnel and keep it updated.
- Do not allow employees to work alone in a remote location or away from other workers.
- In field trailers and base camp facilities, keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin. This may include a “tabletop” exercise or an actual drill depending on the nature and complexity of the project. Drills should take place periodically but no less than once a year.

- Brief new workers on the emergency response plan.

The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2.2 Emergency Equipment and Supplies

The ERC will ensure the following emergency equipment is onsite; verify and update the locations of this equipment as needed. The equipment will be inspected in accordance with manufacturer's recommendations. The inspection will be documented in a field logbook or similar means to be kept in the project files.

Table 9-1
Emergency Equipment and Supplies

Equipment	Location
20 (or two 10) class A, B, C fire extinguisher	Field Vehicle/Heavy Equipment
First-aid kit	Field Vehicle
Potable water	Field Vehicle
Bloodborne-pathogen kit	Field Vehicle
Additional equipment: cellular phones	Field Vehicle/On SSHO

9.2.3 Escape Procedures and Routes

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map and communicated to crew daily.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a "buddy" will remain onsite after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- Small fires posing minimal safety or health hazards may be controlled with onsite fire extinguishers without evacuating the site. When in doubt, evacuate.

Incident Response

In case of fire, explosion, or chemical release, take the following actions:

- Notify appropriate response personnel.
- Shut down operations and evacuate the immediate work area.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.
- Implement incident notification, reporting and investigation procedures.
- Notify and submit reports to clients as contractually required.

Evacuation Signals

Table 9-2
Evacuation Signals

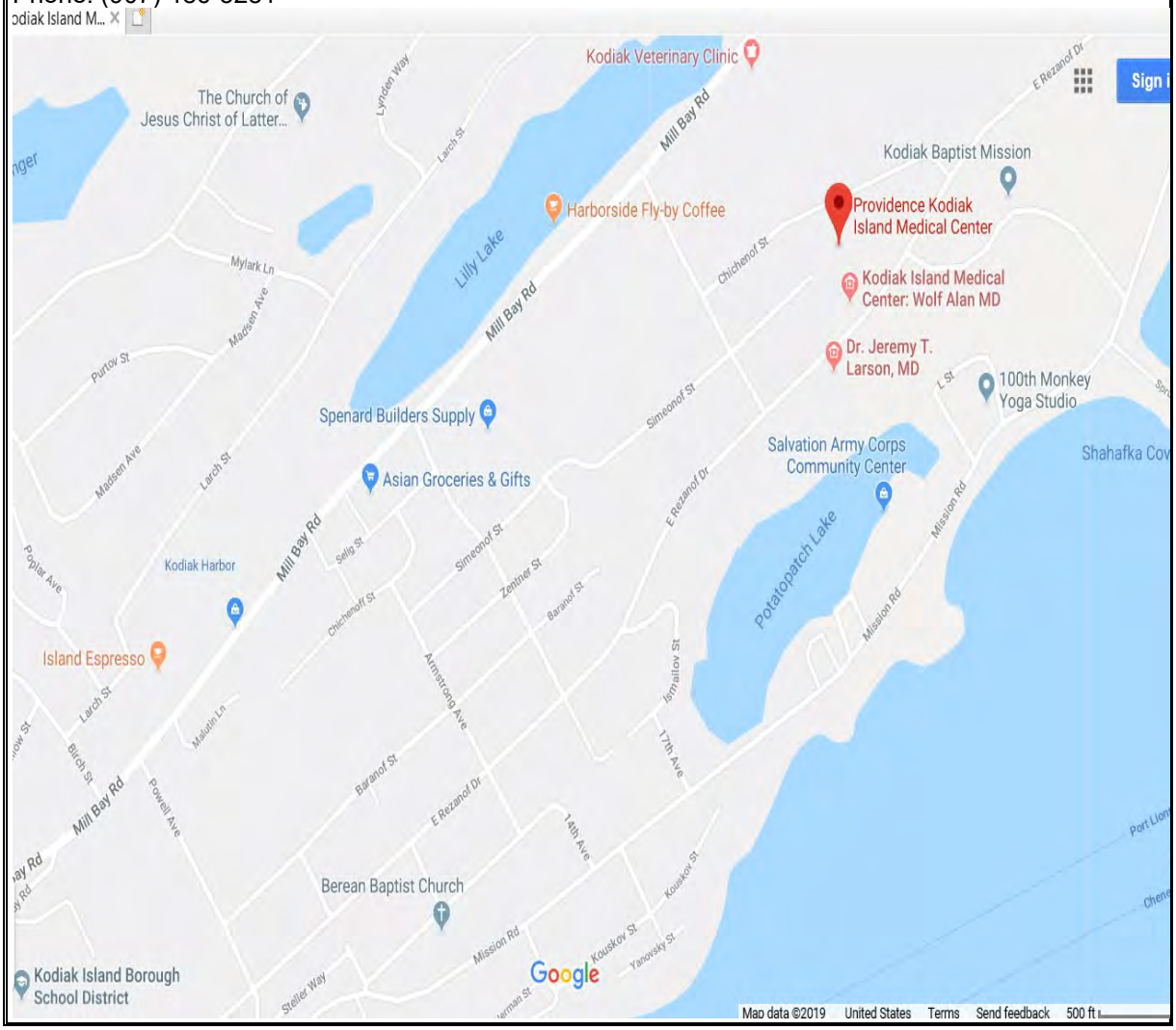
Signal	Meaning
Grasping throat with hand	Emergency; help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

Table 9-3
Emergency Contacts

ECC Injury Reporting	
ECC Project Manager Name: Andy Larson Phone: (907) 385-0677	ECC Crisis Coordinator Name: Stanley R. Seegars Phone: (907) 360-0416
ECC Safety and Health Manager Name: Stanley R. Seegars Phone: (907) 360-0416	ECC Back-up Crisis Coordinator Name: Jessica Bay Phone: (907) 895-1050
24-hour Jacobs Injury Reporting – 1-888-449-7787 **24-hour Jacobs Serious Incident Reporting Contact – Global Assistance and Response HOTLINE # +1-443-221-6281**	
Medical Emergency – Call 911	Jacobs Medical Consultant WorkCare Dr. Peter Greaney, M.D. 300 S. Harbor Blvd, Suite 600, Anaheim, CA 92805 888-449-7787
Fire/Spill Emergency None	Global Environmental Solutions – Health, Safety & Environment Name: Mark Orman/KNV Phone: 414/712-4138
Security & Police Alaska State Trooper Phone: 907-486-4121	Jacobs HSM (for Jacobs controlled tasks ONLY) Name: John Culley/SPK Phone: 206/660-3367
Utilities Emergency Phone Numbers None	Jacobs Human Resources Department Contact Market Sector HR dept.
Jacobs PM Name: Greg Rutkowski Phone: (907) 762-1102	Jacobs Worker's Compensation: Contact HR dept. to have form completed
Jacobs SSHO (for Jacobs controlled tasks ONLY) Name: Jeremiah Knuth Phone: (907) 762-1388	Media Inquiries Corporate Strategic Communications Name: Lorrie Paul Crum/DEN Phone: 303-525-2916
Federal Express Dangerous Goods Shipping Phone: 800-238-5355	CHEMTEL (hazardous material spills) Phone: 800-255-3924
Facility Alarms: Tsunami Warning Alarm	Evacuation Assembly Area(s): USCG Water Storage Tanks

Facility/Site Evacuation Route(s): From Drury Gulch Access Road, take the road that leads to the USCG Water Storage Tanks.
U.S. Coast Guard (USCG) Emergencies: Kodiak USCG Kodiak Station – 907-487-5015 Kodiak Base – 907-487-5170

Directions to Local Hospital
Providence Kodiak Island Medical Center Address: 1915 E Rezanof Dr, Kodiak, AK 99615 Phone: (907) 486-3281



9.2.4 Inclement Weather

The SSHO or designated onsite personnel should be responsible for checking the weather conditions a minimum of twice a day. Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and be aware of signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden

increase in wind. These severe weather triggers will alert the SSHO to monitor weather conditions continuously. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop—seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include the following:

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area.
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers.
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding.
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands.
- Do not use satellite phones or radios during electrical storms, except in the case of emergency.
- If lightning is observed, all load-handling equipment, drill rigs, work on elevated platforms or scaffolding, roofing activities, tree-trimming activities, pole-climbing activities, or work in open areas should stop. A determination should be made as to the proximity to the operation being performed. Once lightning is seen, count the number of seconds until you hear the thunder. Divide number of seconds by 5 to get the distance the lightning is away from you. If lightning is 10 miles away or less, work should stop until 30 minutes after the last audible thunder or visible flash of lightning.
- High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

9.2.5 Spill Plan

The project spill plan is provided in Section 20 of the SSHP (Attachment C-1).

9.2.6 Fire Fighting Plan

The decision on whether or not to try to extinguish a fire using available site personnel and equipment will be made by the SSHO and is based on whether the fire (1) is small or large and (2) involves explosives or flammable liquids or gases.

Location of Fire Extinguishers

Fire extinguishers will be located around the project sites as required in the following places at a minimum:

- In each vehicle
- Near areas where flammable materials are stored or in use
- All fire extinguishers will be kept clearly visible, marked, and placed where they are easily accessible.

9.2.7 Posting of Emergency Telephone Numbers

Emergency telephone numbers are provided in the SSHP (Attachment C-1). They will be posted onsite in clear view, in a specified area accessible by all workers. The posted information will be protected from the environment and kept updated as project information changes.

9.2.8 Alcohol and Drug Abuse Prevention Plan

The project substance abuse plan is provided in the Section 8.15 of the SSHP (Attachment C-1).

9.3 SITE SANITATION PLAN

9.3.1 Waste Disposal

Investigation-derived waste will be stored, profiled, and disposed of in accordance with the project work plan. Nonhazardous waste materials and rubbish will be managed according to the Waste Management Plan.

9.3.2 Vermin Control

No enclosed spaces are being constructed for this project and waste materials will be securely stored and transported offsite to provide vermin control.

9.3.3 Housekeeping

- Always maintain good housekeeping in all project work areas.
- Establish common paths of travel and keep them free from accumulated materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, or other devices.
- Designate specific areas for the proper storage of materials.
- Store tools, equipment, materials, and supplies in an orderly manner.
- As work progresses, store scrap and unessential materials or remove from the work area.
- Provide containers for collecting trash and other debris and remove them at regular intervals.

9.4 MEDICAL SUPPORT AGREEMENT

9.4.1 Onsite Medical Support

When two or more field staff members are present onsite, at least two will have (2) current certification in basic first-aid and CPR and (2) bloodborne pathogens annual training. Unless injured, the SSHO will be the lead person to initiate any required first-aid until onsite EMT personnel can be engaged.

Location and direction to medical support facilities should be posted in a conspicuous location where temporary construction facilities or support are established at the project site. Where temporary construction facilities or a designated administrative or support office are not allowed or provided, the list should be available for quick reference by the SSHO and personnel executing site operations, and its location should also be made known to other site personnel.

In addition, the project should be outfitted with first-aid kits of suitable size and quality (contents) to meet health and safety requirements for onsite first-aid and CPR response. Personal protective devices should be provided such that universal precautions against bloodborne pathogens can be exercised while administering CPR or first-aid. Eye wash stations, either portable or stationary, will be available.

An effective means of communication to summon transportation of injured workers to medical treatment facilities must be evaluated and established before the start of field activities. Communication devices should be tested in the area of use to assure functionality.

When a medical facility or physician is not accessible within 5 minutes of an injury to a group of two or more employees for the treatment of injuries, at least two employees on each shift should be qualified or certified to administer basic first-aid and CPR and have bloodborne pathogens annual training. Unless injured, the SSHO will be the lead person to initiate any required first aid until offsite medical support can be engaged.

When contacting the medical consultant, give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.

9.4.2 Offsite Medical Support

In the event of a medical emergency or if follow up to basic first-aid is required, request emergency medical transport as opposed to transporting the injured person in a private or company vehicle where practical. The contact and location information for the nearest offsite medical support is provided below.

Nearest Medical Facility:

Providence Kodiak Island Medical Center
1915 E Rezanof Dr.
Kodiak, AK 99615
Phone: (907) 486-3281
Emergency: Call 911

Note: The nearest medical facility to the project site can provide basic care only; Medivac may be necessary for more serious injuries.

9.5 BLOODBORNE PATHOGEN PROGRAM

Exposure to bloodborne pathogens may occur when rendering first-aid or CPR.

The onsite bloodborne pathogens kit will include PPE (that is, breathing barrier, latex-free gloves, gowns, masks, eye protectors, and resuscitation equipment).

Our site-specific bloodborne pathogen program will include a site-specific Exposure Control Plan with provisions for engineering and administrative controls, Hepatitis B vaccination, PPE, training, recordkeeping, and a Post-exposure Control Plan in the event of a bloodborne exposure is reflected in SOP HSE-202, which is covered in the required training. Post-exposure protocol as identified in SOP HSE-202 covers immediate medical evaluation of exposed individual(s) per current recommendations of the Center for Disease Control for human immunodeficiency virus, Hepatitis B virus, and Hepatitis C virus.

A minimum of two people trained in first-aid and CPR or those exposed to potentially infectious material (PIM) must complete bloodborne pathogens computer-based training or receive site-specific training by the EMT. This training covers the sources, hazards, and avoidance of bloodborne pathogens and be provided the training specified in 29 CFR 1910.1030. When performing first-aid or CPR, the following apply:

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials.
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes.

- If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. Use one-part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.

ECC or Jacobs will provide exposed employees with a confidential medical examination should an exposure to PIM occur. The examination includes the following procedures:

- Documenting the exposure.
- Testing the exposed employee's and the source individual's blood (with consent).
- Administering post-exposure prophylaxis.

9.6 EXPOSURE CONTROL PLAN

The program includes a site-specific Exposure Control Plan with provisions for engineering and administrative controls, Hepatitis B vaccination, PPE, training, recordkeeping, and a Post-Exposure Control Plan in the event of a bloodborne exposure. Post-exposure protocol as identified in SOP HSE-202 covers immediate medical evaluation of exposed individual(s) per current recommendations of the Center for Disease Control for human immunodeficiency virus, Hepatitis B virus, and Hepatitis C virus.

9.7 AUTOMATIC EXTERNAL DEFIBRILLATOR PROGRAM

NOT APPLICABLE.

9.8 SITE LAYOUT PLAN

NOT APPLICABLE.

9.9 ACCESS/HAUL ROAD PLAN

NOT APPLICABLE.

9.10 HEARING CONSERVATION PROGRAM

Employers are required to control employee exposure to occupational noise levels of 85 decibels (dBA), A-weighted, and above by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95. A noise assessment may be conducted by the HSM or designee based on potential to emit noise above 85 dBA and considering the frequency and duration of the task.

The following identification, documentation, engineering controls, PPE, and hearing testing apply for all employees:

- A noise survey meter calibrated and set to A-weighted scale will be used to identify hazardous noise areas; alternatively, if personnel must raise their voice to speak to someone less than 3 feet apart, they should consider it a hazardous noise environment and don hearing protection.
- Areas or equipment emitting noise at or above 90 dBA will be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- Areas or equipment emitting noise levels at or above 85 dBA, hearing protection must be worn. This will include labeling of all noise hazardous equipment and areas by the SSHO.
- Employees exposed to 85 dBA or a noise dose of 50 percent must participate in the hearing conservation program including initial and annual (as required) audiograms.
- Employees who are exposed at or above the action level of 85 dBA are required to complete any employer provided training
- Hearing protection will be maintained in a clean and reliable condition, inspected before use and after any occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection will be repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing-protection-required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner, and a copy of the OSHA standard 29 CFR 1910.95 will be posted in the workplace.
- Pre-employment and end-of-employment hearing testing of individuals who will be working in noise hazardous environments greater than 30 days a year will be provided.

9.11 RESPIRATORY PROTECTION PLAN

NOT APPLICABLE.

9.12 HEALTH HAZARD CONTROL PROGRAM

Safety and health hazards for performing work covered under this APP are identified through the preparation of AHAs (provided in Attachment C-1). Each AHA also indicates recommended controls for each identified potential safety/health hazard, which (as applicable) are in line with the general site-specific hazards and controls that described the SSHP. Appropriate PPE will be supplied and used at all times for this project. PPE selection is based on the selected hazard control measures specified in the AHAs and will be in accordance with Section 11 of this APP.

9.13 HAZARD COMMUNICATION PROGRAM AND GLOBAL HARMONIZED SYSTEM

Chemical products may occasionally be stored and used on the project site or stored on field vehicles. Examples of chemicals may include, but are not limited to, gases used to calibrate sensing equipment and lubricants. Other chemicals may be used as well. The chemicals may pose hazards, including flammability, corrosiveness, reactivity and incompatibility, and toxicity. Because of these potential hazards, special precautions must be taken including the following:

- Tracking and controlling hazardous chemical products received and stored
- Performing a hazard evaluation of each chemical product, using such sources as Safety Data Sheets (SDSs)
- Informing workers of the potential hazards through training, SDSs, and appropriate labeling of containers
- Performing air monitoring, in the case of potential respiratory hazards
- Designing and implementing engineering controls such as ventilation and source control
- Developing storage, handling, housekeeping, and decontamination procedures
- Assigning appropriate PPE such as eye and face protection, gloves, body protection, and respirators; Respirator usage by ECC or subcontractor employees will be in accordance with the employees' Injury and Illness Prevention Program.

- Training personnel who will be handling chemicals on safe handling procedures, PPE, and emergency and spill cleanup procedures
- Hazardous substances that may be encountered in soil on the project site are not covered by this program. Section 12 of the SSHP (Attachment C-1) addresses chemical and other hazard assessment and mitigation associated with site contaminants, including investigation and remediation of waste materials.

9.13.1 Chemicals Covered by this Project Program

For the purposes of this program, chemicals considered to be hazardous if the following are true:

- Listed in the OSHA Permissible Exposure Limits
- Included in the American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances (2017)
- Found to be suspected or confirmed carcinogens by the National Toxicology Program in the latest edition of the Annual Report on Carcinogens, or by the International Agency for Research on Cancer (IARC) in the latest edition of the IARC monographs
- Exceptions to this policy, by OSHA definition, include consumer products that are used in a consumer fashion and pose no more of an exposure hazard than a consumer would face.

9.13.2 Training

Employees who work with or are potentially exposed to hazardous chemicals will receive initial training on the elements of this Hazard Communication Program, including the following:

- Content and requirements of this program and the OSHA Hazard Communication Standard
- The potential physical and toxic hazards of the chemicals used in their work location, and especially the hazards of non-routine tasks
- Chemical inventory and tracking procedures
- Location of this Hazard Communication Program, the chemical inventory, and the SDSs
- How to read SDSs
- Methods to detect the release of or exposure to chemicals in their area
- Content and interpretation of labels
- Safe use and handling of chemicals
- Required PPE
- Basic emergency procedures

- Additional training will be provided annually, whenever a new chemical is added to the workplace, and when non-routine tasks are planned.

9.13.3 Labeling

The SSHO will ensure that hazardous chemicals brought onto the site are properly labeled with at least the following information, in English, as a minimum, and the language of non-English-speaking employees who may use the product, as appropriate. This labeling includes the following:

- The identity of the product and chemical components
- Appropriate hazard warnings
- Name and address of the manufacturer, importer, or other responsible party

Hazard warnings will also be transmitted in the form of the National Fire Prevention Agency or Hazardous Materials Information System color-coded warnings, which are ranked on a 0 to 4 scale. When chemicals are transferred to a portable container, labels containing chemical identification and hazard warnings must be affixed to the portable container.

9.13.4 Current Onsite Inventory

See SSHP for a list of chemicals covered by the GHS system which may be used onsite (for example, sample preservatives, decontamination solutions, and calibration gases)

9.14 PROCESS SAFETY MANAGEMENT PLAN

NOT APPLICABLE.

9.15 LEAD COMPLIANCE PLAN

NOT APPLICABLE. There is currently no expectation of encountering lead-containing materials.

9.16 ASBESTOS ABATEMENT PLAN

NOT APPLICABLE. There is currently no expectation of encountering asbestos-containing materials.

9.17 RADIATION SAFETY PROGRAM

NOT APPLICABLE. There is currently no expectation of encountering radioactive sources.

9.18 ABRASIVE BLASTING PROCEDURES

NOT APPLICABLE.

9.19 HEAT STRESS MONITORING PLAN

Heat stress illnesses are not anticipated under the weather conditions at Tanaga Island. However, heat illness prevention regulations that must be implemented include the following:

- Having enough water onsite so that each worker can consume, at a minimum, one quart per hour per shift.
- Frequent reminders or water breaks will be taken so that each person can consume enough water.
- Access to shade (that is, blockage from direct sunlight) will be provided at all times and will be reasonably close to the work area. Keep in mind that a vehicle or other enclosed are with no air conditioning is NOT considered shade. Must be a well ventilated area or have air conditioning.
- Workers suffering from heat-illness-related symptoms or those needing preventative recovery will be provided access to shade for at least 5 minutes, or longer, for recovery (if heat-related symptoms are occurring, contact the HSM).
- Workers will receive training on risk factors, signs and symptoms of heat illness, importance of hydration and acclimatization, importance of reporting symptoms and what to do in case of heat illness emergency, and contacting emergency medical services according to the following sections.
- Heat-related illnesses are caused by more than just temperature and humidity factors.

Physical fitness influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the

lower the body temperature (indicates less retrained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress. Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. With a recent history of heat-stress exposures of at least 2 continuous hours per day for 5 of the last 7 days to 10 of the last 14 days, a worker can be considered acclimatized. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days and may be completely lost in 3 to 4 weeks. Because acclimatization is to the level of the heat-stress exposure, a person will not be fully acclimatized to a sudden higher level, such as during a heat wave.

Dehydration reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

Table 9-4
Symptoms and Treatment of Heat Stress

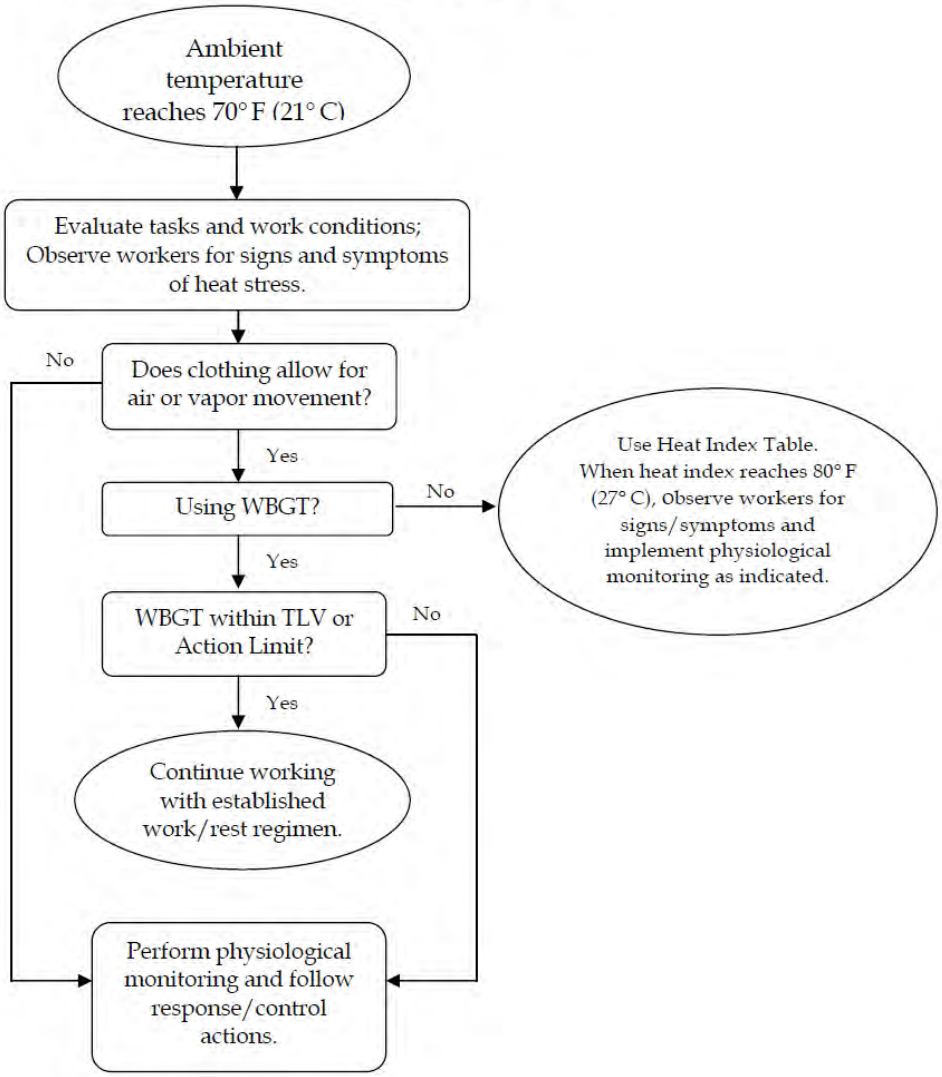
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low.	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature of 104°F or higher.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!

Precautions

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50 degrees Fahrenheit (°F) (10 degrees Celsius [°C]) to 60°F (15.6°C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Remind employees to drink water throughout their work shift.
- Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate to site work conditions by slowly increasing workloads; for example, do not begin site work with extremely demanding activities. Closely monitor employees during their first 14 days of work in the field.
- Supervisors and SSHOs must continually observe employees throughout the work shift for signs and symptoms of heat stress or illness. Employees must monitor themselves for heat stress as well as observe their coworkers.
- Effective communication must be maintained with employees throughout the work shift either by voice, observation, or electronic device.
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.

- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brimmed hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shade to protect personnel against radiant heat (for example, sun, flames, or hot metal).
- Use portable fans for convection cooling or, in extreme heat conditions, an air-conditioned rest area when needed.
- In hot weather, rotate shifts of workers.
- Maintain good hygiene standards by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should consult medical personnel.
- Brief employees initially before the project work begins and routinely as part of the daily safety briefing, on the signs and symptoms, of heat-related illnesses, precautions to measures, and emergency procedures to follow as described in this plan.
- Observe one another for signs of heat stress. PREVENTION and communication are key.
- Chart 9-1
- Thermal Stress Monitoring

Thermal Stress Monitoring Flow Chart

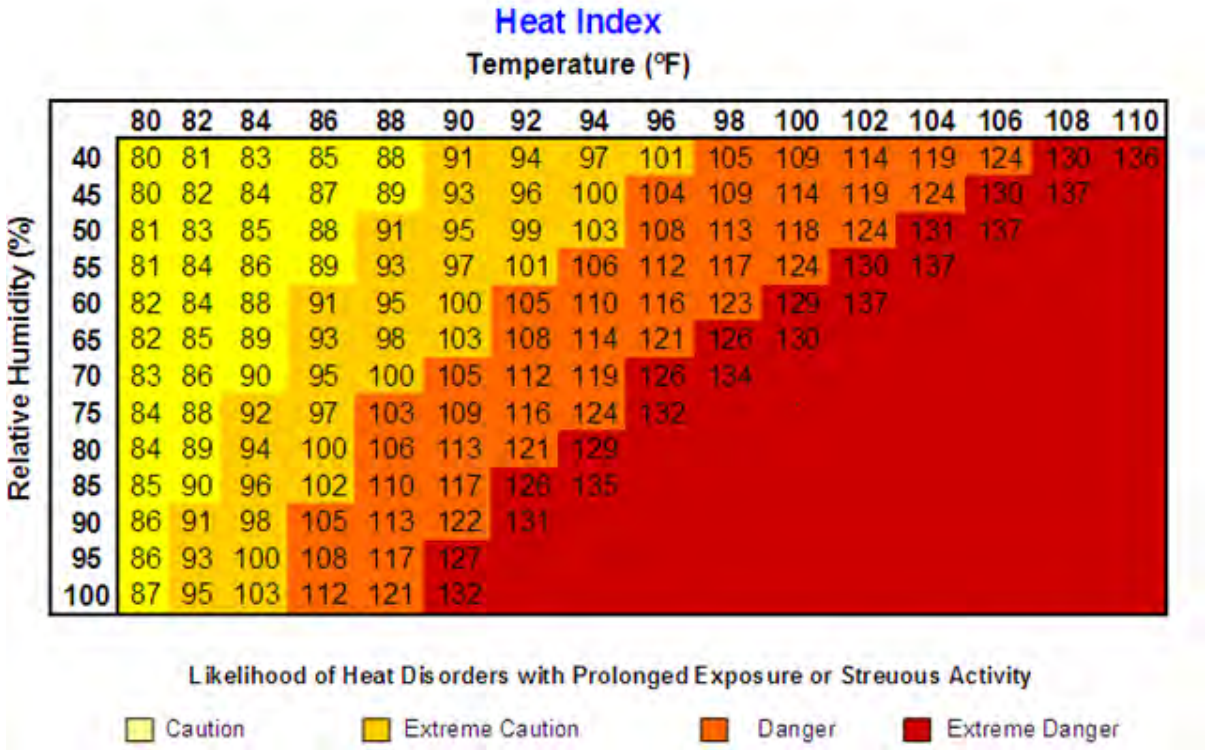


Thermal Stress Monitoring—Permeable or Impermeable Clothing

When **permeable work clothes** are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement physiological monitoring as indicated below. This should start when the heat index reaches 80°F (27°C) (see Chart 9-1 Heat Index), or sooner if workers exhibit symptoms of heat stress indicated in the previous table. The heat index values were devised for shady, light wind conditions; exposure to full sunshine can increase the values by up to 15°F (8°C). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

When wearing **impermeable clothing** (for example, clothing doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described in Exhibit 9-1 will be conducted when the ambient temperature reaches 70°F (21°C), or sooner if climatic conditions may present greater risk of heat stress combined with wearing unique variations of impermeable clothing or workers exhibit symptoms of heat stress.

Chart 9-1 Heat Index



Heat Index	Possible Heat Disorders	Minimum Frequency of Physiological Monitoring
80°F - 90°F (27°C - 32°C)	Fatigue possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline and observe workers for signs of heat stress and implement physiological monitoring if warranted.
90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline, then at least every hour, or sooner, if signs of heat stress are observed.
105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.	Conduct initial monitoring as baseline, then every 30 minutes or sooner if signs of heat stress are observed.
130°F or Higher (54°C or Higher)	Heat/Sunstroke highly likely with continued exposure.	Conduct initial monitoring as baseline, then every 15 minutes or sooner if signs of heat stress are observed.

Source: National Weather Service

Physiological Monitoring and Associated Actions

- For employees wearing permeable clothing, follow the minimum frequency of physiological monitoring listed in Chart 9-1.
- For employees wearing impermeable clothing, physiological monitoring should begin initially at a 15-minute interval. Then, if the employee's heart rate or body temperature is within acceptable limits, conduct the subsequent physiological monitoring at 30 minutes, and follow the established regimen protocol.

When physiological monitoring is required, use either radial pulse or aural temperature and perform the following actions:

- The sustained heart rate during the work cycle should remain below 180 beats per minute (bpm) minus the individual's age (for example 180 – 35-year-old person = 145 bpm). The sustained heart rate can be estimated by measuring the heart rate at the radial pulse for 30 seconds as quickly as possible prior to starting the rest period.
- The heart rate after one minute rest period should not exceed 120 bpm.
- If the heart rate is higher than 120 bpm after the FIRST minute into the rest period, the next work period should be shortened by 33 percent, while the length of the rest period stays the same.
- If the pulse rate still exceeds 120 bpm at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.
- Continue this procedure until the rate is maintained below 120 bpm after the FIRST minute into the rest period.
- Alternately, the body temperature can be measured, either oral or aural (ear), before the workers have something to drink.
- If the oral or aural temperature exceeds 99.6°F (37.6°C) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral or aural (ear) temperature is maintained below 99.6°F (37.6°C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field; however, a digital aural (aural) thermometer is easy to obtain and inexpensive to purchase.
- Use the form attached to this APP to track workers' measurements and actions taken.

Procedures for when Heat Illness Symptoms are Experienced

- Always contact the HSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.

- In the case of all other heat-related symptoms (for example, fainting, heat rash, and heat exhaustion), and if the worker is a Jacobs worker, contact their immediate supervisor, as well as the occupational physician at 1-888-449-7787.
- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, follow precautions under the emergency medical treatment of this APP.
- Follow the incident notification, reporting, and investigation information in Section 22 of the SSHP.

9.20 COLD STRESS MONITORING PLAN

Low ambient temperatures and wet conditions increase the heat lost from the body to the environment by radiation and convection.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. For example, one's body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration-soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing the insulating layer of air increases heat loss by convection.

Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. The chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

Be aware of the symptoms of cold-related disorders (Table 9-5), and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.

Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council.

The wind-chill index in Chart 9-2 is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.

Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor or the PM to avoid progression of cold-related illness.

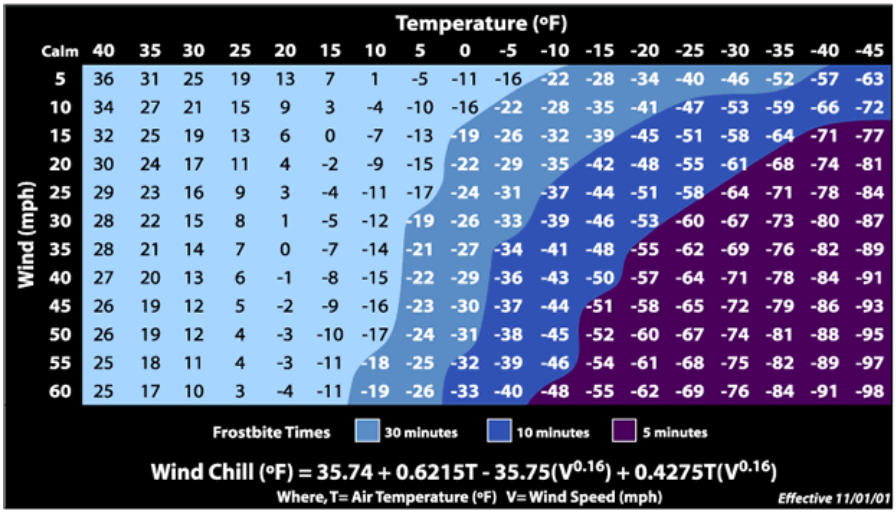
Observe one another for initial signs of cold-related disorders.

Obtain and review weather forecast – be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

Table 9-5
Symptoms and Treatment Of Cold Stress

	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm—but not hot—water. Have victim drink warm fluids, but not coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.

Chart 9-2 NOAA Wind-chill Chart



Source: www.nws.noaa.gov/om/winter/windchill-images/windchillchart3.pdf

9.21 INDOOR AIR QUALITY MANAGEMENT

NOT APPLICABLE.

9.22 MOLD REMEDIATION PLAN

NOT APPLICABLE.

9.23 CHROMIUM (VI) EXPOSURE EVALUATION

NOT APPLICABLE.

9.24 CRYSTALLINE SILICA EVALUATION

NOT APPLICABLE.

9.25 LIGHTING PLAN FOR NIGHT OPERATIONS

NOT APPLICABLE.

9.26 TRAFFIC CONTROL PLAN

NOT APPLICABLE.

9.27 FIRE PREVENTION PLAN

The decision on whether or not to try to extinguish a fire using available site personnel and equipment will be made by the SSHO (if present), and is based on whether the fire is small or large, and involves explosives or flammable liquids or gases.

9.27.1 Location of Fire Extinguishers

Fire extinguishers will be located around the project sites, as required, in the following places (at a minimum):

- In each vehicle
- Near areas where flammable materials are stored or in use
- All fire extinguishers will be kept clearly visible, marked, and placed where they are easily accessible.

9.27.2 Fire Extinguishers and General Fire Prevention Practices

Fire extinguishers rated 2A:20B:C will be provided within the immediate work area.

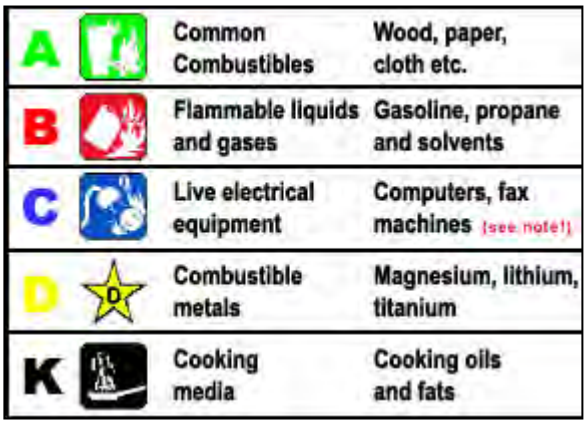
- The following must be true for all extinguishers:
  - Maintained in a fully charged and operable condition
  - Visually inspected each month
  - Undergo a maintenance check each year
- The area in front of extinguishers must be kept clear.
- Combustible materials stored outside should be at least 10 feet (3 meters) from any building.
- Solvent waste and oily rags must be kept in a fire-resistant, covered container until removed from the site.
- Keep areas neat. Housekeeping is important.
- Flammable and combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

Fire extinguishers can represent an important segment of any overall fire-protection program.

However, their successful function depends on the following conditions being met:

- The extinguisher is properly located and in working order.
- The extinguisher is of proper type and for a fire which may occur.
- The fire is discovered while still small enough for the extinguisher to be effective.
- The fire is discovered by a person ready, willing, and able to use the extinguisher.
- Class C fires can be readily extinguished by quenching-cooling with water or a water-mixture agent. Class B fires are more effectively extinguished by an agent that blankets-smothers the fire through exclusion of oxygen surrounding the fire area. Those extinguishers containing bromochlorodifluoromethane, monobromotrifluoromethane, carbon dioxide, or dry chemical are generally best suited for extinguishing Class B fires. For Class C fires, the primary consideration in extinguishing this type of fire is the selection of nonconductive extinguishing agent to prevent dangerous electrical shock and possible death to user.
- Because of its corrosive nature, dry chemical is not recommended for use on computerized, electronic, or other equipment with extensive circuitry.

The following chart defines and explains classes of fires:



Fires are classified into five groups:

- Class A: Class A fires involve common combustibles such as wood, paper, cloth, rubber, trash, and plastics. They are common in typical commercial and home settings, but can occur anywhere these types of materials are found.
- Class B: Class B fires involve flammable liquids, gases, solvents, oil, gasoline, paint, lacquers, tars, and other synthetic or oil-based products. Class B fires often spread rapidly and, unless properly secured, can reflash after the flames are extinguished.

- Class C: Class C fires involve energized electrical equipment, such as wiring, controls, motors, data processing panels, or appliances. They can be caused by a spark, power surge, or short circuit and typically occur in locations that are difficult to reach and see.
- Class D: Class D fires involve combustible metals such as magnesium and sodium. Combustible metal fires are unique industrial hazards that require special dry powder agents.

  (NOTE: Although ABC and BC dry chemical extinguishers can control a fire involving electronic equipment, the National Fire Code specifically advises against dry-chemical extinguishers for fires involving computers or other delicate electronic equipment due to the potential damage from residues).

Firefighting will only be conducted by those trained and certified in this practice. The commonly accepted practice is the PASS method: Pull the pin, Aim, Squeeze the handle, and Sweep the base of the fire area. The SSHO will verify that at least two staff members are onsite that have the required training for use of fire extinguishers.

9.27.3 Dispensing of Flammable and Combustible Liquids

- Areas in which flammable or combustible liquids are dispensed in quantities greater than 5 gallons (22.7 liters) will be separated from other operations by at least 25 feet (7.6 meters).
- Drainage away from storm drains or surface waters or other means of containment will be provided to control spills.
- Adequate natural or mechanical ventilation will be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.
- Dispensing of flammable liquids from one container to another will be done only when containers are electrically interconnected (bonded).
- Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks is prohibited.
- Dispensing devices and nozzles for flammable liquids will be of an approved type.

9.28 WILDLAND FIRE MANAGEMENT PLAN

NOT APPLICABLE.

9.29 ARC FLASH HAZARD ANALYSIS

NOT APPLICABLE.

9.30 ASSURED EQUIPMENT GROUNDING CONTROL PROGRAM

NOT APPLICABLE.

9.31 HAZARDOUS ENERGY CONTROL PROGRAM AND PROCEDURES

NOT APPLICABLE.

9.32 STANDARD PRE-LIFT PLAN – LOAD HAULING EQUIPMENT

A. Load

1. Load Dimensions _____
2. Load Weight _____ lbs.
3. Weight of Ball _____ lbs.
4. Weight of Main Block _____ lbs.
5. Weight of Aux Tip _____ lbs.
6. Weight of Load Line _____ lbs.
7. Weight of Additional Equipment _____ lbs.
8. Weight of Slings/Shackles _____ lbs.

TOTAL _____ lbs.

B. Crane

1. Crane Model _____
2. Boom Angle _____
3. Boom Length _____
4. Max Radius _____
5. Planned Radius _____
6. Capacity at Max Radius _____
7. Capacity at Planned Radius _____
8. Max Load on Crane = _____ lbs.

LIFT = % of Crane's Capacity

C. Rigging

1. No. of Slings __ Size __Type___
2. External Equipment _____
3. Sling Angles _____
4. Sling Assembly Rated Capacity _____ lbs.
   a. Vertical b. Choke c. Basket
5. Shackle Size ___No. of Shackles __
6. Shackle Rated Capacity _____ lbs.

D. Diagrams (Use Space Below As Necessary)

1. Site Layout with Dimensions
2. Pick-Up, Placement and Load Orientation
3. Rigging Arrangement and Configuration

E. Pre-Lift Checklist

1. Y / N Center of Gravity Determined
2. Y / N Load in Good Condition & Secured
3. Y / N Loose Objects Removed
4. Y / N Load Weights Confirmed
5. Y / N Pick Points Adequate
6. Y / N Load Will Clear Boom/Objects
7. Y / N Swing Direction: _____
8. Y / N Swing Room
9. Y / N Hoist Height
10. Y / N Head Room
11. Y / N Crane Inspected
12. Y / N Rigging Inspected
13. Y / N Operator Qualified
14. Y / N Rigger Qualified
15. Y / N Signal System – Radio/Hand
16. Y / N Lift Responsibilities Assigned
17. Y / N Tag Lines
18. Y / N No Personnel Under Load
19. Y / N Ground Conditions Adequate
20. Y / N Crane Level
21. Y / N Track/Outrigger Supported
22. Y / N Electrical Hazards Addressed
23. Y / N Travel
24. Y / N Wind Speed and Temp: _____
25. Y / N Wind/Temp De-rating: _____
26. Y / N Fall Protection & Manlift Utilized

27. Y / N Other Hazards & Controls: _____

_____

_____

_____

_____

28. Y / N Pre-Lift Meeting

29. Y / N Client/Site Owner Notified

Y / N Site Approvals, Sign and Date:

Crane Operator: _____

Qualified Rigger: _____

Supervisor: _____

Superintendent/Mngr. (as necessary): _____

9.32.1 Safe Work Practices

These safe work practices are to be followed by ECC and Jacobs employees who are exposed to the hazards posed by crane operations, regardless of the company responsible for the operation (subcontractor or third party contractor).

- Cranes should only be operated by a certified crane operators who meets the physical qualifications described in ANSI B30.5 Section 5-3.1.2.
- Cranes should have a current annual inspection (within the last 12 months), including load test certification (within the last 12 months) meeting all state and federal safety standards. Crane operations manuals and load charts designated for each individual crane should be onsite and accessible.
- Accessible areas within the swing radius of the rear of the rotating superstructure of the crane, either permanently or temporarily mounted, should be barricaded in such a manner as to prevent an employee from being struck or crushed by the crane. The swing radius of the rotating superstructure of the crane should be barricaded to prevent struck against or crushing hazards.
- A competent person should inspect cranes daily to ensure that they are in safe operating condition.
- All parties involved in that day's crane operation should attend a pre-lift meeting before starting work.
- Cranes are designed for vertical lifts only and should only be used for that purpose. Attempting to pull objects along the ground from side to side, toward, or away from the crane may result in crane failure.

- All personnel in the vicinity of the crane should make eye contact with the operator prior to passing through/ or near crane operations so as to make the operator aware of their presence.
- Only one person should signal the crane operator. This person should be thoroughly familiar with all of the crane's operation and should be able to communicate with the crane operator with the appropriate hand signals.
- Cranes should not swing booms or loads over live walkways, industrial processes, or occupied areas.
- No personnel should be permitted on or under a load lifted by crane or hoist at any time.
- Crane operators should sound an alarm or horn blast when the load is about to be lifted.
- Weather conditions are to be considered when lifting operations are to be performed. Lifting operations should be re-evaluated whenever wind speeds exceed 25 to 30 miles per hour, or if other environmental conditions may have an adverse impact and could hinder those operations.
- Whenever internal combustion engine powered equipment exhausts in enclosed spaces, air monitoring should be performed and recorded to ensure employees are not exposed to unsafe concentrations of toxic gases or oxygen deficient atmospheres.
- No modification or addition, which that could affect the capacity and or safe operation of the equipment, should be made without the manufacturer's written approval.

9.33 CRITICAL LIFT PLAN – LOAD-HANDLING EQUIPMENT

NOT APPLICABLE.

9.34 FLOATING PLANT INSPECTION AND EQUIPMENT CERTIFICATION

NOT APPLICABLE.

9.35 SEVERE WEATHER PLAN FOR MARINE ACTIVITIES

NOT APPLICABLE.

9.36 EMERGENCY PLAN FOR MARINE ACTIVITIES

NOT APPLICABLE.

9.37 MAN OVERBOARD AND ABANDON SHIP PROCEDURES

NOT APPLICABLE.

9.38 FLOAT PLAN FOR LAUNCHES, MOTORBOATS, AND SKIFFS

NOT APPLICABLE.

9.39 FALL PREVENTION AND PROTECTION PLAN

NOT APPLICABLE.

9.40 DEMOLITION AND RENOVATION PLAN

NOT APPLICABLE.

9.41 ROPE ACCESS WORK PLAN

NOT APPLICABLE.

9.42 EXCAVATION AND TRENCHING PLAN

- Though shallow excavation, test-pitting, and trenching may occur, no persons will enter an excavation or trench deeper than 4 feet in depth. From deeper excavations, all samples will be collected using the excavator bucket or hand tool from outside the trench. In addition, all persons will be required to stay away from the trenches so the walls are not at risk of collapsing.
- All trenching work will be undertaken under the guidance of an excavation-competent person. An excavation oversight AHA has been developed and is available in the SSHP.
- EM385-specific Excavation Plan requirements are as follows:
- For all piping activities, include workers' increased exposure during connection activities (that is, bent over or kneeling): **Not Applicable, No Entry**
- Methods and locations for egress: **Not Applicable, No Entry**
- Identification and credentials of the competent person for Excavation: Subcontractor will identify the competent person before work and training documentation will be submitted to the HSM, project manager, and SSHO. The competent person must have formal training in excavation safety. In addition, the competent person must be been designated in writing by the employer to be responsible for the immediate supervision, implementation and

monitoring of the excavation and trenching program, who through training, knowledge and experience in excavation and trenching is capable of identifying, evaluating and addressing existing and potential hazards and, who has the authority to take prompt corrective measures with regard to such hazards.

- Documentation that examination of the ground by the competent person provides no indication of a potential cave-in: **Not Applicable, No Entry. However, the competent person will inspect the trench daily.**
- A rescue plan should be prepared and maintained when workers are working at depths in excess of 5 feet (1.5 meters): **Not Applicable, No Entry**
- Projected maximum depth of the excavation: **Planned excavation depths are provided in the project work plan.**
- Projected soil type and method of testing to determine soil type: **Not Applicable, No Entry**
- Planned method of shoring, sloping, or benching: **Not Applicable, No Entry**
- Planned method for confined space entry, trench access, and egress and atmospheric monitoring processes: **Not Applicable, No Entry**
- Location of utility shut offs (if required): **Not Applicable, No live utilities are present.**
- Proposed methods for preventing damage to overhead utility lines, trees designated to remain, and other man-made facilities or natural features designated to remain within or adjacent to the construction rights-of-way: **To be determined during project site reconnaissance work, scheduled before excavation activities.**
- Plan for management of excavated soil/asphalt/concrete: See project work plan and Waste Management Plan (Appendix F to the work plan).
- Plan for traffic control: **Not Applicable.**

9.43 FIRE PREVENTION AND PROTECTION PLAN FOR UNDERGROUND CONSTRUCTION

NOT APPLICABLE.

9.44 COMPRESSED AIR WORK PLAN FOR UNDERGROUND CONSTRUCTION

NOT APPLICABLE.

9.45 ERECTION AND REMOVAL PLAN FOR FORMWORK AND SHORING

NOT APPLICABLE.

9.46 PRECAST CONCRETE PLAN

NOT APPLICABLE.

9.47 LIFT-SLAB PLANS

NOT APPLICABLE.

9.48 MASONRY BRACING PLAN

NOT APPLICABLE.

9.49 STEEL ERECTION PLAN

NOT APPLICABLE.

9.50 EXPLOSIVES SITE PLAN (AVOIDANCE OF MUNITIONS AND EXPLOSIVES OF CONCERN AND/OR MATERIAL POTENTIALLY PRESENTING AN EXPLOSIVE HAZARD)

NOT APPLICABLE.

9.51 EXPLOSIVES OPERATIONS

NOT APPLICABLE.

9.52 DIVE OPERATIONS PLAN

NOT APPLICABLE.

9.53 SAFE PRACTICES MANUAL FOR DIVING ACTIVITIES

NOT APPLICABLE.

9.54 EMERGENCY MANAGEMENT PLAN FOR DIVING

NOT APPLICABLE.

9.55 TREE FELLING AND MAINTENANCE PROGRAM

Safety procedures to be implemented during vegetation removal operations for this program are addressed in the SSHP and the task-specific AHAs.

9.56 AIRCRAFT AND AIRFIELD CONSTRUCTION SAFETY AND PHASING PLAN

NOT APPLICABLE.

9.57 AIRCRAFT AND AIRFIELD SAFETY PLAN COMPLIANCE DOCUMENT

NOT APPLICABLE.

9.58 SITE SAFETY AND HEALTH PLAN

An SSHP is attached to this APP. The SSHP meets the requirements for work on hazardous waste sites in accordance with 29 CFR 1910.120 and 29 CFR 1926.65.

9.59 CONFINED SPACE ENTRY PROCEDURES

NOT APPLICABLE.

9.60 CONFINED SPACE PROGRAM

NOT APPLICABLE.

(intentionally blank)

10.0 RISK MANAGEMENT PROCESS

10.1 ACTIVITY HAZARDS ANALYSIS

The detailed project-specific hazards and controls are documented in the AHAs that have been prepared for each major phase of work. As such, AHAs have been prepared for the tasks listed in Section 2.5.6.

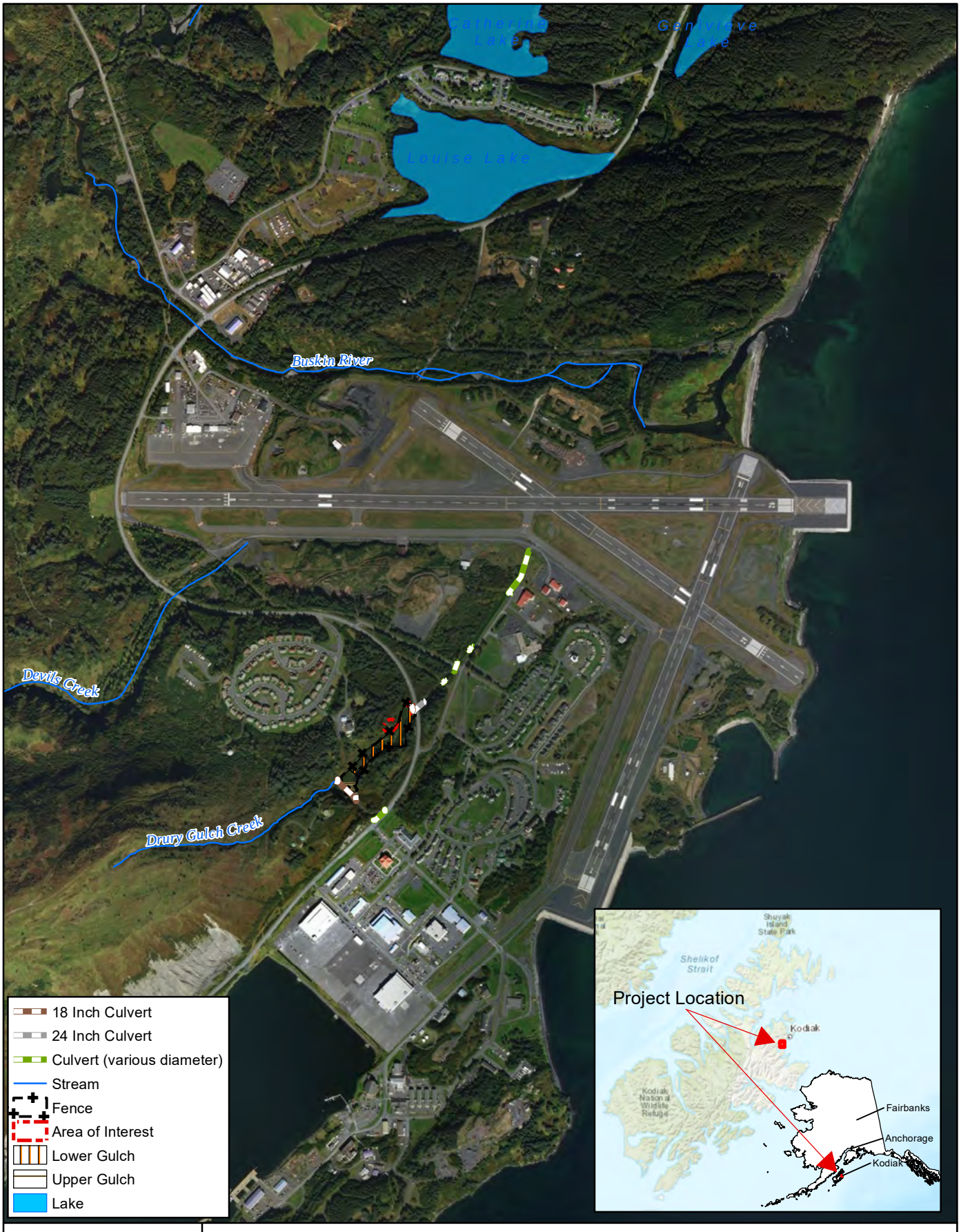
The AHAs for this project are provided in Exhibit C-7 of the SSHP. No work will begin on an activity (that is, a definable feature of work) until the initial AHA has been accepted by the SSHO addressing the project-specific hazards. While the work is being performed, workers and crews should have in their possession the current AHA that reflects current site conditions, personnel, equipment, and control measures. The AHA should be used by the contractor and subcontractor personnel to assure work is being performed consistent with the AHA. In the event that the work is not being conducted in a safe manner, the contractor or the subcontractor should stop the unsafe work being conducted until it is in compliance with the EM 385 manual, APP, and the AHA, or until the APP and AHA are revised and accepted by the Government Designated Authority, if necessary.

10.2 OPERATIONAL READINESS REVIEW

A pre-fieldwork Operational Readiness Review conference will be held prior to the start of site activities and after submission of the APP and SSHP. The objective of the meeting is to discuss health and safety concerns related to the impending work, discuss project health and safety organization and expectations, and review and answer comments and concerns regarding the APP and SSHP or other health and safety concerns. Individuals responsible for health and safety at the project level will attend this meeting.

(intentionally blank)

FIGURE



N

0 1,000 2,000

FEET

U.S. Army Corps of Engineers Alaska District

PROJECT LOCATION AND VICINITY MAP

DRURY GULCH
FORMALLY USED DEFENSE SITE
FUDS # F10AK100701
KODIAK ISLAND, ALASKA

FIGURE C-1

\\brooksidefiles\GIS_SHARE\ENBG\00_Proj\U\USACE\AK_Kodiak\GIS\FUDS_F10AK100701_MXD\Figure 1 - Location Vicinity.mxd eggerikt

ATTACHMENT C-1
Site Safety and Health Plan

U.S. Army Corps of Engineers
Alaska District

ACCIDENT PREVENTION PLAN

ATTACHMENT C-1
SITE SAFETY AND HEALTH PLAN

DRURY GULCH
KODIAK, ALASKA

FUDS NO. F10AK1007-01

DRAFT REVISION 1
NOVEMBER 2019

TABLE OF CONTENTS

SECTION **PAGE**

ACRONYMS AND ABBREVIATIONS C1-ix

APPROVAL C1-xi

1.0 INTRODUCTION C1-1-1

1.1 POLICY AND COMMITMENT C1-1-1

1.1.1 Safe Work Policy C1-1-1

1.1.2 Health and Safety Commitment C1-1-1

1.1.3 Project-specific Health, Safety, and the Environment Goals C1-1-2

2.0 APPLICABILITY C1-2-1

3.0 GENERAL PROJECT INFORMATION C1-3-1

3.1 PROJECT INFORMATION AND BACKGROUND C1-3-1

3.2 SITE BACKGROUND AND SETTING C1-3-1

3.2.1 SITE DESCRIPTION C1-3-2

3.3 CONTRACTOR ACCIDENT EXPERIENCE C1-3-2

3.4 DESCRIPTION OF TASKS C1-3-2

3.4.1 HAZWOPER-regulated Tasks C1-3-3

3.4.2 Non-HAZWOPER-regulated Tasks C1-3-3

3.5 TASKS REQUIRING ACTIVITY HAZARD ANALYSIS C1-3-3

4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES C1-4-1

4.1 CLIENT C1-4-1

4.2 CONTRACTOR PERSONNEL C1-4-1

4.2.1 ECC Project Manager C1-4-1

4.2.2 ECC Health and Safety Manager C1-4-2

4.2.3 Project Environmental Manager C1-4-2

4.2.4 Site Safety and Health Officer C1-4-3

4.3 EMPLOYEE RESPONSIBILITIES C1-4-5

4.3.1 Employee Authority C1-4-5

4.4 LINES OF AUTHORITY C1-4-6

5.0 STANDARDS OF CONDUCT C1-5-1

5.1 STANDARDS OF CONDUCT VIOLATIONS C1-5-1

TABLE OF CONTENTS (Continued)

SECTION			PAGE
	5.2	SUBCONTRACTOR SAFETY PERFORMANCE	C1-5-1
	5.3	INCENTIVE PROGRAM	C1-5-2
	5.4	REPORTING UNSAFE CONDITIONS AND PRACTICES	C1-5-2
6.0	SAFETY PLANNING AND CHANGE MANAGEMENT		C1-6-1
	6.1	DAILY SAFETY MEETINGS AND PRE-TASK SAFETY PLANS	C1-6-1
	6.2	CHANGE MANAGEMENT	C1-6-1
7.0	PROJECT HAZARD ANALYSIS AND HEALTH HAZARD CONTROL PROGRAM		C1-7-1
	7.1	ACTIVITY HAZARD ANALYSIS	C1-7-2
	7.2	SUBCONTRACTOR ACTIVITY HAZARD ANALYSIS	C1-7-2
8.0	GENERAL HAZARDS AND CONTROLS		C1-8-1
	8.1	BLOODBORNE PATHOGENS	C1-8-1
	8.2	CHEMICAL STORAGE	C1-8-1
		8.2.1 Storage of Flammable and Combustible Liquids	C1-8-2
		8.2.2 Indoor Storage of Flammable and Combustible Liquids	C1-8-2
		8.2.3 Outside Storage of Flammable/Combustible Liquids	C1-8-2
		8.2.4 Storage of Hazardous Waste	C1-8-3
	8.3	ELECTRICAL SAFETY	C1-8-3
	8.4	FIELD VEHICLES	C1-8-4
	8.5	FIRE PREVENTION	C1-8-5
		8.5.1 Fire Extinguishers and General Fire Prevention Practices	C1-8-5
		8.5.2 Dispensing of Flammable and Combustible Liquids	C1-8-7
	8.6	GENERAL PRACTICES AND HOUSEKEEPING	C1-8-7
	8.7	HAZARD COMMUNICATION AND GLOBALLY HARMONIZED SYSTEM	C1-8-8
	8.8	KNIFE USE	C1-8-9
	8.9	LIGHTING	C1-8-9
	8.10	MANUAL LIFTING	C1-8-10
	8.11	PERSONAL HYGIENE	C1-8-10
	8.12	PERSONAL SECURITY	C1-8-11

TABLE OF CONTENTS (Continued)

SECTION			PAGE
		8.12.1 General Safety and Security Guidelines	C1-8-11
	8.13	SHIPPING AND TRANSPORTATION OF HAZARDOUS MATERIALS	C1-8-11
	8.14	SUBSTANCE ABUSE	C1-8-13
	8.15	UNKNOWN OR SUSPECT OBJECTS OR MATERIALS	C1-8-13
9.0	PROJECT-SPECIFIC HAZARD CONTROLS		C1-9-1
	9.1	DRILLING AND DIRECT-PUSH	C1-9-1
	9.2	DRUM AND PORTABLE TANK HANDLING	C1-9-2
	9.3	EARTHMOVING EQUIPMENT	C1-9-3
	9.4	EXCAVATION OPERATIONS	C1-9-4
	9.5	HAND AND POWER TOOLS	C1-9-5
		9.5.1 Machine Guarding	C1-9-5
	9.6	PORTABLE GENERATOR HAZARDS	C1-9-6
	9.7	SLIPS, TRIPS AND FALLS	C1-9-7
		9.7.1 General	C1-9-7
		9.7.2 Muddy Conditions	C1-9-7
		9.7.3 Steep Slopes, Uneven Ground, and Rock and Vertical Slopes	C1-9-7
	9.8	UTILITIES (UNDERGROUND)	9-8
		9.8.1 Background and Records Assessment of Known Utilities	C1-9-8
		9.8.2 Designated Local Utility Locating Service	C1-9-9
		9.8.3 Independent Field Survey (Utility Locate)	9-9
		9.8.4 Visual Assessment before and during Intrusive Activities	C1-9-10
		9.8.5 Subsurface Activities within 5 feet of an Underground Utility or if there is Uncertainty	C1-9-10
		9.8.6 Spotter	C1-9-11
	9.9	UTILITIES (OVERHEAD)	9-11
10.0	PHYSICAL HAZARDS AND CONTROLS		C1-10-1
	10.1	CONTINGENCY PLAN FOR SEVERE WEATHER	C1-10-1
		10.1.1 Inclement Weather	C1-10-1
	10.2	NOISE	C1-10-2

TABLE OF CONTENTS (Continued)

SECTION			PAGE
10.3	ULTRAVIOLET RADIATION (SUN EXPOSURE)		10-2
	10.3.1	Limit Exposure Time	C1-10-3
	10.3.2	Provide Shade	C1-10-3
	10.3.3	Clothing	C1-10-3
	10.3.4	Sunscreen	C1-10-3
10.4	TEMPERATURE EXTREMES		C1-10-4
	10.4.1	Heat	C1-10-4
	10.4.2	Precautions	C1-10-5
	10.4.3	Thermal Stress Monitoring	C1-10-6
	10.4.4	Thermal Stress Monitoring—Permeable or Impermeable Clothing	C1-10-7
	10.4.5	Cold	C1-10-11
10.5	RADIOLOGICAL HAZARDS		C1-10-13
11.0	BIOLOGICAL HAZARDS AND CONTROLS		C1-11-1
11.1	BEES AND OTHER STINGING INSECTS		C1-11-1
11.2	BIRD DROPPINGS		C1-11-2
11.3	MOSQUITO BITES		C1-11-2
11.4	NO-SEE-UMS		C1-11-3
11.5	BEARS		C1-11-3
12.0	CONTAMINANTS OF CONCERN		C1-12-1
13.0	SITE MONITORING		C1-13-1
13.1	DIRECT READING MONITORING SPECIFICATIONS		C1-13-1
14.0	PERSONAL PROTECTIVE EQUIPMENT		C1-14-1
14.1	REQUIRED PERSONAL PROTECTIVE EQUIPMENT		C1-14-1
15.0	WORKER TRAINING AND QUALIFICATION		C1-15-1
15.1	WORKER TRAINING		C1-15-1
	15.1.1	Hazardous Waste Operations Training	C1-15-1
	15.1.2	First-aid and Cardiopulmonary Resuscitation	C1-15-2
	15.1.3	Site Safety and Health Officer Training	C1-15-2

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

15.1.4 Site-specific Training C1-15-2
15.1.5 Project-Specific Training Requirements C1-15-3
15.2 SUBCONTRACTOR PERSONNEL QUALIFICATIONS C1-15-3
15.2.1 Competent Persons and Qualified Operators C1-15-3
15.2.2 Activity and Equipment List C1-15-3
15.3 PROJECT EMPLOYEE ORIENTATION C1-15-3
15.4 PERSONAL PROTECTIVE EQUIPMENT TRAINING C1-15-4
15.5 SAFETY MEETINGS AND TOOLBOX MEETINGS C1-15-4
15.6 ACTIVITY HAZARD ANALYSIS TRAINING C1-15-4
15.7 SAFETY PRE-TASK PLANNING AND TRAINING C1-15-4
15.8 VENDOR TRAINING C1-15-4
15.9 EMERGENCY RESPONSE PLAN TRAINING C1-15-5
15.10 CONDUCT OF TRAINING C1-15-5
15.10.1 Instructor or Trainer Requirements C1-15-5
15.10.2 Initial Training C1-15-5
15.10.3 Retraining C1-15-5
15.10.4 Demonstrated Competency C1-15-6
15.11 DOCUMENTATION C1-15-6
16.0 MEDICAL SURVEILLANCE AND QUALIFICATION C1-16-1
16.1 HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE C1-16-1
16.2 JOB- OR SITE-SPECIFIC MEDICAL SURVEILLANCE C1-16-1
16.3 RESPIRATOR USER QUALIFICATION C1-16-1
16.4 HEARING CONSERVATION C1-16-2
17.0 SITE CONTROL PLAN C1-17-1
17.1 SITE CONTROL PROCEDURES C1-17-1
17.2 REMEDIATION WORK AREA ZONES C1-17-1
17.2.1 Support Zone C1-17-2
17.2.2 Contamination Reduction Zone C1-17-2

TABLE OF CONTENTS (Continued)

SECTION		PAGE
17.2.3	Exclusion Zone	C1-17-2
17.2.4	Other Controlled Areas	C1-17-3
18.0	DECONTAMINATION	C1-18-1
18.1	CONTAMINATION PREVENTION	C1-18-1
18.2	PERSONNEL AND EQUIPMENT DECONTAMINATION	C1-18-2
18.3	DECONTAMINATION DURING MEDICAL EMERGENCIES	C1-18-2
18.4	WASTE COLLECTION AND DISPOSAL	C1-18-2
18.5	DIAGRAM OF PERSONNEL-DECONTAMINATION LINE	C1-18-3
19.0	EMERGENCY RESPONSE PLAN	C1-19-1
19.1	PRE-EMERGENCY PLANNING	C1-19-1
19.2	EMERGENCY EQUIPMENT AND SUPPLIES	C1-19-4
19.3	INCIDENT RESPONSE	C1-19-4
19.4	EMERGENCY MEDICAL TREATMENT	C1-19-5
19.5	EVACUATION	C1-19-5
19.6	EVACUATION SIGNALS	C1-19-5
19.7	FIREFIGHTING PLAN	C1-19-6
19.8	INCLEMENT WEATHER	C1-19-6
20.0	SPILL CONTAINMENT PROCEDURES	C1-20-1
21.0	INSPECTIONS	C1-21-1
21.1	MANAGEMENT HEALTH, SAFETY, SECURITY, AND ENVIRONMENT INSPECTIONS	C1-21-1
22.0	INCIDENT NOTIFICATION, REPORTING, AND INVESTIGATION	C1-22-1
22.1	GENERAL INFORMATION	C1-22-1
22.2	DEFINITIONS	C1-22-1
22.3	REPORTING REQUIREMENTS	C1-22-2
22.4	SERIOUS INCIDENT REPORTING REQUIREMENTS	C1-22-3
22.4.1	Serious Incident Determination	C1-22-3
22.4.2	Serious Incident Reporting	C1-22-3
22.5	INCIDENT ROOT CAUSE ANALYSIS	C1-22-4

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

22.5.1 Contributing Factors C1-22-5

22.5.2 Corrective Actions C1-22-6

23.0 RECORDS AND REPORTS C1-23-1

TABLES

Table 7-1 General Activity Hazard Analysis C1-7-3

Table 10-1 Symptoms and Treatment of Heat Stress C1-10-5

Table 10-2 Heat Index Requirements C1-10-9

Table 10-3 Symptoms and Treatment of Cold Stress C1-10-12

Table 12-1 Contaminants of Concern C1-12-1

Table 13-1 Direct Reading Instrument Monitoring Plan C1-13-1

Table 14-1 Project-specific Personal Protective Equipment Requirements [a] C1-14-3

Table 19-1 Emergency Contacts C1-19-2

Table 19-2 Emergency Equipment and Supplies C1-19-4

Table 19-3 Emergency Signals C1-19-6

FIGURES

Figure 4-1: Personnel Roles and Lines of Authority C1-4-6

Figure 10-1: Thermal Stress Monitoring Flow Chart C1-10-7

Figure 10-2: NOAA Wind-chill Chart C1-10-13

Figure 18-1: Work Area—Set-up Appropriately Based On Wind Direction C1-18-3

Figure 18-2: Typical Contamination Reduction Zone C1-18-4

TABLE OF CONTENTS (Continued)

SECTION **PAGE**

EXHIBITS

EXHIBIT C1-1 Health and Safety Plan Employee Signoff Form
EXHIBIT C1-2 Chemical Inventory/Register Form
EXHIBIT C1-3 Chemical-Specific Training Form
EXHIBIT C1-4 Forms
EXHIBIT C1-5 Key Safety Program Elements
EXHIBIT C1-6 Working Alone Protocol Call-In Contact Form
EXHIBIT C1-7 Completed Activity Hazard Analyses
EXHIBIT C1-8 Safety Data Sheets

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
µg/m^3	microgram(s) per cubic meter
AHA	activity hazard analysis
APP	Accident Prevention Plan
bpm	beats per minute
CFR	*Code of Federal Regulations*
Jacobs	Jacobs Engineering, Inc.
CO	carbon monoxide
COC	contaminant of concern
CON/HTRW	containerized, hazardous, toxic, or radioactive waste
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
dBA	decibel (A-weighted scale)
DEET	N,N-diethylmetatoluamide
DOT	Department of Transportation
ECC	Environmental Compliance Consultants, Inc.
EM	Engineering Manual
EMT	emergency medical technician
EOD	Explosive Ordnance Disposal
ERC	emergency response coordinator
ESBG	Environmental Services Business Group
EZ	exclusion zone
FID	flame ionization detector
FUDS	Formerly Used Defense Site
GFCI	ground-fault circuit interrupter
HAZWOPER	hazardous waste operations and emergency response
HITS	Hours and Incident Tracking System
HSE	health, safety, and environment
HSM	health and safety manager
IDLH	immediately dangerous to life and health
kV	kilovolt(s)
LEL	lower explosive limit
MEC	Munitions and Explosives of Concern
mm	millimeter(s)
mph	miles per hour

ACRONYMS AND ABBREVIATIONS (Continued)

MPPEH	Material Potentially Presenting an Explosive Hazard
MR	Munitions Response
MRA	Munitions Response Area
MRS	Munitions Response Site
OSHA	Occupational Safety and Health Administration
PAH	polycyclic aromatic hydrocarbon
PEL	permissible exposure limit [OSHA]
PFD	personal flotation device
PID	photoionization detector
PIM	potentially infectious material
PM	project manager
PPE	personal protective equipment
ppm	parts per million
PTSP	Pre-Task Safety Plan
REL	recommended exposure limit
SBO	safe behavior observation
SDS	Safety Data Sheet
SOP	standard operating procedure
SSHO	site safety and health officer
SSHP	Site Safety and Health Plan
SZ	support zone
TLV	threshold limit value
UL	Underwriters Laboratory
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
UTV	utility terrain vehicle

APPROVAL

ORIGINAL PLAN

ECC HSM Approval: **Date:** _____

ECC PM Approval: **Date:** _____

Jacobs HSM Approval: **Date:** _____

Jacobs PM Approval: **Date:** _____

Subcontractor Approval: **Date:** _____

Subcontractor Approval: **Date:** _____

REVISIONS

Revisions Made By: **Date:** _____

Description of Revisions to Plan:

Revisions Approved By: **Date:** _____

Revisions Approved By: **Date:** _____

Revisions Approved By: **Date:** _____

(intentionally blank)

1.0 INTRODUCTION

1.1 POLICY AND COMMITMENT

1.1.1 Safe Work Policy

It is the policy of ECC to perform work in the safest manner possible. Safety must never be compromised. To fulfill the requirements of this policy, an organized and effective safety program must be carried out at each location where work is performed.

For over 15 years ECC has committed to delivering on quality and safety for USACE and its customers. We strive to operate a safe work environment and aim for incident and injury-free performance.

All injuries are preventable, and we are dedicated to the goal of a safe work environment. To achieve this goal, every employee on the project must assume responsibility for safety.

Every employee is empowered to:

- Conduct their work in a safe manner
- Stop work immediately to correct any unsafe condition that is encountered
- Take corrective actions so that work may proceed in a safe manner

Safety, occupational health, and environmental protection will not be sacrificed for production. These elements are integrated into quality control, cost reduction, and job performance, and are crucial to our success.

1.1.2 Health and Safety Commitment

ECC has embraced a philosophy for health and safety excellence. The primary driving force behind our commitment to health and safety is simple: employees are ECC and Jacobs Engineering, Inc.'s (Jacobs) most significant asset and our corporate management values their safety, health, and welfare. Also, top management believes that all injuries are preventable. ECC and Jacobs' safety culture empowers employees at all levels to accept ownership for safety

and take whatever actions are necessary to eliminate injury. Our company is committed to world-class performance in health and safety and understands that world-class performance in health and safety is a critical element in overall business success.

ECC and Jacobs are committed to the prevention of personal injuries, occupational illnesses, and damage to equipment and property in all its operations; to the protection of the general public whenever it comes in contact with our work; and to the prevention of pollution and environmental degradation.

ECC and Jacobs' management, field supervisors, and employees plan safety into each work task in order to prevent occupational injuries and illnesses. The ultimate success of ECC and Jacobs' safety program depends on the full cooperation and participation of each employee.

ECC and Jacobs' management extends its full commitment to health and safety excellence.

1.1.3 Project-specific Health, Safety, and the Environment Goals

All management and employees are to strive to meet the project-specific health, safety, and the environment (HSE) goals outlined here. The team will be successful only if everyone makes a concerted effort to accomplish these goals. The goals allow the project to stay focused on optimizing the health and safety of all project personnel and, therefore, making the project a great success.

The project has established the following 11 specific goals and objectives:

- Create an injury-free environment
- Have zero injuries or incidents
- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example
- Ensure effective implementation of the Site Safety and Health Plan (SSHP) through education, delegation, and teamwork
- Ensure 100 percent participation in HSE compliance
- Continuously improve our safety performance
- Maintain free and open lines of communication

- Make a personal commitment to safety as a value
- Focus safety improvements on high-risk groups
- Continue strong employee involvement initiatives
- Achieve health and safety excellence

(intentionally blank)

2.0 APPLICABILITY

This SSHP applies to the following:

- All ECC and Jacobs staff, including subcontractors and tiered subcontractors of ECC working on the site
- All visitors to the construction site in the custody of ECC, including visitors from the client, the government, the public, and other staff of any project-related company or entity

This SSHP defines the procedures and requirements for the health and safety of ECC and Jacobs staff, subcontractors, and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This SSHP will be kept onsite during field activities and will be reviewed as necessary. The SSHP will be amended or revised as project activities or conditions change or when supplemental information becomes available. The SSHP adopts, by reference, the Enterprise-wide Core Standards and standard operating procedures (SOPs), as appropriate. In addition, the SSHP may adopt procedures from the project work plan and any governing regulations. If there is a contradiction between this SSHP and any governing regulation, the more stringent and protective requirement will apply.

All ECC and Jacobs staff and subcontractors must sign the employee signoff form included in this document (Exhibit C- 1) to acknowledge review of this document. Copies of the signature page will be maintained onsite by the site safety and health officer (SSHO).

(intentionally blank)

3.0 GENERAL PROJECT INFORMATION

3.1 PROJECT INFORMATION AND BACKGROUND

Client:	U.S. Army Corps of Engineers, Alaska District
Project/Site Name:	Drury Gulch Post-Remedial Action Monitoring and Maintenance
Site Address:	Kodiak, Alaska
ECC Project Manager:	Andy Larson
Date SSHP Developed:	November 2019
Date(s) of Site Work:	TBD

3.2 SITE BACKGROUND AND SETTING

Drury Gulch and the surrounding area were used by the U.S. Navy from 1939 to 1972 as part of the Kodiak Naval Station Reservation. The Navy stored and disposed of a variety of metal and wood debris in Drury Gulch for an unknown period. During the rerouting of the Rezanof Highway in the mid-1970s and the mid-1980s, the majority of metal and debris was removed from the site or buried on site and the surface was subsequently regraded. Site investigations in 1993, 1999, and 2000 showed that elevated levels of PCBs remain in the gulch from past military activities. The presence of PCBs in the area is believed to result from dumping PCB containing metal debris, such as electrical components, or reusing backfill material/soil cover containing PCBs.

In July 2003, a cleanup Decision Document (DD) was finalized which presents the selected RA and supporting rationale for the cleanup at the Drury Gulch Formerly Used Defense Site (FUDS). The 2003 DD references the 2002 remedial investigation/feasibility study (RI/FS) report and summarizes the site features and conditions. In 2013, the Hydrology and Hydraulics Review Report (HHRR) was prepared that further identified important site features associated with the Drury Gulch FUDS.

Terminology used before and after finalization of the DD has not been consistent throughout previous reporting and planning documents. Additionally, as new important features were identified throughout the history at the site, they were labeled but not clearly and consistently

defined in previous reports. The terminology used in this LTMM plan will be consistent with that identified in the 2002 RI/FS, the 2003 DD, and the 2013 HHRR.

3.2.1 SITE DESCRIPTION

Drury Gulch is a natural drainage basin bounded by shallow bedrock which slopes to the northwest and southeast, and primarily drains toward the northeast. A small, secondary side drainage slopes toward the southeast along the Site Access Road and conveys water from the Drury Gulch Creek through a culvert toward the Rezanof Highway.

The Drury Gulch FUDS is divided into four onsite sub-areas: Upper Gulch Area, Lower Gulch Area, Area North of the Rezanof Highway (ANRH), and the Lower Drainage Channel Area. The entirety of the Drury Gulch FUDS boundary encompasses these four sub-areas. The Rezanof Highway curves around the natural gulch and bisects the Drury Gulch FUDS, separating the Upper and Lower Gulch Areas from the ANRH and the Lower Drainage Channel Area. The Upper and Lower Gulch Areas, including the natural gulch, are located upgradient and are contained within a site perimeter fence. The ANRH and the Lower Drainage Channel Area are located outside the perimeter fence and extend downgradient toward the Kodiak Airport. The water conveyed through the Drury Gulch FUDS predominately flows toward the northeast through aboveground, open drainage channels before entering the Kodiak Airport stormwater drainage system and ultimately discharging into Womens Bay. In addition, to the four onsite sub-areas, Aviation Hill is an offsite area that directly influences onsite conditions at Drury Gulch FUDS.

3.3 CONTRACTOR ACCIDENT EXPERIENCE

Section 3.4 of the Accident Prevention Plan (APP) (to which this SSHP is appended) provides details on past 5 years of corporate safety history.

3.4 DESCRIPTION OF TASKS

All ECC and subcontractor employees engaging in hazardous waste operations or emergency response (HAZWOPER) will receive appropriate training as required by 29 *Code of Federal*

Regulations (CFR) 1910.120 and 29 CFR 1926.65 (or if required by subcontract). Personnel who have not met these training requirements will not be allowed to engage in the following HAZWOPER or emergency response activities.

3.4.1 HAZWOPER-regulated Tasks

- Soil/Sediment PCB Sampling (with or without heavy equipment)
- IDW management

3.4.2 Non-HAZWOPER-regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state HAZWOPER regulations are not applicable. The following tasks do not involve exposure to safety or health hazards associated with the hazardous waste operations. HAZWOPER training or medical requirements do not apply for the following tasks:

Tasks	Controls
No expected contact with contaminated media expected for these tasks; if this changes that task will be moved to the HAZWOPER-regulated category Utility clearance (as applicable) Post Remedial Action Monitoring and Maintenance Post Storm Event Inspections	Brief on hazards, limits of access, and emergency procedures. Post areas of contamination as appropriate. Wear personal protective equipment (PPE) as outlined in Section 14. Perform air sampling/monitoring as specified in Section 13.

3.5 TASKS REQUIRING ACTIVITY HAZARD ANALYSIS

Activity hazard analyses (AHAs) are required for all definable work tasks. As the project gets closer to initiation of field operations, additional information such as identification of subcontractor, specific equipment and tools is obtained, the AHAs will be updated accordingly. AHAs for the planned field tasks are included in Exhibit C-7:

- 01, Post Remedial Action and Post Storm Event Monitoring and Management
- 02, Utility Clearance
- 03, Drilling

- 04, Soil and Sediment Sampling
- 05, Mobilization, Use, and Demobilization of Earthmoving Equipment – To be prepared once the type of maintenance and the equipment needed has been determined.
- 06, IDW Management

Refer to Section 7 for information regarding AHA preparation, training, and use for visual inspection and all other tasks associated with this project.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

4.1 CLIENT

Contact Name: Greg Vanagel, USACE Alaska District Project Manager

Phone: (907) 753-5529

4.2 CONTRACTOR PERSONNEL

4.2.1 ECC Project Manager

Project Manager Name: Andy Larson

Telephone Number: (907) 385-0677

The project manager (PM) is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HSE management process. The PM has overall management responsibility for the tasks listed in this section. The PM may explicitly delegate specific tasks to other staff, as described in the following sections, but retains ultimate responsibility for completion of the following in accordance with this document:

- Incorporate standard terms and conditions, and contract-specific HSE roles and responsibilities in contract and subcontract agreements (including flow-down requirements to lower-tier subcontractors).
- Select safe and competent subcontractors by:
  - Choosing potential subcontractors based on technical ability and HSE performance
  - Implementing the subcontractor prequalification process
- Ensure copies of training and medical monitoring records and site-specific safety procedures are maintained in the project file and are accessible to site personnel.
- Provide oversight of subcontractor HSE practices per the site-specific safety plans and procedures.
- Manage the site and interfacing with third parties in a manner consistent with the contract and subcontract agreements and the applicable standard of reasonable care.
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented.
- Provide visible support and motivation for HSE programs, rules, procedures, processes, and training, leading by example and encouraging employees to take ownership of HSE issues.
- Intervene or stop work when an unsafe condition or behavior is observed or when an environmentally compromising condition is encountered.

- Make available to and require employees to complete required HSE training within established timelines and provide project numbers for such training.
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and on project work sites.
- Promptly report all work-related HSE incidents or near misses.
- Wear any required PPE.
- Ensure employees complete required HSE training within established timelines.
- Conduct, cooperate, or assist with HSE incident investigations.
- Consult with the Human Resources Delivery Partner before taking any disciplinary action (other than verbal counseling).

4.2.2 ECC Health and Safety Manager

HSM Name: Stanley R. Seegars

Cellular Number: (907) 360-0416

The HSM is responsible for the following:

- Review and evaluate subcontractor HSE performance using the prequalification process.
- Approve the SSHP and its revisions as well as AHA.
- Review and evaluate subcontractor site-specific safety procedures for adequacy prior to start of subcontractor's field operations.
- Support the oversight (or SSHO's direct oversight) of subcontractor and tiered subcontractor HSE practices.
- Permit upgrades and downgrades in respiratory protection after reviewing analytical data.
- Conduct audits as determined by project schedule and coordination with PM.
- Participate in incident investigations, lessons learned, and loss and near loss reporting.

4.2.3 Project Environmental Manager

Environmental Manager Name: Jessica Bay

Telephone Number: (907) 895-1050

Cellular Number: (757) 754-9240

The project environmental manager is responsible for the following:

- Provide environmental program support in areas such as training, auditing, planning, permit tracking, and subcontractor oversight as needed or as specified in the project environmental plan.
- Review and evaluate qualifications for subcontractors with a history of environmental noncompliance and for waste transportation and disposal subcontractors.
- Evaluate any spills, releases, or environmental permit incidents for appropriate follow-up actions, notifications, and recordkeeping requirements.
- Provide environmental compliance and environmental management expertise and advice to the project team as needed during the course of the project.

4.2.4 Site Safety and Health Officer

ECC SSHO for ECC Controlled Tasks: Jessica Bay; (757) 754-9240

Jacobs SSHO for Jacobs Controlled Tasks: Jeremiah Knuth; (907) 762-1388

The SSHO is responsible for verifying that the project is conducted in a safe manner, including the following specific obligations:

- Conduct HSE orientation for all team members before they enter the project work areas.
- Verify compliance with the requirements of this SSHP and applicable contractor SSHP, USACE Engineering Manual (EM) 385-1-1, and federal, state, and local regulations.
- Verify this SSHP is current and amended when project activities or conditions change.
- Verify onsite personnel and subcontractor personnel read the SSHP and sign the Employee Signoff Form (Exhibit C-1) before commencing field activities.
- Verify onsite personnel have completed any required specialty training (for example, fall protection, confined space entry, and similar) and medical surveillance as identified in this SSHP.
- Verify that project files include copies of subcontractor training and medical monitoring records and accepted site-specific safety procedures before the start of subcontractor's field operations.
- Act as the project hazard communication coordinator and perform the responsibilities outlined in this SSHP.
- Act as the project emergency response coordinator (ERC) and perform the responsibilities outlined in this SSHP.
- Act as the project competent person for general tasks not conducted by a specialized subcontractor.

- Post the Occupational Safety and Health Administration (OSHA) job-site poster—the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established.
- Hold or verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (as tasks or hazards change).
- Verify that project health and safety forms and permits are being used as outlined this SSHP.
- Perform oversight and assessments of subcontractor HSE practices per the site-specific safety plan and verify that project activity self-assessment checklists are being used as outlined this SSHP.
- Coordinate with the HSM regarding ECC and Jacobs and subcontractor operational performance, and third-party interfaces.
- Verify appropriate PPE use, availability, and training.
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented.
- Conduct accident investigations, including root cause analysis.
- Calibrate and conduct air monitoring in accordance with the SSHP and maintain all air monitoring records in the project file.
- Maintain HSE records and documentation.
- Facilitate client, OSHA, or other government agency inspections, including accompanying the inspector and providing all necessary documentation and follow-up.
- Deliver field HSE training as-needed, based on project-specific hazards and activities.
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites.
- Wear any required PPE.
- Conduct, cooperate, or assist with HSE incident investigations.
- Contact the PM and HSM when standards of conduct or Jacobs Policy 203 has been violated by a Jacobs employee.
- Contact the HSM and PM in the event of an incident.
- Contact the HSM and project environmental manager in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required.
- When an apparent imminent danger exists, immediately remove all affected employees and subcontractors, notify subcontractor safety representative, stop affected work until adequate corrective measures are implemented, and notify the PM and HSM as appropriate.
- Document all verbal health-and-safety-related communications in project field logbook, daily reports, or other records.

4.3 EMPLOYEE RESPONSIBILITIES

All personnel are assigned responsibility for safe and healthy operations. This concept is the foundation for involving all employees in identifying hazards and providing solutions. For any operation, individuals have full authority to stop work and initiate immediate corrective action or control. In addition, each worker has a right and responsibility to report unsafe conditions or practices. This right represents a significant facet of worker empowerment and program ownership. Through shared values and a belief that all accidents are preventable, our employees accept personal responsibility for working safely. Each employee is responsible for the following performance objectives:

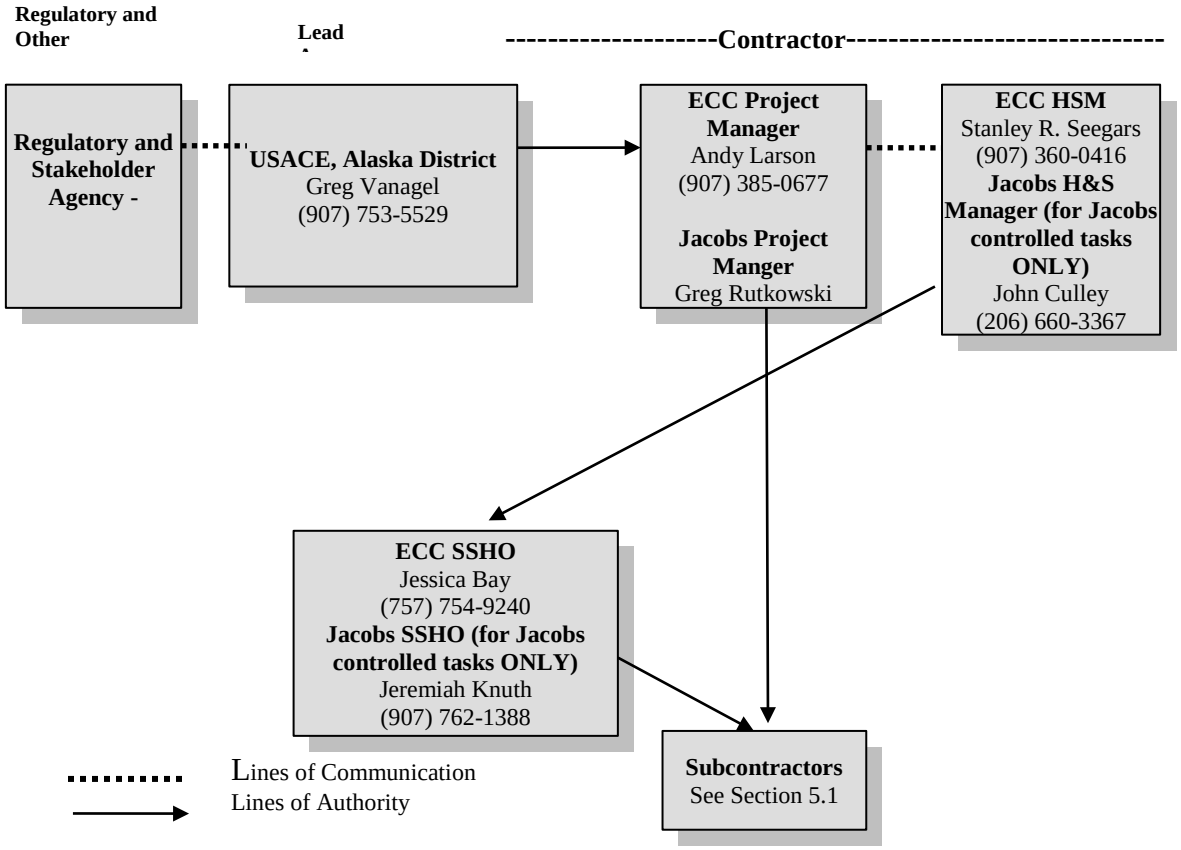
- Understanding and abiding by their respective company's and client HSE programs, rules, procedures, processes, and training, including any that are project-specific
- Completing all required HSE training made available and accessible within established timelines
- Always wearing any required personal protective equipment
- Intervening or stopping work for you or other employees when an unsafe condition or behavior is encountered or observed, or when an environmentally compromising condition exists
- Promptly notifying a supervisor, PM, SSHO, or HSM when an unsafe condition or behavior is observed, or when an environmentally compromising condition exists
- Promptly reporting a supervisor, PM, SSHO, or HSM all work-related HSE incidents or near misses
- Attending required project HSE pre-task briefings and meeting before performing work
- Cooperating or assisting with HSE incident investigations

4.3.1 Employee Authority

Each employee on the project has the obligation and authority to shut down any perceived unsafe work. During employee orientation, each employee will be informed of their authority to do so.

4.4 LINES OF AUTHORITY

Figure 4-1: Personnel Roles and Lines of Authority



5.0 STANDARDS OF CONDUCT

All individuals associated with this project must work injury-free and drug-free and must comply with the following standards of conduct, the SSHP, and the safety requirements of ECC. Commonly accepted standards of conduct help maintain good relationships between people. They promote responsibility and self-development. Misunderstandings, frictions, and disciplinary action can be avoided by refraining from thoughtless or wrongful acts.

5.1 STANDARDS OF CONDUCT VIOLATIONS

All individuals associated with this project are expected to behave in a professional manner. Violations of the standards of conduct would include, but not be limited to, the following:

- Failure to perform work
- Inefficient performance, incompetence, or neglect of work
- Willful refusal to perform work as directed (insubordination)
- Negligence in observing safety regulations, poor housekeeping, or failure to report on-the-job injuries or unsafe conditions
- Unexcused or excessive absence or tardiness
- Unwillingness or inability to work in harmony with others
- Discourtesy, irritation, friction, or other conduct that creates disharmony
- Harassment or discrimination against another individual
- Failure to be prepared for work by wearing the appropriate construction clothing or bringing the necessary tools
- Violation of any other commonly accepted reasonable rule of responsible personal conduct

5.2 SUBCONTRACTOR SAFETY PERFORMANCE

ECC and Jacobs should continuously endeavor to observe subcontractors' safety performance and adherence to their plans and AHAs. This endeavor should be reasonable and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. Neither ECC nor Jacobs is responsible for exhaustive observation for hazards and unsafe practices. Jacobs oversight does not relieve ECC nor project subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

5.3 INCENTIVE PROGRAM

Each project is encouraged to implement a safety incentive program that rewards workers for exhibiting exemplary safety behaviors. Actions that qualify are those that go above and beyond what is expected. Actions that will be rewarded include spotting and correcting a hazard, bringing a hazard to the attention of your foreman, telling your foreman about an incident, coming up with a safer way to get the work done, or stopping a crew member from doing something unsafe. The program will operate throughout the project, covering all workers. The incentive program will be communicated to all employees during the project employee orientation and project safety meetings.

5.4 REPORTING UNSAFE CONDITIONS AND PRACTICES

Responsibility for effective health and safety management extends to all levels of the project and requires good communication between employees, supervisors, and management. Accident prevention requires a proactive policy on near misses, close calls, unsafe conditions, and unsafe practices. All personnel must report any situation, practice, or condition that might jeopardize the safety of our projects. All unsafe conditions or unsafe practices will be corrected immediately. The project team should have zero tolerance of unsafe conditions or unsafe practices.

No employee or supervisor will be disciplined for reporting unsafe conditions or practices. Individuals involved in reporting the unsafe conditions or practices will remain anonymous.

The following reporting procedures will be followed by all project employees:

- Upon detection of any unsafe condition or practice, the responsible employee will attempt to safely correct the condition.
- The unsafe condition or practice will be brought to the attention of the worker's direct supervisor, unless the unsafe condition or practice involves the employee's direct supervisor. If so, the SSHO needs to be notified at once by the responsible employee.
- Either the responsible employee or responsible employee's direct supervisor is responsible for immediately reporting the unsafe condition or practice to the SSHO.
- The SSHO will act promptly to correct the unsafe condition or practice.

- Details of the incident or situation will be recorded by the SSHO in the field logbook. If the subcontractor was involved, the observed hazard form will be used.

(intentionally blank)

6.0 SAFETY PLANNING AND CHANGE MANAGEMENT

6.1 DAILY SAFETY MEETINGS AND PRE-TASK SAFETY PLANS

Daily safety meetings are to be held with all project personnel in attendance to review the hazards posed and required HSE procedures and AHAs that apply for each day's project activities. The Pre-Task Safety Plans (PTSPs) serve the same purpose as the general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on hazards posed to individual work crews.

At the start of each day's activities, the crew supervisor completes the PTSP, included in Exhibit C-5, with input from the work crew, during their daily safety meeting. The day's tasks, personnel, tools, and equipment that will be used to perform the tasks listed, along with the hazards posed and required HSE procedures are reviewed as the PTSP is completed. The use of PTSPs promotes worker participation in the hazard recognition and control process while reinforcing the task-specific hazard and required HSE procedures with the crew each day.

6.2 CHANGE MANAGEMENT

This SSHP addresses all known activities and associated hazards. As work progresses, if significant changes are identified that could affect health and safety at the site, coordinate with the HSM to determine whether an SSHP update is necessary.

The following are examples of changes that may require a revision to the plan:

- Change in key project staff
- New subcontractor to perform work
- New chemicals brought to site for use
- Change in scope or addition of new tasks
- Change in contaminants of concern (COCs) or change in concentrations of COCs
- New hazards or hazards not previously identified that are not addressed in this SSHP

(intentionally blank)

7.0 PROJECT HAZARD ANALYSIS AND HEALTH HAZARD CONTROL PROGRAM

(Reference: EM 385-1-1 Section 01.B.06)

The Health Hazard Control Program will be conducted by the use of the AHA process. Section 7 outlines the process that will be used by the SSHO onsite to determine the presence of hazardous environments or whether hazardous or toxic agents could be released into the work environment.

A health and safety risk analysis (Exhibit C-5) has been performed for each task. The ECC HSM will consider various methods for mitigating hazards in the order listed in this section. Employees are trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects.

- Elimination of the hazards (that is, use remote sampling methodology to avoid going into a confined space)
- Substitution (that is, reduce exposure to vapors by using of a geoprobe instead of test-pitting)
- Engineering controls (that is, ventilate a confined space to improve air quality)
- Warnings (that is, establish exclusion zones to keep untrained people away from hazardous waste work)
- Administrative controls (that is, implement a work and warming schedule to reduce chance of cold stress)
- Use of PPE (that is, use respirators when action levels are exceeded)

The hazard controls and safe work practices are summarized in the following sections of this SSHP:

- Section 8, General Hazards and Controls
- Section 9, Project-Specific Hazards and Controls
- Section 10, Physical Hazards and Controls
- Section 11, Biological Hazards and Controls
- Section 12, Contaminants of Concern

7.1 ACTIVITY HAZARD ANALYSIS

An AHA must be developed for each job activity. The AHA should define the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard. A listing of the equipment to be used to perform the activity, inspection requirements to be performed, and training requirements for the safe operation of the equipment listed must be identified. Workers are briefed on the AHA before performing the work and their input is solicited before, during, and after work is performed to further identify the hazards posed and control measures required. The AHA should identify the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard.

The hazard controls described in the following sections should be used as a basis for preparing AHAs.

AHAs prepared for project activities and subcontractors are included as Exhibit C-5.

7.2 SUBCONTRACTOR ACTIVITY HAZARD ANALYSIS

ECC, Jacobs, and subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by ECC. Each subcontractor will submit AHAs for its field activities, as defined in its scope of work, along with a project-specific safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

Table 7-1
General Activity Hazard Analysis

Potential Hazard	Project Activities			
	Soil/Sediment PCB Sampling (with or without heavy equipment)	Post Remedial Action Monitoring and Maintenance; Post Storm Event Inspections	IDW management	Utility Clearance
Biological Hazards	X	X	X	X
Drilling	X			
Drum Handling	X			
Earthmoving Equipment	X			
Electrical Safety	X			X
Field Vehicles and Fuel Handling	X	X	X	X
Fires	X	X	X	X
Hand and Power Tools	X	X	X	X
Manual Lifting	X	X	X	X
Noise	X	X	X	X
Slips, Trips, Falls	X	X	X	X
Temperature Extremes	X	X	X	X
Ultraviolet Light exposure (sunburn)	X	X	X	X
Utilities (underground/overhead)	X			
Visible Lighting	X	X	X	X
Weather Extremes	X	X	X	X

(intentionally blank)

8.0 GENERAL HAZARDS AND CONTROLS

Section 8 provides safe work practices and control measures used to reduce or eliminate potential hazards. It is a summarized list of requirements.

8.1 BLOODBORNE PATHOGENS

Exposure to bloodborne pathogens may occur when rendering first-aid or cardiopulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material (PIM).

Employees trained in first-aid and CPR or those exposed to PIM must complete a bloodborne pathogens training module annually. When performing first-aid or CPR, the following apply:

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials.
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes.
- If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. Use one-part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.

Employees will be provided with a confidential medical examination should exposure to PIM occur. The examination includes the following procedures:

- Documenting the exposure
- Testing the exposed employee’s and the source individual’s blood (with consent)
- Administering post-exposure prophylaxis

8.2 CHEMICAL STORAGE

The following are general guidelines for storing chemicals and other hazardous materials:

- Keep acids away from bases.

- Keep oxidizers (for example, nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (that is, metals).
- Keep flammables and corrosives in appropriate storage cabinets.
- Do not store paper or other combustibles near flammables.
- Use secondary containment and lipped shelving that is secured.
- Have a fire suppression system available.

8.2.1 Storage of Flammable and Combustible Liquids

- Use only approved containers and portable tanks for storage and handling of flammable and combustible liquids.
- Use approved safety cans when handling or working with 5 gallons (19 liters) or less of flammable liquids. Do not use plastic gas cans. For quantities of 1 gallon (3.78 liters) or less, the original container may be used.
- Do not store flammable or combustible liquids in stairways or areas normally used for the passage of people.

8.2.2 Indoor Storage of Flammable and Combustible Liquids

- Do not store more than 25 gallons (95 liters) of flammable or combustible liquids in a room outside of an approved storage cabinet.
- Store quantities of flammable and combustible liquids in excess of 25 gallons (95 liters) in an acceptable or approved cabinet.
- Mark cabinets conspicuously with "FLAMMABLE: KEEP FIRE AWAY."
- Do not store more than 60 gallons (228 liters) of flammable or 120 gallons (456 liters) of combustible liquids in any one storage cabinet. Not more than three such cabinets may be located in a single storage area.

8.2.3 Outside Storage of Flammable/Combustible Liquids

- Do not exceed 1,100 gallons (4,180 liters) of container-storage (not more than 60 gallons [228 liters] each) in any one area. No area will be within 20 feet (6.1 meters) of any building.
- Grade storage areas to divert spills away from buildings and surround with an earthen dike.
- Do not locate storage areas near a storm drain. Overflow and spills must be diverted away from storm drains or surface waters.
- Ensure storage areas are free from weeds, debris, and other combustible materials.

- Ensure that outdoor portable tanks are provided with emergency vent devices and are not closer than 20 feet (6.1 meters) from any building.
- Post No Smoking signs around the storage area.

8.2.4 Storage of Hazardous Waste

- Ensure all facilities storing ignitable and combustible liquids and hazardous wastes are designed, constructed, maintained, and operated to minimize the possibility of a fire, explosion, or release of hazardous constituents.
- Store flammable wastes more than 50 feet from the property line.

8.3 ELECTRICAL SAFETY

The following hazard controls and safe work practices should be applied when using electrical tools, extension cords, or other electrical-powered equipment, or when exposed to electrical hazards:

- Permit only qualified personnel to work on unprotected energized electrical systems
- Only enter high-voltage areas with proper authorization.
- For Jacobs employees who might from time to time work in an environment influenced by the presence of electrical energy, complete the Awareness Level Electrical Safety Training located on the Jacobs Virtual Office (VO).
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.
- Inspect electrical equipment, power tools, and extension cords for damage before use. Do not use defective electrical equipment and remove it from service.
- Ground fault circuit interrupters (GFCIs) are the standard method for protecting employees from the hazards associated with electric shock. Use GFCIs on all 120-volt, single-phase 15 and 20-ampere receptacle outlets that are not part of the permanent wiring of the building or structure.
- Implement an assured equipment grounding conductor program under the following scenarios:
  - GFCIs cannot be used.
  - Client requires such a program.
  - The owning sector decides to implement such a program in addition to GFCI protection.
- Equip extension cords with third-wire grounding and cover, elevate, or otherwise protect cords passing through work areas. Cords should not be routed through doorways unless

protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire

- Ensure electrical power tools and equipment are effectively grounded or double-insulated and Underwriters Laboratory (UL) approved.
- Operate and maintain electric power tools and equipment according to manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kilovolts (kV) or less, and 10 feet (3 meters) plus 0.4 inch (1.0 centimeters) (for every 1 kV over 50 kV).
- Do not suspend temporary lights by their electric cord unless designed for such. Protect lights from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

8.4 FIELD VEHICLES

Field vehicles may be personal vehicles, rental vehicles, fleet vehicles, or project vehicles; the following procedures should be used regardless of vehicle origin:

- Maintain a first aid kit, bloodborne pathogen kit, and fire extinguisher in the field vehicle at all times.
- Use a rotary beacon on vehicle if working adjacent to active roadway.
- Familiarize yourself with rental vehicle features before operating the vehicle, including the following:
  - Vision fields and blind spots
  - Vehicle size
  - Mirror adjustments
  - Seat adjustments
  - Cruise control features, if offered
  - Pre-program radio stations and GPS, if equipped
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if using a van or pick-up truck.
- Close car doors slowly and carefully. Fingers can get pinched in doors.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.

- Ensure back-up alarms are functioning, if equipped. Before backing a vehicle, take a walk around the vehicle to identify obstructions or hazards. Use a spotter when necessary to back into or out of an area.

8.5 FIRE PREVENTION

(Reference EM 385-1-1 Section 09.A.01)

8.5.1 Fire Extinguishers and General Fire Prevention Practices

- Fire extinguishers will be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet (30.5 meters). When 5 gallons (19 liters) or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet (15.2 meters). When 10 liters or more of a flammable or combustible liquid is being used, an extinguisher must be within 15 meters.
- Ensure that the following is true for all extinguishers:
  - Maintained in a fully charged and operable condition
  - Visually inspected each month
  - Undergo a maintenance check each year
- Keep the area in front of extinguishers clear.
- Store combustible materials outside, at least 10 feet (3 meters) from any building.
- Keep solvent waste and oily rags in a fire-resistant, covered container until removed from the site.
- Keep areas neat. Housekeeping is important.
- Provide a fire extinguisher, rated not less than 2A, for each 280 square meters of a combustible building area, or major fraction thereof. Travel distance from any point of the protection area to the nearest fire extinguisher should not exceed a horizontal distance of 50 feet or 15 meters.
- Keep flammable or combustible liquids in approved containers, and store in an approved storage cabinet.

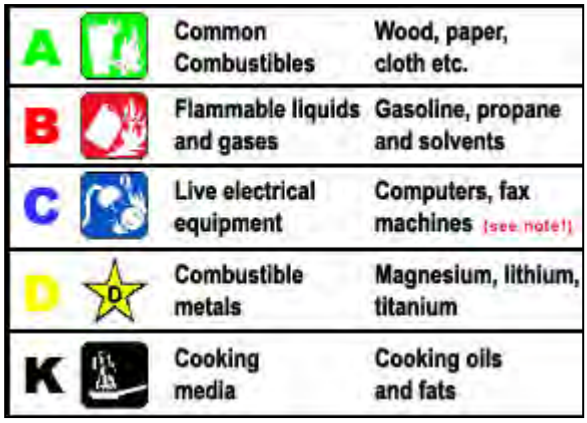
Fire extinguishers can represent an important segment of any overall fire protection program.

However, their successful functioning depends upon the following conditions having been met:

- The extinguisher is properly located and in working order.
- The extinguisher is of proper type and for a fire that may occur.
- The fire is discovered while still small enough for the extinguisher to be effective.

- The fire is discovered by a person ready, willing, and able to use the extinguisher.
- Class C fires can be readily extinguished by quenching-cooling with water or a water-mixture agent. Class B fires are more effectively extinguished by an agent that blankets-smothers the fire through exclusion of oxygen surrounding the fire area. Extinguishers containing bromochlorodifluoromethane, monobromotrifluoromethane, carbon dioxide, or dry chemical are generally best suited for extinguishing Class B fires. For Class C fires, the primary consideration in extinguishing this type of fire is the selection of nonconductive extinguishing agent to prevent dangerous electrical shock and possible death to user.
- Because of its corrosive nature, dry chemical is not recommended for use on computerized, electronic, or other equipment with extensive circuitry.

The following chart explains the classes of fires:



Fires are classified into the following five groups:

- Class A: Class A fires involve common combustibles such as wood, paper, cloth, rubber, trash, and plastics. They are common in typical commercial and home settings but can occur anywhere these types of materials are found.
- Class B: Class B fires involve flammable liquids, gases, solvents, oil, gasoline, paint, lacquers, tars, and other synthetic or oil-based products. Class B fires often spread rapidly and, unless properly secured, can reflash after the flames are extinguished.
- Class C: Class C fires involve energized electrical equipment, such as wiring, controls, motors, data processing panels, or appliances. They can be caused by a spark, power surge, or short circuit and typically occur in locations that are difficult to reach and see.
- Class D: Class D fires involve combustible metals such as magnesium and sodium. Combustible metal fires are unique industrial hazards that require special dry powder agents.

  (NOTE: Although ABC and BC dry chemical extinguishers can control a fire involving electronic equipment, the National Fire Code specifically advises against dry-chemical

extinguishers for fires involving computers or other delicate electronic equipment due to the potential damage from residues).

Firefighting should only be conducted by those trained and certified in this practice. The commonly accepted practice is the PASS method: Pull the pin, Aim, Squeeze the handle, and Sweep the base of the fire area. The SSHO should verify that at least two staff members are onsite that have the required training for use of fire extinguishers.

8.5.2 Dispensing of Flammable and Combustible Liquids

- Separate areas in which flammable or combustible liquids are dispensed in quantities greater than 5 gallons (22.7 liters) from other operations by at least 25 feet (7.6 meters).
- Provide drainage away from storm drains or surface waters or other means of containment, to control spills.
- Provide adequate natural or mechanical ventilation to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.
- Dispense flammable liquids from one container to another only when containers are electrically interconnected (bonded).
- Do not dispense flammable or combustible liquids by means of air pressure on the container or portable tanks.
- Use only approved dispensing devices and nozzles for flammable liquids.

8.6 GENERAL PRACTICES AND HOUSEKEEPING

The following general requirements are applicable to all portions of the work:

- Perform site work during daylight hours whenever possible.
- Good housekeeping must always be maintained in all project work areas
- Establish common paths of travel and keep them free from accumulated materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, or other devices.
- Designate specific areas for the proper storage of materials.
- Store tools, equipment, materials, and supplies in an orderly manner.
- As work progresses, store scrap and unessential materials or remove from the work area.

- Provide containers for collecting trash and other debris and remove them at regular intervals.
- Quickly clean up all spills and remove oil and grease from walking and working surfaces.
- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others.
- Familiarize yourself with, understand, and follow jobsite emergency procedures.
- Do not fight or horseplay while conducting the firm's business.
- Do not use or possess firearms or other weapons while conducting the firm's business.
- Report unsafe conditions or unsafe acts to your supervisor immediately.
- Report emergencies, occupational illnesses, injuries, vehicle accidents, and near misses immediately
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment.
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor.
- Shut down and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion.
- Do not run in the workplace.
- When ascending or descending stairways, use the handrail and take one step at a time.
- Do not apply compressed air to any person or clothing.
- Do not wear shoes with metal exposed to the sole.
- Do not wear rings, loose clothing, wristwatches, or other loose accessories when within arm's reach of moving machinery.
- Remove waste and debris from the workplace and dispose of it in accordance with federal, state, and local regulations.
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible.
- Check the work area to determine what problems or hazards may exist.

8.7 HAZARD COMMUNICATION AND GLOBALLY HARMONIZED SYSTEM

(Reference Section 01.B.06, EM 385-1-1)

Effective information and training on hazardous chemicals should be given to project employees by their employer at the time of initial assignment or whenever a new physical or

health hazard the employees have not been previously trained about is introduced into their work area.

The hazard communication coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by project personnel using the chemical inventory form (Exhibit C-2).
- Confirm that an inventory of chemicals brought onsite by subcontractors is available.
- Request or confirm locations of Safety Data Sheets (SDSs) from the client, contractors, and subcontractors for chemicals to which personnel are potentially exposed to.
- Before or as the chemicals arrive onsite, obtain an SDS for each hazardous chemical and include on the chemical inventory sheet, and add the SDS to the onsite repository.
- Label chemical containers with the identity of the chemical and appropriate hazard warnings, and store properly.
- Give employees required chemical-specific hazard communication training using the chemical-specific training form (Exhibit C-3).
- Store all materials properly, considering compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

8.8 KNIFE USE

Open-bladed knives (for example, box cutters, utility knives, pocket knives, machetes, and multi-purpose tools with fixed blades such as a Leatherman) are prohibited at worksites, except where the following three conditions are met:

- The open-bladed knife is determined to be the best tool for the job.
- An approved AHA or written procedure is in place and covers the necessary safety precautions (that is, work practices, PPE, and training).
- Knife users have been trained and follow the AHA.

8.9 LIGHTING

Lighting should be evaluated when conducting work inside buildings, confined spaces, or other areas or instances where supplemental light may be needed (for example, work before sunrise

or after sunset). A light meter can be used to evaluate the adequacy of lighting. The following are common requirements for lighting and the conditions and type of work being performed:

- While work is in progress outside construction, areas should have at least 33 lux.
- Construction work conducted inside buildings requires light of at least 55 lux.
- The means of egress should be illuminated with emergency and nonemergency lighting to provide a minimum 11 lux measured at the floor. Egress illumination should be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb, will not leave any area in total darkness.

8.10 MANUAL LIFTING

Back injuries are the leading cause of disabling work and most back injuries are the result of improper lifting techniques or overexertion. Use the following to mitigate the hazards associated with lifting:

- When possible, modify the task to minimize manual lifting hazards.
- The SSHO will evaluate lifting of loads weighing more than 40 pounds (18 kilograms).
- Where possible, lift heavy objects such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys by mechanical means.
- Seek assistance when performing manual lifting tasks that appear beyond your physical capabilities.
- In general, practice the following steps when planning and performing manual lifts:
  - Assess the situation before you lift.
  - Ensure good lifting and body positioning practices.
  - Ensure good carrying and setting down practices.

8.11 PERSONAL HYGIENE

Good hygiene is essential for personal health and to reduce the potential of cross-contamination when working on a hazardous waste site. Personnel should implement the following:

- Keep hands away from nose, mouth, and eyes during work.
- Keep areas of broken skin (that is, chapped or burned) covered.
- Wash hands with soap and water before eating, smoking, or applying cosmetics.

8.12 PERSONAL SECURITY

Follow the guidelines below for personal security measures. The HSM and firm-wide Security Office can be contacted if additional, specific measures are needed (such as evaluating the needs for security service).

8.12.1 General Safety and Security Guidelines

The following guidelines apply for workers in the United States:

- Stay alert and be aware of your surroundings. Avoid preoccupation with mobile devices while in an unfamiliar area.
- Whenever possible, use the buddy system with another employee or client or subcontractor employee.
- Trust your intuition; if a situation appears strange or wrong, it probably is.
- Be confident in your walk or stride; do not give the appearance you are new in town.
- Avoid carrying and displaying large sums of cash.
- If you sense or see dangerous situations along your route, change your route and depart the area quickly. If you feel that you are being followed, go to the nearest police station or safe location and file a complaint with the police. Provide a description of the person, their vehicle, license plate number, and any other useful information.
- Only walk short distances that are safe and secure while visiting an unfamiliar city or location.
- Take host-approved transportation for long distances.
- In fight or flight situations, leave the dangerous area rather than staying to fight.
- Always report suspicious activity to the nearest local law enforcement agency.
- Locate emergency exits in your hotel or where you are staying to ensure you know where to go in case of a fire or a natural or man-made disaster.
- Secure your electronic devices when left in your room or take them with you if you are not able to secure them properly.

8.13 SHIPPING AND TRANSPORTATION OF HAZARDOUS MATERIALS

The U.S. Department of Transportation (DOT) has specific regulations governing shipping of hazardous materials (also called dangerous goods). The DOT may define chemicals brought to

the site, hazardous wastes that may be shipped offsite, and other project wastes as hazardous materials.

All staff who are involved in shipment of hazardous materials, including receiving hazardous materials, preparing profiles or manifests, packaging hazardous wastes, labeling, or transporting hazardous materials by road, are called HazMat employees (note Jacobs cannot transport hazardous wastes by public road). HazMat employees must receive training in shipping dangerous goods.

For all hazardous materials that are shipped (for example, via Federal Express) or transported by road, ensure that the materials are properly identified, labeled, packed, and documented by trained staff.

49 CFR 172 requires that all hazmat employees be aware of potential transportation security concerns. Each employee must understand the security risks involved with transporting hazardous materials.

All transporters of hazardous materials must be prequalified by a contract administrator, who evaluates the carrier's safety rating, security measures, and employee screening procedures. The following points are provided as an overview of security measures to increase awareness of this important matter:

- When shipping hazardous materials, check driver credentials and ask about shipping details.
- When receiving a hazardous materials shipment, inspect packages for signs of tampering or damage to the contents. Verify the drivers and company information on the form with the driver.

If there is suspicious or unusual behavior (for example, driver without credentials, evasive answers) or any discrepancies identified, do not offer or accept the shipment, and immediately notify the PM or the HSM.

8.14 SUBSTANCE ABUSE

Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. ECC and Jacobs do not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior.

The following are prohibited onsite:

- Use or possession of intoxicating beverages while performing work
- Abuse of prescription or nonprescription drugs
- Use or possession of illegal drugs or drugs obtained illegally
- Sale, purchase, or transfer of legal, illegal, or illegally obtained drugs
- Arrival at work under the influence of legal or illegal drugs or alcohol

Employees may be required to submit to drug or alcohol testing, or both, as required by clients.

8.15 UNKNOWN OR SUSPECT OBJECTS OR MATERIALS

If unknown or suspect objects or materials (that is, exposed or partially buried drums, biological waste, cylinders, munitions of explosive concern, and unexpected stained or discolored soil) are encountered during site operations, ongoing activities should be immediately suspended. ECC and Jacobs or subcontractor personnel encountering unknown or suspect objects or materials should adhere to the following:

- Secure the area and identify the location of the object or material to the extent possible, without causing bodily injury to yourself or others and without disturbing the object.
- Evacuate the work area.
- Immediately notify the PM and/or HSM of the encountered condition.
- Do not provide additional disturbance or otherwise handle the suspect object/material.

The SSHO should contact the PM and the HSM to evaluate potential hazards associated with the specific situation encountered. The project team will then address the need for the use of

special procedures, engineering controls, PPE, or specialized subcontract personnel to safely mitigate the situation.

9.0 PROJECT-SPECIFIC HAZARD CONTROLS

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. The practices and controls are to be implemented by the party in control of either the work or the particular hazard. Each person onsite is required to abide by the hazard controls. ECC and Jacobs employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. Project personnel who do not understand any of these provisions should contact the HSM for clarification.

9.1 DRILLING AND DIRECT-PUSH

Only authorized personnel are permitted to operate drill rigs. In addition, the following hazard controls and safe work practices apply:

- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.
- Stay as clear as possible of all hoisting operations. Loads should not be hoisted overhead of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair must be restrained.
- If equipment becomes electrically energized, personnel should be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party should be contacted to have line de-energized prior to approaching the equipment. Notify emergency personnel immediately.
- Never smoke around drilling operations.
- Wear the appropriate PPE when sampling (refer to Section 14) especially when splash hazards exist.
- Use the appropriate lifting procedures when unloading equipment and sampling.
- Use proper lifting techniques (refer to Section 8.10).
- Allow ample space for personnel to lift and store drilling rods.
- Avoid movement near rig. Do not place hands near hammer.
- If dermal contact with the groundwater and acid used in sample preservation, wash exposed skin thoroughly with soap and water.
- Avoid eating and drinking onsite and during sampling.
- Use ear plugs during sampling if sampling involves a generator.

- Ensure the drill rig is equipped with a kill wire or switch, and personnel are informed of its location.
- Be aware and stand clear of heavy objects that are hoisted overhead.
- The driller has the following additional responsibilities:
  - Verify the rig is properly maintained in accordance with the company's maintenance program.
  - Verify that all machine guards are in place while the rig is in operation.
  - Perform housekeeping (maintain a clean work area).
- Ensure the drill rig is equipped with at least one fire extinguisher.
- Level and stabilize the drill rig with jacks and adequate cribbing before raising the mast and during drilling operations. Cribbing materials should be made from materials that are capable of supporting the weight of the rig. Care should be taken in muddy, soggy soils, or partially frozen areas. In addition to cribbing, guy wires should be used to improve stability if the rig is located on wet, partially frozen ground, or in areas with loose, caving soil, or in an area subject to frequent gusty winds.

9.2 DRUM AND PORTABLE TANK HANDLING

The following hazard controls and safe work practices should be applied when overseeing the movement of drums or when handling drums:

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries.
- Ensure drum or tank bungs and lids are secured and are labeled before moving.
- Ensure that drums and tanks remain covered except when removing or adding material or waste. Properly secure covers and lids at the end of each workday.
- Provide equipment to keep the operator removed from the drums, to lessen the likelihood of injury. Such equipment might include a drum grappler attached to a hydraulic excavator, a small front-end loader that can be either loaded manually or equipped with a bucket sling, a rough terrain forklift, a roller conveyor equipped with solid rollers, or drum carts designed specifically for drum handling.
- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface.
- Ensure there are appropriately designed Plexiglas cab shields on loaders, backhoes, and similar when handling drums containing potentially explosive materials.
- Ensure equipment cabs are supplied with fire extinguishers and are air-conditioned to increase operator efficiency.
- Supply operators with appropriate respiratory protective equipment when needed.

- Ensure that drums are secure and are not in the operator's view of the roadway.
- Before handling, warn all personnel about potential hazards.
- Before moving anything, determine the most appropriate sequence in which the various drums, portable tanks, and other containers should be moved (for example, small containers may have to be removed first to permit heavy equipment to enter and move the drums).
- Keep overpack drums and an adequate volume of absorbent near areas where minor spills may occur.
- Use containers or overpacks that are compatible with the waste or materials.
- Provide drums containing liquids or hazardous waste with secondary containment and do not locate near a storm water inlet or conveyance.
- Allow enough aisle space between drum pallets and between drums and other equipment that the drums can be easily accessed (at least 2 to 3 feet) by fire control equipment and similar equipment.
- Make sure that a spill kit is available in drum or tank storage areas (or where liquids are transferred from one vessel to another).

9.3 EARTHMOVING EQUIPMENT

ECC and Jacobs authorize only those employees qualified by training or previous experience to operate material handling equipment. The following hazard controls and safe work practices apply when working around or operating heavy equipment:

- Maintain safe distance from operating equipment and stay alert of equipment movement. Avoid positioning between fixed objects and operating equipment and equipment pinch points, remain outside of the equipment swing and turning radius. Pay attention to backup alarms, but not rely on them for protection. Never turn your back on operating equipment.
- Approach operating equipment only after receiving the operator’s attention. The operator should acknowledge your presence and stop movement of the equipment. Caution should be used when standing next to idle equipment; when equipment is placed in gear it can lurch forward or backward. Never approach operating equipment from the side or rear where the operator’s vision is compromised.
- When required to work in proximity to operating equipment, wear high-visibility vests to increase visibility to equipment operators. For work performed after daylight hours, vests should be made of reflective material or include a reflective stripe or panel.
- Do not ride on earthmoving equipment unless it is specifically designed to accommodate passengers. Only ride in seats that are provided for transportation and that are equipped with seat belts.
- Stay as clear as possible of all hoisting operations. Loads should not be hoisted overhead of personnel.

- If equipment becomes electrically energized, personnel should be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party should be contacted to have line de-energized before approaching equipment.
- Earthmoving equipment should not be used to lift or lower personnel.

9.4 EXCAVATION OPERATIONS

The requirements in this section will be followed whenever excavation to depths of less than 4 feet is being performed. Excavations deeper than 4 feet or that qualify as a confined space will not be entered by personnel on this project.

- Do not enter the excavations unless completely necessary, and only after the excavation competent person has completed their daily inspection and has authorized entry. An inspection will be conducted by the competent person before the start of work, as needed throughout the shift, after every rainstorm, and after any hazard increasing occurrence. Documentation of the inspection must always be maintained onsite.
- Follow all excavation entry requirements established by the excavation competent person and any excavation permit being used.
- Use sloping, benching, shoring, shielding, or other protective systems to protect personnel from cave-ins, except when the excavation is made entirely in stable rock or is less than 5 feet deep (1.5 meters) and there is no indication of possible cave-in, as determined by the excavation competent person. Protective systems for excavations deeper than 20 feet (6.1 meters) must be designed or approved by a registered professional engineer.
- Provide trenches greater than 4 feet (1.2 meters) deep with a ladder, stairway, or ramp positioned so that the maximum lateral travel distance is no more than 25 feet (7.6 meters).
- Excavations will not be entered in the following situations:
  - Protective systems are damaged or unstable.
  - Objects or structures above the work location may become unstable and fall into the excavation.
  - The potential for a hazardous atmosphere exists, unless the air has been tested and found to be at safe levels.
  - Accumulated water exists in the excavation, unless precautions have been taken to prevent excavation cave-in.

9.5 HAND AND POWER TOOLS

The following hazard controls and safe work practices apply when personnel or subcontractors are using hand and power tools:

- Inspect tools before use and tag and remove damaged tools from service.
- Use hand tools only for their intended use and operate in accordance with manufacturer's instructions and design limitations.
- Maintain all hand and power tools in a safe condition.
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool.
- Do not carry or lower a power tool by its cord or hose.
- Plug all portable power tools into GFCI-protected outlets.
- Ensure all portable power tools are UL-listed and have a three-wire grounded plug or are double insulated.
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters).
- Ensure safety guards on tools are installed while the tool is in use and are promptly replaced after repair or maintenance has been performed.
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials.
- If a cordless tool is connected to its recharge unit, ensure both pieces of equipment conform strictly with electrical standards and manufacturer's specifications.
- When working in an explosive environment, use only tools rated for work in that environment (that is, intrinsically safe and sparkproof).
- Working with manual and pistol-grip hand tools may involve highly repetitive movement, extended elevation, constrained postures, awkward positioning of body members (for example, hand, wrist, arm, shoulder, or neck), or a combination thereof. Consider alternative tool designs, improved posture, the selection of appropriate materials, changing work organization, and sequencing to prevent muscular, skeletal, repetitive motion, and cumulative trauma stressors.

9.5.1 Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points, or any other sources of mechanical injury.
- Unplug jammed equipment only when equipment has been shut down, all sources of energy have been isolated, and equipment has been locked/tagged and tested.

- When performing maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk, lockout that equipment before work.

9.6 PORTABLE GENERATOR HAZARDS

Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire; the following hazard controls and safe work practices apply:

- Never use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of CO very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can't smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air right away. Do not delay. The CO from generators can rapidly lead to full incapacitation and death.
- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Ensure the generator is grounded in accordance with the manufacturer's operation manual.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator or use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with GFCIs. Test the GFCIs daily to determine whether they are working
- If the generator is not equipped with GFCI-protected circuits plug a portable GFCI into the generator and plug appliances, tools and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

9.7 SLIPS, TRIPS AND FALLS

The following hazard controls and safe work practices should be applied to avoid slips, trips, and falls.

9.7.1 General

- Institute and maintain good housekeeping practices.
- Designate foot traffic paths in and out of sites, when necessary, to ensure paths are kept free from slip, trip, and fall hazards or to deter personnel from taking shortcuts where slip and trip hazards may exist.
- Mitigate icy conditions by keeping foot traffic paths clear of ice and snow.
- Watch your footing while walking to avoid trip hazards, animal holes, or other obstacles, especially in tall grassy areas.

9.7.2 Muddy Conditions

- Muddy conditions present a slipping hazard. Use mats or other similar surface to work from if footing cannot be stabilized.
- Take shortened steps across muddy areas.
- Use a walking staff or other similar means to assist with balance.

9.7.3 Steep Slopes, Uneven Ground, and Rock and Vertical Slopes

- Be aware that escarpments can slough. Avoid these areas.
- Exercise caution in relying on rocks and trees or tree stumps to support yourself; these are often loose.
- Whenever possible, switchback your way up or down steep areas, and maintain a slow pace with firm footing.
- Employees walking in ditches, swales and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls, which can result in twisted or sprained ankles, knees, and backs.
- Whenever possible, observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed.
- If steep terrain must be negotiated, coordinate with HSM to evaluate the need for ladders or ropes to provide stability.

9.8 UTILITIES (UNDERGROUND)

An assessment for underground utilities must be conducted where there is a potential to contact underground utilities or similar subsurface obstructions during intrusive activities. Intrusive activities include excavation, trenching, drilling, hand augering, soil sampling, or similar activities.

The assessment must be conducted before any intrusive subsurface activity and must include at least the following elements:

- A background and records assessment of known utilities or other subsurface obstructions
- Contacting and using the designated local utility locating service
- Conducting an independent field survey to identify, locate, and mark potential underground utilities or subsurface obstructions (*Note: This is independent of, and in addition to, any utility survey conducted by the designated local utility locating service.)*
- A visual survey of the area to validate the chosen location

When any of these steps identifies an underground utility within 5 feet (1.5 meters) of intrusive work, nonaggressive means must be used to physically locate the utility before a drill rig, backhoe, excavator or other aggressive method is used. Aggressive methods are never allowed within 2 feet of an identified high-risk utility.

Any deviation from these requirements must be approved by the HSM and the PM.

9.8.1 Background and Records Assessment of Known Utilities

Identify any client- or location-specific permit or procedural requirements (for example, dig permit or intrusive work permit) for subsurface activities. For military installations, contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Obtain available utility diagrams, as-built drawings, or both for the facility.

Review locations of possible subsurface utilities, including sanitary and storm sewers, electrical lines, water supply lines, natural gas lines, fuel tanks and lines, communication lines, and

lighting protection systems. Use caution in relying on as-built drawings as they are rarely 100 percent accurate.

Request that a facility contact with knowledge of utility locations review and approve proposed locations of intrusive work.

9.8.2 Designated Local Utility Locating Service

Contact your designated local utility locating service (for example, Dig-Safe, Blue Stake, or One Call) to identify and mark the location of utilities. Call 811 in the U.S. or go to www.call811.com to identify the appropriate local service group. Contacting the local utility locating service is a legal requirement in most jurisdictions.

9.8.3 Independent Field Survey (Utility Locate)

The organization conducting the intrusive work should arrange for an independent field survey to identify, locate, and mark any potential subsurface utilities in the work area. This survey is in addition to any utility survey conducted by the designated local utility-locating service.

The independent field survey provider will determine the most appropriate instrumentation and technique or combinations thereof to identify subsurface utilities based on their experience and expertise, types of utilities anticipated to be present, and specific site conditions.

A subcontractor representative must be present during the independent field survey to observe the utility locate and verify that the work area and utilities have been properly identified and marked. If there is any question that the survey was not performed adequately or the individual was not qualified, then arrangements must be made to obtain a qualified utility locate service to re-survey the area. Obtain documentation of the survey and clearances in writing and signed by the party conducting the clearance. Maintain all documentation in the project file.

If the site owner (military installation or client) can provide the independent field survey, the project team shall ensure that the survey includes:

- Physically walking the area to verify the work location and identify, locate, and mark underground utility locations.
- Having qualified staff available and instrumentation to conduct the locate.
- Agreeing to document the survey and clearances in writing.

Should any of the above criteria not be met, the project must arrange for an alternate independent utility locate service to perform the survey.

The markings from utility surveys must be protected and preserved until the markings are no longer required. If the utility location markings are destroyed or removed before intrusive work commences or is completed, the PM, SSHO, or designee must notify the independent utility locate service or the designated local utility locating service to resurvey and remark the area.

9.8.4 Visual Assessment before and during Intrusive Activities

Perform a 360-degree assessment. Walk the area and inspect for utility-related items such as valve caps, previous linear cuts, patchwork in pavement, hydrants, manholes, utility vaults, drains, and vent risers in and around the dig area.

Include all surface landmarks, including manholes, previous liner cuts, patchwork in pavement, pad-mounted transformers, utility poles with risers, storm sewer drains, utility vaults, and fire hydrants.

If any unanticipated items are found, conduct further research before initiating intrusive activities and implement any actions needed to avoid striking the utility or obstruction.

9.8.5 Subsurface Activities within 5 feet of an Underground Utility or if there is Uncertainty

When aggressive intrusive activities will be conducted within 5 feet (1.5 meters) of an underground utility or when there is uncertainty about utility locations, physically verify

locations by nonaggressive means such as air or water knifing, hand digging, or human powered hand-augering. Nonconductive tools must be used if electrical hazards may be present. If intrusive activities are within 5 feet (1.5 meters) of and parallel to a marked existing utility, the utility location must be exposed and verified by nonaggressive methods every 100 feet (30.5 meters). Check to see if the utility can be isolated during intrusive work.

9.8.5.1 Intrusive Activities within 2 feet of an Underground Utility

Use nonaggressive methods (for example, hand digging or vacuum excavation) to perform intrusive activities within 2 feet of a high-risk utility (that is, a utility that cannot be de-energized or would cause significant impacts to repair or replace). Hazardous utilities will be de-energized whenever possible.

9.8.6 Spotter

Use a spotter to monitor for signs of utilities during advancement of intrusive work (for example, sudden change in advancement of auger or split spoon, presence of pea gravel or sand in soils, presence of concrete or other debris in soils, or refusal of auger or excavating equipment). If any suspicious conditions are encountered, stop work immediately and contact the PM or HSM to evaluate the situation. The spotter must have a method to alert an operator to stop the intrusive activity (for example, air horn or hand signals).

9.9 UTILITIES (OVERHEAD)

9.9.1.1.1 Proximity to Power Lines

- No work is to be conducted within 50 feet (15.2 meters) of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet (15.2 meters) of overhead power lines without first making this determination.

9.9.1.1.2 Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:

- Power has been shut off, positive means (such as lockout) have been taken to prevent lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.

- The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum clearances shown in the table.

MINIMUM DISTANCES FROM POWERLINES

Powerlines Nominal System Kv	Minimum Required Distance, Feet (Meters)
0-50	10
51-200	15
201-350	20
351-500	25
501-750	35
751-1000	45
Over 1000	Established by utility owner/operator or by a professional engineer in electrical power transmission/distribution

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

- The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the PM prior to the start of work.

10.0 PHYSICAL HAZARDS AND CONTROLS

Physical hazards include exposure to temperature extremes, sun, noise, and radiation. If you encounter a physical hazard that has not been identified in this plan, contact the HSM so that a revision to this plan can be made.

10.1 CONTINGENCY PLAN FOR SEVERE WEATHER

10.1.1 Inclement Weather

- Work may proceed in light rain; if so, wear rain gear. However, no roof work can proceed during any storm event.
- Take care, as exposure to slips, trips, and falls is increased during rainy conditions.
- Cease work and take cover in a sheltered location during adverse weather conditions (that is, high winds or heavy rain) or in the event of lightning or tornado warnings.
- Identify “Take Shelter” areas before starting the project.
- Notify the PM and client representative after shelter has been sought.

Adverse weather conditions requiring immediate suspension of fieldwork activities are defined as the following:

- Thunder or lightning. Thunderstorm watches or warning, as the situation warrants, will be used as an alert to potential electrical activity. Typically, a 30-minute stand-down occurs to allow the storm cell to pass the area. If lightning or thunder is observed within the stand down period, the 30-minute timeframe is extended until electrical activity ceases. (Note that if you are inadvertently caught outside in a thunder or lightning storm, move away from all metal structures.)
- Sustained wind gusts of 25 mph for boating activities.
- Sustained wind speeds of 25 mph or wind gusts of 35 mph for high-profile work where wind chill is not a factor (that is, where the temperature is greater than 60 degrees Fahrenheit [°F]).
- Sustained wind speeds of 40 mph or wind gusts of 45 mph for non-high-profile work.
- Moderate rain or snow fall of 0.11 to 0.3 inch per hour during hoisting activities. Freezing rain is also cause for suspending hoist use.
- An equivalent wind chill factor of minus 24°F on the wind chill factor chart (see Section 10.4.2); this will trigger systematic shut down of all non-emergency work activities.

- A tornado or hurricane warning for the general area or county; will suffice in requiring a general work stoppage.

10.2 NOISE

All project personnel will have employee exposure to occupational noise levels be controlled to 85 decibels (dBA), A-weighted, and below by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95. A noise assessment may be conducted by the HSM or designee based on potential to emit noise above 85 dBA and also considering the frequency and duration of the task.

- Areas or equipment emitting noise at or above 90 dBA will be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- Hearing protection must be worn in areas or with equipment emitting noise levels at or above 85 dBA.
- Employees exposed to 85 dBA or a noise dose of 50 percent must participate in the hearing conservation program, including initial and annual (as required) audiograms.
- The HSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift in their hearing.
- Employees who are exposed at or above the action level of 85 dBA are required to complete Employer provided training.
- Hearing protection will be maintained in a clean and reliable condition, inspected before use and after any occurrence to identify any deterioration or damage. Damaged or deteriorated hearing protection will be repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing-protection-required areas as long as that specific task is taking place.
- High-noise areas requiring hearing protection should be posted or employees informed of the requirements in an equivalent manner, and a copy of the OSHA standard 29 CFR 1910.95 will be posted in the workplace.

10.3 ULTRAVIOLET RADIATION (SUN EXPOSURE)

Health effects regarding ultraviolet (UV) radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn),

photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer. The controls in the following sections should be implemented to avoid sunburn.

10.3.1 Limit Exposure Time

- Rotate staff so the same personnel are not exposed all of the time.
- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).
- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

10.3.2 Provide Shade

- Take lunch and breaks in shaded areas.
- Create shade or shelter through the use of umbrellas, tents, and canopies.
- Use fabrics such as canvas, sailcloth, awning material and synthetic shade cloth, which create good UV radiation protection.
- Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.

10.3.3 Clothing

- Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.
- Wear head protection to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or Foreign-Legion-style caps offer added protection.
- Wear UV-protective sunglasses or safety glasses. These should fit closely to the face. Wrap-around style glasses provide the best protection.

10.3.4 Sunscreen

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Reapply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.

- Choose a sunscreen with a high sun protection factor. Most dermatologists advocate sun protection factor 30 or higher for significant sun exposure.
- Select waterproof sunscreens for use in or near water, and by those who perspire sufficiently to wash off nonwaterproof products.
- Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- Remember, no sunscreen provides 100-percent protection against UV radiation. Other precautions must be taken to avoid overexposure.

10.4 TEMPERATURE EXTREMES

Each employee is responsible for the following:

- Recognizing the symptoms of heat or cold stress.
- Taking appropriate precautionary measures to minimize their risk of exposure to temperature extremes.
- Communicating any concerns regarding heat and cold stress to their supervisor or SSHO.

10.4.1 Heat

Heat-related illnesses are caused by more than just temperature and humidity factors, as follows:

- **Physical fitness** influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retrained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.
- **Acclimatization** is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress (see Table 10-1). Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. With a recent history of heat-stress exposures of at least 2 continuous hours per day for 5 of the last 7 days to 10 of the last 14 days, a worker can be considered acclimatized. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days and may be completely lost in 3 to 4 weeks. Because acclimatization is to the level of the heat-stress exposure, a person will not be fully acclimatized to a sudden higher level, such as during a heat wave.
- **Dehydration** reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.
- The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production

depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

- When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

Table 10-1
Symptoms and Treatment of Heat Stress

	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low.	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature of 104°F or higher.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool–but not cold–water. Call ambulance, and get medical attention immediately!

10.4.2 Precautions

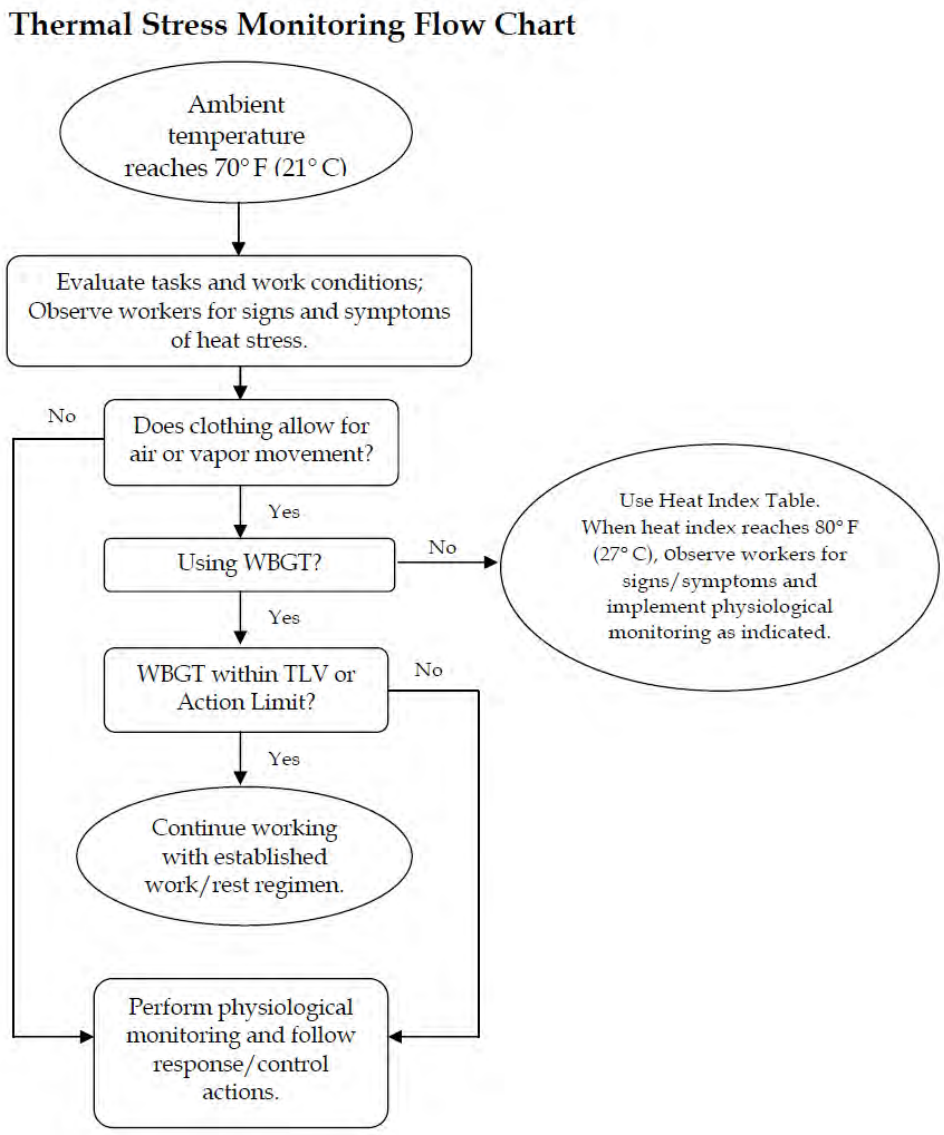
- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F (10 degrees Celsius [°C]) to 60°F (15.6°C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Remind employees to drink water throughout their work shift.
- Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate to site work conditions by slowly increasing workloads (for example, do not begin site work with extremely demanding activities). Closely monitor employees during their first 14 days of work in the field.

- Supervisors and SSHOs must continually observe employees throughout the work shift for signs and symptoms of heat stress or illness. Employees must monitor themselves for heat stress as well as observe their coworkers.
- Maintain effective communication with employees throughout the work shift either by voice, observation, or electronic device.
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shade to protect personnel against radiant heat (sun, flames, hot metal).
- Use portable fans for convection cooling or in extreme heat conditions, an air-conditioned rest area when needed.
- In hot weather, rotate shifts of workers.
- Maintain good hygiene standards by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should consult medical personnel.
- Brief employees initially before the project work begins and routinely as part of the daily safety briefing, on the signs and symptoms, of heat-relatedness illnesses, precautions to measures and emergency procedures to follow as described in this plan.
- Observe one another for signs of heat stress (see Table 10-1). Prevention and communication are key.

10.4.3 Thermal Stress Monitoring

Figure 10-1 provides an overview of the process for assessing risks to workers from thermal stress.

Figure 10-1: Thermal Stress Monitoring Flow Chart



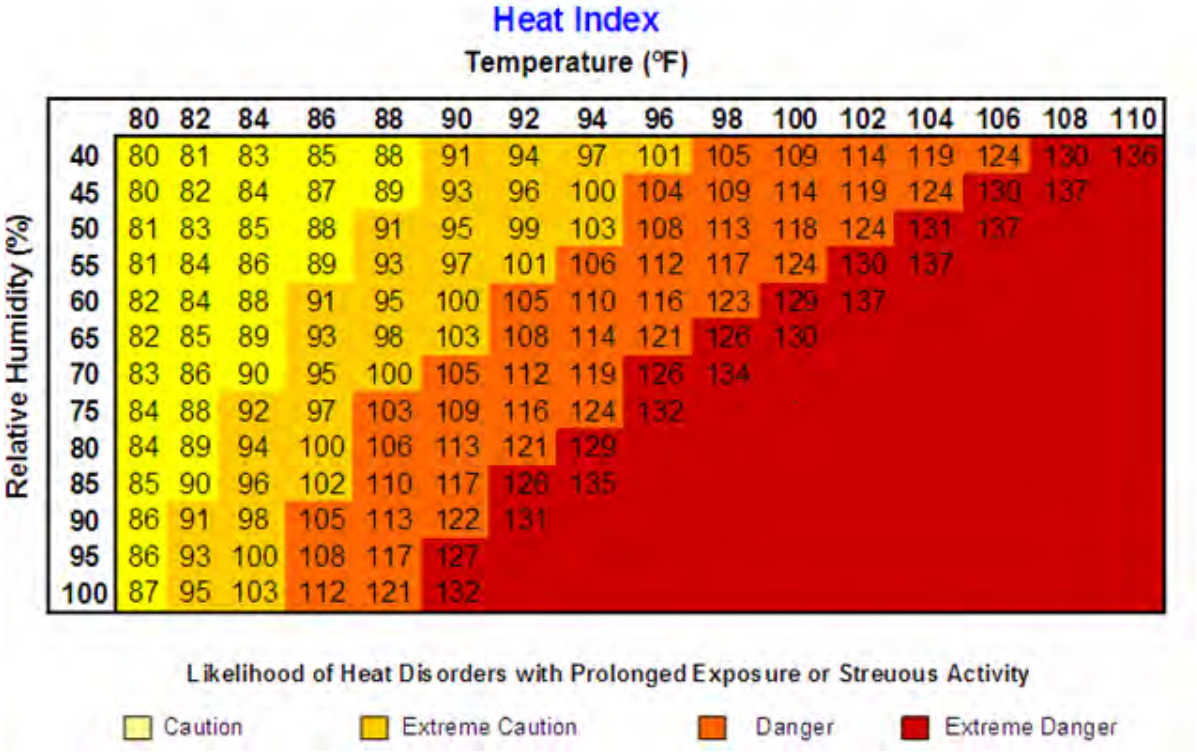
10.4.4 Thermal Stress Monitoring—Permeable or Impermeable Clothing

When **permeable work clothes** are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement physiological monitoring as indicated below. This should start when the heat index reaches 80°F (27°C) [see Table 10-2], or sooner if workers exhibit symptoms of heat stress indicated in the table above. The heat index values were devised for shady, light wind conditions; exposure

to full sunshine can increase the values by up to 15°F (8°C). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

When wearing **impermeable clothing** (for example, clothing that doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described in Table 10-2 should be conducted when the ambient temperature reaches 70°F (21°C) or sooner (for example, when climatic conditions may present greater risk of heat stress combined with wearing unique variations of impermeable clothing, or workers exhibit symptoms of heat stress).

Table 10-2
Heat Index Requirements



Heat Index	Possible Heat Disorders	Minimum Frequency of Physiological Monitoring
80°F - 90°F (27°C - 32°C)	Fatigue possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline and observe workers for signs of heat stress and implement physiological monitoring if warranted.
90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline, then at least every hour, or sooner, if signs of heat stress are observed.
105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.	Conduct initial monitoring as baseline, then every 30 minutes or sooner if signs of heat stress are observed.
130°F or Higher (54°C or Higher)	Heat/Sunstroke highly likely with continued exposure.	Conduct initial monitoring as baseline, then every 15 minutes or sooner if signs of heat stress are observed.

Source: National Weather Service

10.4.4.1 Physiological Monitoring and Associated Actions

For employees wearing permeable clothing, follow the minimum frequency of physiological monitoring listed in Table 10-2.

For employees wearing impermeable clothing, begin physiological monitoring initially at 15-minute intervals; then, if the employee's heart rate or body temperature is within acceptable limits, conduct the subsequent physiological monitoring at 30 minutes, and follow the established regimen protocol below.

The following physiological monitoring protocol, using either radial pulse or aural temperature, should occur when the heat index is 80°F or greater (or when personnel exhibit signs of heat stress):

- The sustained heart rate during the work cycle should remain below 180 beats per minute (bpm) minus the individual's age (for example, 180 – 35-year-old person = 145 bpm). The sustained heart rate can be estimated by measuring the heart rate at the radial pulse for 30 seconds as quickly as possible prior to starting the rest period.
- The heart rate after a 1-minute rest period should not exceed 120 bpm.
- If the heart rate is higher than 120 bpm after the FIRST minute into the rest period, the next work period should be shortened by 33 percent, while the length of the rest period stays the same.
- If the pulse rate still exceeds 120 bpm at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.
- Continue this procedure until the rate is maintained below 120 bpm after the FIRST minute into the rest period.
- Alternately, the body temperature can be measured, either orally or aurally (by ear), before the workers have something to drink.
- If the oral or aural temperature exceeds 99.6°F (37.6°C) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral or aural temperature is maintained below 99.6°F (37.6°C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field. However, a digital aural thermometer is easy to obtain and inexpensive to purchase.

10.4.4.2 Procedures for when Heat Illness Symptoms are Experienced

- **Always** contact the HSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.
- In the case of all other heat-related symptoms (for example, fainting, heat rash, or heat exhaustion) workers should contact their respective safety office or physician. If the worker is a Jacobs worker, contact your immediate supervisor and the occupational physician at 1-888-449-7787.
- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, and follow precautions under the emergency medical treatment of this SSHP.
- Follow the protocol in Section 22, Incident Notification, Reporting, and Investigation.

10.4.5 Cold

10.4.5.1 General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, heat loss is also caused by conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. The body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration-soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing the insulating layer of air increases heat loss by convection.

Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. They reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface-area-to-volume ratios. These substances may also aggravate an already hypothermic condition.

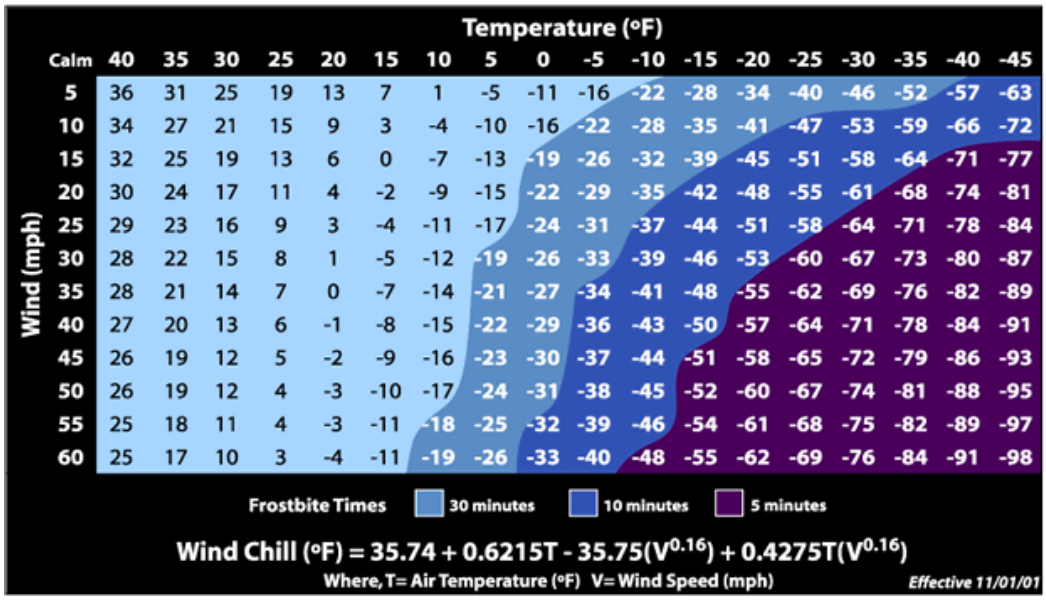
10.4.5.2 Precautions

- Be aware of the symptoms of cold-related disorders (Table 10-3), and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council.
- The wind-chill index (Figure 10-2) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- Persons who experience initial signs of immersion foot, frostbite, or hypothermia should report it immediately to their supervisor or the PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast; be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

Table 10-3
Symptoms and Treatment of Cold Stress

	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm—but not hot—water. Have victim drink warm fluids, but not coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.

Figure 10-2: NOAA Wind-chill Chart



Source: www.nws.noaa.gov/om/winter/windchill-images/windchillchart3.pdf

10.5 RADIOLOGICAL HAZARDS

None expected at this time.

(intentionally blank)

11.0 BIOLOGICAL HAZARDS AND CONTROLS

Biological hazards are everywhere and change with the region and season. During project planning stages, ask the site point of contact if there are insect or other biological hazards that have been noted at any of the work sites.

If you encounter a biological hazard that has not been identified in this plan, contact the HSM so that a revision to this plan can be made. Whether it is contact with a poisonous plant, a poisonous snake, or a bug bite, do not take bites or stings lightly. If there is a chance of an allergic reaction or infection, or to seek medical advice on how to properly care for the injury, contact the occupational nurse at 1-888-449-7787.

11.1 BEES AND OTHER STINGING INSECTS

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic.

The following precautions should be taken to avoid being stung:

- Watch for and avoid nests.
- Keep exposed skin to a minimum.
- Carry a kit if you have had allergic reactions in the past, and inform your supervisor, a buddy, or both. When working at a remote location, ensure that first-aid kits contain over-the-counter allergy and itch medication (for example, Benadryl or Claritin), as well as other over-the-counter medications that may not be available to aid in symptom treatment.
- If bees or other stinging insects are known to be present, determine whether additional protective clothing should be donned before entering or working in brushy areas.
- Before entering a heavily vegetated or brushy area, observe the area for several minutes to see if bees or other stinging insects may be present. If nests or individual insects are observed, retreat and inquire whether a specialist or a client service can be contacted to clear the area before work proceeds.
- Consider if heavy-weight clothing, Tyvek, or head netting would provide additional protection in areas where wasps or bees are known or suspected. Be aware of heat stress conditions that additional clothing may cause.
- Use insect repellent on clothing. Wear light-colored clothing and remove bright reflective safety-colored clothing if not working near a roadway as these may attract the wasps.

- Wear fragrance-free or lightly-scented sunscreen, and body lotions. Bees are attracted to sweet scents. Avoid using floral scented soaps, shampoos, or conditioners.
- Move slowly and calmly through vegetated areas and try to avoid major disturbance of vegetation as wasps/bees often react to aggressive movement.
- If you encounter a wasp, back away slowly and calmly, do not run or swat at the insect. Wait for it to leave, or gently move or brush it off gently with a piece of paper or other light object. Do not use your hand.

If you are stung and a stinger is present, remove it as soon as possible using something with a thin, hard edge (for example, credit card) to scrape the stinger out. Be sure to sanitize the object first with hand sanitizer, alcohol, or soap and water. Wash and disinfect the wound, cover it, and apply ice. Watch for an allergic reaction if you have never been stung before. Call 911 if the reaction is severe.

11.2 BIRD DROPPINGS

Large amounts of bird droppings may present a disease risk. The best way to prevent exposure to fungus spores in bird droppings is to avoid disturbing it. A brief inhalation exposure to highly contaminated dust may be all that is needed to cause infection and subsequent development of fungal disease.

If disturbing the droppings or if removal is necessary to perform work, follow these controls:

- Use dust control measures (wetting with water or high-efficiency particulate air vacuuming) for all activities that may generate dust from the accumulated droppings.
- Wear Tyvek with hoods, disposable gloves and booties, and air-purifying respirators with a minimum N95 rating.
- Put droppings into plastic or polyurethane bags, and preferably into a 55-gallon drum to prevent bag from ripping.

11.3 MOSQUITO BITES

Because of the recent detection of the West Nile Virus in the southwestern United States, it is recommended that preventative measures be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines

should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent:

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors
- Spray clothing with repellents containing permethrin or N,N-diethyl-meta-toluamide (DEET) because mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35 percent DEET. Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

11.4 NO-SEE-UMS

While these insects usually annoy livestock, they will sometimes bite a human. Similar to mosquitoes, it is the females that seek protein-rich blood to lay eggs.

Although no-see-ums are significantly smaller than mosquitoes, their bites are significantly more painful, and they can bite through light clothing as well as fly through screens. However, their bites have little, if any, side effect, and the greatest irritation may be caused by their loud buzz of attack. Tightly woven outer garments that do not directly contact the body help prevent biting, as do common bug repellents. The type of head nets commonly used by fisherman can help put a barrier between your face and head and the no-see-ums.

11.5 BEARS

The following hazard controls and safe work practices are recommended when working where bears might be present:

- Inspect the area for signs of bear activity; tracks, scat, ground disturbances, etc.
- Wear high visibility clothing.
- Carry protect equipment (bear spray and/or air horn) where it can be easily accessed in the event of an encounter but cannot accidently discharged.
- Avoid working in thick brush/grass where visibility is limited.
- Look around frequently to assess your surroundings.

In the event of a bear encounter:

- Maintain a safe distance and avoid startling the bear.
- Be prepared to deploy bear spray or air horn.
- Do not run, instead back away slowly, facing the bear.
- If charged, deploy air horn immediately, shout, and wave arms (do not run). If using bear spray wait until the bear is close enough for the bear spray to be effective (generally 30 feet).
- Leave the area until it is safe to return.

12.0 CONTAMINANTS OF CONCERN

Table 12-1 summarizes the potential COCs and their occupational exposure limit and signs and symptoms of exposure. The table also includes the maximum concentration of each COC and the associated location and media that was sampled (groundwater, soil boring, surface soil). The concentrations were used to determine engineering and administrative controls described in Section 9, Project-Specific Hazard Controls, as well as PPE and site monitoring requirements.

Table 12-1
Contaminants of Concern

Contaminant	Location and Maximum[a] Concentration	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Polychlorinated biphenyl (PCBs)	Potential	0.5 mg/m^3	5 Ca	Eye and skin irritation, acne-form dermatitis, liver damage, reproductive effects	UK

Notes:
[a]Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water).
[b]Appropriate value of permissible exposure limit (PEL), recommended exposure limit (REL), or threshold limit value (TLV) listed.
[c]IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.
[d]PIP = photoionization potential; NA = Not applicable; UK = Unknown.
$\mu g/m^3$ = micrograms per cubic meter
eV = electron volt
mg/kg = milligrams per kilogram
mg/m^3 = milligrams per cubic meter
ppm = parts per million
Potential Routes of Exposure
Dermal: Contact with contaminated media. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of PPE.
Inhalation: Vapors and contaminated particulates. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of respiratory protection when other forms of control do not reduce the potential for exposure.
Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (for example, wash hands and face before drinking or smoking).

(intentionally blank)

13.0 SITE MONITORING

When performing site monitoring, record all the information (for example, in a field logbook). Note date and time, describe monitoring location (for example, in breathing zone, at source), site location, and what the reading is. If any action levels are reached, note it in the field logbook, and note the action taken.

Exposure records (air sampling) must be preserved for the duration of employment, plus 30 years. Ensure that copies of the field logbook are maintained in the project file. Copies of all project exposure records (for example, copies of field logbook pages where air monitoring readings are recorded and associated calibration) shall be sent to the regional safety program assistant for retention and maintained in the project files.

13.1 DIRECT READING MONITORING SPECIFICATIONS

Table 13-1 presents the required instrument monitoring associated with key project tasks that potentially expose site workers to contaminants.

Table 13-1
Direct Reading Instrument Monitoring Plan

Instrument	Tasks	Action Levels[a]		Frequency [b]	Calibration
PID: MiniRAE or MultiRAE with 10.6 eV lamp	**** Optional tasks** Soil and Sediment sampling IDW management Drilling/DPT Excavation	<5 ppm → Level D ≥5 ppm → Stop work; Notify HSM		Initially and periodically during task	Daily
O_2: MultiRae or equivalent[c]	Drilling/DPT Excavation	20.9% → >23.5% →	Normal O_2 Fire Hazard; notify HSM	Initially and periodically during task	Daily
LEL/ CGI: MultiRae or equivalent[c]	Drilling/DPT Excavation	<10% LEL: → ≥10% LEL: →	No explosion hazard Explosion hazard; evacuate or vent	Initially and periodically during task	Daily
Dust Monitor: Visual Assessment	All intrusive activities	Visual Dust→ Initiate dust control methods (for example apply water or mist immediately)		Initially and periodically during tasks	NA

[a] Action levels apply to **sustained** breathing-zone measurements above background **for more than 5 minutes**.

[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SSHO; generally, every 5 to 15 minutes if acceptable; it may be appropriate to do so more frequently. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place or location where measurement is taken (for example, "Breathing Zone/MW-3," "at surface/SB-2," or similar).

Air monitoring results may be obtained from other onsite parties if the following conditions are met:

- Instruments are calibrated in accordance with manufacturer's specifications. Calibration logs and verifications must be kept by the SSHO.
- Readings must be taken in employee breathing zones (or from an employee who has a higher level of exposure) for the task listed. Results must be recorded as often as is stated in Section 13.1.
- The action levels listed in Table 13-1 must be followed.

14.0 PERSONAL PROTECTIVE EQUIPMENT

(Reference EM 385-1-1 Section 5, Personal Protective and Safety Equipment)

14.1 REQUIRED PERSONAL PROTECTIVE EQUIPMENT

PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control the hazards.

A PPE assessment has been conducted by the HSM based on project tasks (see Table 14-1). Verification and certification of assigned PPE by task is completed by the HSM that approved this plan. The following items apply when using any form of PPE:

- Employees must be trained to properly wear and maintain the PPE.
- Employees must be trained in the limitations of the PPE.
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area.
- Areas requiring PPE should be posted or employees must be informed of the requirements in an equivalent manner.
- PPE must be inspected before use and after any occurrence to identify any deterioration or damage.
- PPE must be maintained in a clean and reliable condition.
- Damaged PPE will not be used and must either be repaired or discarded.
- PPE will not be modified, tampered with, or repaired beyond routine maintenance.

The employer will identify actual or potential hazards and the need for PPE. The following two conditions typically dictate the necessity for PPE: general hazards present in the work area, and hazards created by the tasks being performed. Some work areas have actual or potential hazards that can be present at any time, thereby potentially exposing any personnel working or walking through the area. Such areas should be posted as PPE-required areas, or personnel should be informed of the requirements in an equivalent manner. In addition, the actual task being performed may create a hazard and require personnel who perform this task to wear appropriate PPE. The areas where the tasks are taking place may become PPE-required areas as long as that specific task is taking place. Specific hazardous assessments are conducted through the AHA

process; AHAs become the daily tool for proper hazard assessment and mitigation. Table 14-1 should be used as a general minimum guideline, with the specific task AHA having the final required protocol for PPE. AHAs are a living document and should reflect changing site conditions.

Table 14-1 outlines PPE to be used according to task, based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the HSM so the table can be updated.

Table 14-1
Project-specific Personal Protective Equipment Requirements [a]

Task	Level	Body	Head	Respirator [b]
Utility clearance (as applicable) Post Remedial Action Monitoring and Maintenance Post Storm Event Inspections	Non-HW	Work clothes; safety toed leather work boots and gloves	Hardhat [c] Safety glasses with side shields Ear protection [d]	None required
**** Optional tasks** Soil/Sediment PCB Sampling (with or without heavy equipment) IDW management Drilling/DPT Excavation	Modified D	**Coveralls:** Cotton; or raingear **Boots:** Safety-toed leather or chemical resistant boots **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves. **Other:** Appropriate level of American National Standards Institute/ISEA 107-2010 high-visibility safety vests. **Other:** Waders or knee-high boots if working in the vicinity of surface water, depending on depth of water. **Other:** PFD if entering water above the knees or swift-moving	Work near vehicular traffic ways or earth moving equipment.	
Equipment decontamination if using pressure washer	Modified D with splash protection	**Coveralls:** Polycoated Tyvek® **Boots:** Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Face shield [c] over safety glasses with side shields or splash goggles Ear protection [d]	None required.

Table 14-1 (Continued)
Project-specific Personal Protective Equipment Requirements [a]

Task	Level	Body	Head	Respirator [b]
Not Anticipated. Contact HSM prior to upgrading PPE.	C	**Coveralls:** Polycoated Tyvek® **Boots:** Safety -toe, chemical-resistant boots OR Safety -toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	Air-purifying respirator, full face, MSA Advantage 1000 w/ GME-P100 cartridge[e]. or equivalent

Reasons for Upgrading or Downgrading Level of Protection (with approval of the HSM)	
Upgrade[f]	Downgrade
Request from individual performing tasks. Change in work tasks that will increase contact or potential contact with hazardous materials. Occurrence or likely occurrence of gas or vapor emission. Known or suspected presence of dermal hazards. Instrument action levels in the “Site Monitoring” section exceeded.	New information indicating that situation is less hazardous than originally thought. Change in site conditions that decrease the hazard. Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. Each project team member should have PPE supplied by their employer.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat, protective chaps, and face-shield areas are to be determined by the SSHO, depending on task.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet (1 meter) or less without shouting.
[e] See cartridge change-out schedule.
[f] Performing a task that requires an upgrade to a higher level of protection (for example, Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SSHO qualified at that level is present.

15.0 WORKER TRAINING AND QUALIFICATION

15.1 WORKER TRAINING

The intent of employee training program is to ensure that employees receive the appropriate level of training to conduct their work in a safe manner and to comply with applicable regulations. All employees are required to maintain the training qualification necessary to perform their assigned duties and job functions.

15.1.1 Hazardous Waste Operations Training

Employees engaging in HAZWOPER will receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65. At a minimum, the training will consist of instruction in the topics outlined in 29 CFR 1910.120 and 29 CFR 1926.65. Personnel who have not met these training requirements are not allowed to engage in HAZWOPER activities.

15.1.1.1 Initial Training

General site workers engaged in hazardous waste operations should, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations, unless otherwise noted in the above-referenced standards.

15.1.1.2 Three-day Actual Field Experience

General site workers for hazardous waste operations should receive 3 days of actual experience (on-the-job training) under the direct supervision of a trained, qualified supervisor, and then documented. If the field experience has not already been received and documented at a similar site, the supervised experience shall be accomplished and documented at the beginning of the assignment of the project.

15.1.1.3 Refresher Training

General site workers and treatment, storage, and disposal workers shall receive 8 hours of refresher training annually (within the previous 12-month period) to maintain qualifications for fieldwork. Employees engaged in emergency response operations shall receive annual refresher

training of sufficient content and duration to maintain their competencies or shall demonstrate competency in the areas at least annually.

15.1.1.4 Eight-hour Supervisory Training

Onsite management or supervisors who will be directly responsible for, or supervise employees engaged in hazardous waste site operations, will have received at least 8 hours of additional specialized training in managing such operations. Employees designated as the SSHO are considered 8-hour HAZWOPER Site Safety Supervisor-trained.

15.1.2 First-aid and Cardiopulmonary Resuscitation

First-aid and CPR training consistent with the requirements of a nationally recognized organization such as the American Red Cross Association or National Safety Council will be administered by a certified trainer. A minimum of two personnel per active field operation will have first-aid and CPR training.

15.1.3 Site Safety and Health Officer Training

SSHOs are trained to implement the HSE program on field projects. A qualified SSHO is required to be identified in the SSHP. SSHOs must also meet the requirements of the worker category appropriate to the type of field project (construction or hazardous waste). In addition, the SSHOs shall have completed additional safety training required by the specific work activity on the project that qualifies them to implement the HSE program (for example, fall protection or excavation). Furthermore, the SSHO shall have an understanding of the USACE EM 385-1-1 Safety Manual.

15.1.4 Site-specific Training

Before the start of field activities, all field personnel assigned to the project will have completed site-specific training that will address the contents of applicable health and safety plans, including the activities, procedures, monitoring, and equipment used in the site operations. Site-specific training will also include site and facility layout, potential hazards, risks associated with identified emergency response actions, and available emergency services. The training

allows fieldworkers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and work operations for their particular activity.

15.1.5 Project-Specific Training Requirements

Section 6.2 of the APP provides further information on the level of training and qualifications for specific project roles. Additional project-specific training for this project includes the following:

- AHAs

15.2 SUBCONTRACTOR PERSONNEL QUALIFICATIONS

All subcontractors will provide the HSM with a list certifying the training and qualifications of competent persons and qualified operators for the activities and equipment in the following sections.

15.2.1 Competent Persons and Qualified Operators

- To be determined

15.2.2 Activity and Equipment List

- To be determined

15.3 PROJECT EMPLOYEE ORIENTATION

Employees expecting to access the site are required to have project employee orientation training provided by the SSHO. Employee orientation training will include the following:

- Review the SSHP and APP
- Present an overall site safety briefing (general site safety)
- Review employee responsibilities
- Review AHA policies and procedures
- Review emergency procedures and evacuation plan
- Review injury and incident reporting procedures

- Review reporting procedures for hazardous conditions and/or hazardous activities

15.4 PERSONAL PROTECTIVE EQUIPMENT TRAINING

OSHA requires each PPE user to receive training on the proper care, maintenance, limitations, and instructions on how to wear and adjust PPE. The proper use of PPE will also be included in project safety briefings and toolbox meetings.

15.5 SAFETY MEETINGS AND TOOLBOX MEETINGS

Safety meetings provide a method for maintaining safety awareness and providing safety-related information and training to employees. Safety meetings for project supervisory personnel and project employees shall be held at least daily and include relevant information for on- and off-the-job safety.

15.6 ACTIVITY HAZARD ANALYSIS TRAINING

Each supervisor will review task-specific AHAs with all workers assigned to perform that task before the beginning of that task anywhere on the job site. All workers will sign the AHA document, signifying they have been trained and understand the task steps, hazards, and hazard controls to be used.

15.7 SAFETY PRE-TASK PLANNING AND TRAINING

Each day, the onsite supervisors shall hold informational safety training with each member of their crew. Information discussed and training performed should pertain to current project activities and scope of work. The subcontractor is encouraged to use the time for employee input and task-specific training.

15.8 VENDOR TRAINING

No vendors that supply equipment to the project are anticipated to be onsite other than the indicated subcontractors. If a vendor is present, they will be required to undergo a brief training session to review and explain the safe operation procedures relevant to their presence onsite.

Topics covered will include site hazards, camp operations, personnel hygiene and comfort, emergency communications, and evacuation and medical emergency procedures, at a minimum.

15.9 EMERGENCY RESPONSE PLAN TRAINING

Emergency Response Plan training will occur during the employee orientation, with retraining occurring periodically in safety meetings. The Emergency Response Plan training will include evacuation alarms, site evacuation, designated evacuation assembly areas, and the route to the emergency medical facility. Emergency drills will be performed at least at project start and will thereafter be held at least twice yearly. Section 19 presents the emergency preparedness procedures.

15.10 CONDUCT OF TRAINING

15.10.1 Instructor or Trainer Requirements

All personnel who conduct training will have documented expertise in the areas in which they will be conducting training, and knowledge of any regulatory or other requirements. They will also be listed as a competent person in that area by the employer or contractor.

15.10.2 Initial Training

All employees will have documentation of initial training required to perform their assigned duties with their assigned tools and equipment. If previous documentation or subcontractor certification is not available, then initial training will take place onsite before the employee begins work.

15.10.3 Retraining

Retraining will be required under the following conditions:

- There is a change in operations or equipment capabilities.
- An employee is seen performing an unsafe act, or operating equipment or machinery in an unauthorized manner.

- There is an incident or accident on the job site.
- Anytime the regulatory requirements require refresher training because of a certain time period, such as annually required HAZWOPER training or similar.

15.10.4 Demonstrated Competency

For all training conducted for equipment, machinery, or hazardous activities, the trainer will document in writing that the individual has "demonstrated competency" in the areas required to perform their assigned tasks safely and in compliance with the regulatory and other guidance.

15.11 DOCUMENTATION

All training will be documented. Documentation and certificates verifying completion will be maintained onsite by the employer, and copies of the training documentation will be submitted to the HSM. Training documentation will be made available for review at all times.

16.0 MEDICAL SURVEILLANCE AND QUALIFICATION

All site workers participating in HAZWOPER will maintain an adequate medical surveillance program in accordance with 29 CFR 1910.120 or 29 CFR 1926.65 and other applicable OSHA standards. Documentation of employee medical qualification (for example, physician's written opinion) will be maintained in the project files and made available for inspection.

16.1 HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE

Personnel expected to participate in onsite HAZWOPER tasks must have documented current medical qualification for performing this work, consisting of a qualified physician's written opinion regarding fitness for duty at a hazardous waste site (including any recommended limitations on the employee's assigned work). The physician's written opinion must state whether the employee has any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health from HAZWOPER work or respirator use.

16.2 JOB- OR SITE-SPECIFIC MEDICAL SURVEILLANCE

The nature of hazards for a particular job or work site may require specialized medical surveillance. This could include biological monitoring for specific compounds, or specialized medical examinations for field personnel.

Site-specific medical surveillance is not needed.

16.3 RESPIRATOR USER QUALIFICATION

Personnel required to wear respirators must have a current medical qualification to wear respirators. Medical qualification will consist of a qualified physician's written opinion regarding the employee's ability to safely wear a respirator in accordance with 29 CFR 1910.134.

16.4 HEARING CONSERVATION

Personnel working in hazardous waste operations or operations that fall under 29 CFR 1910.95 and exposed to noise levels in excess of the 85 dBA time-weighted average will be included in a hearing-conservation program that includes annual audiometric testing.

17.0 SITE CONTROL PLAN

17.1 SITE CONTROL PROCEDURES

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas.

The SSHO will implement site control procedures, including the following bulleted items:

- Establish support, contamination reduction, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the buddy system.

17.2 REMEDIATION WORK AREA ZONES

Contaminated areas will be controlled using a three-zone approach, as follows:

- EZ
- Contamination reduction zone (CRZ)
- Support zone (SZ)

Access will be allowed only to personnel with appropriate and verified training and medical qualification. The three-zone approach is not required for construction work performed outside contaminated areas where control of site contamination is not a concern.

Specific work control zones will be established as necessary during task planning. Site work zones should be modified in the field as required, based on such factors as equipment used, air monitoring results, environmental conditions, or alteration of work plans. The following guidelines will be used for establishing and revising these preliminary zone designations.

17.2.1 Support Zone

The SZ is an uncontaminated area (for example, trailer, office, or field vehicle) that will serve as the field support area for most operations. The SZ coordinates field team communications and provides staging for emergency response. Appropriate sanitary facilities and safety and emergency response equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged and decontaminated materials, or personnel with medical emergencies that cannot be decontaminated.

17.2.2 Contamination Reduction Zone

The CRZ is established between the EZ and the SZ, upwind of the contaminated area where possible. The CRZ provides an area for decontamination of personnel, portable handheld equipment and tools, and heavy equipment. In addition, the CRZ serves as access for heavy equipment and emergency support services.

17.2.3 Exclusion Zone

The EZ is used for activities involving exposure to site contaminants, hazardous materials or conditions, or a combination thereof, and must be demarcated to prevent unauthorized entry. More than one EZ may be established if there are different levels of protection to be employed, or if different hazards occur in the same work area. The EZ must be large enough to allow adequate space for the field personnel and equipment needed to complete the activity, as well as necessary emergency equipment.

Demarcation should include some form of physical barrier or signage, which must be placed so that they are visible to personnel approaching or working in the area. Barriers and boundary markers will be removed when no longer needed.

17.2.4 Other Controlled Areas

The following work areas may also need to be controlled because of the presence of an uncontrolled hazard, to warn workers of requirements, or to prevent unauthorized entry:

- General construction work areas
- Open excavations
- High-noise areas
- Vehicle access areas
- Locations of similar activities or limited access
- These areas shall be clearly demarcated with physical barriers (for example, fencing, cones, reinforced caution tape, or rope) as necessary, and posted with appropriate signage.

(intentionally blank)

18.0 DECONTAMINATION

Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the EZ where possible and should consider any adjacent or nearby projects and personnel. The SSHO must establish and monitor the decontamination procedures and their effectiveness; any decontamination procedure found to be ineffective will be modified by the SSHO. The SSHO must ensure that procedures are established for disposing of materials generated on the site.

No eating, drinking, or smoking is permitted in contaminated areas and in the EZ or decontamination zone. The SSHO should establish areas for eating, drinking, and smoking.

18.1 CONTAMINATION PREVENTION

Preventing or avoiding contamination of personnel, tools, and equipment will be considered in planning work activities at all field locations. Good contamination prevention and avoidance practices will assist in preventing worker exposure and result in a more efficient decontamination process. The following procedures and hazard controls apply for contamination prevention and avoidance:

- Do not walk through areas of obvious or known contamination.
- Do not directly handle or touch contaminated materials.
- Make sure there are no cuts or tears in PPE.
- Fasten all closures in suits and cover them with duct tape, if appropriate.
- Take particular care to protect any skin injuries.
- Stay upwind of airborne contamination, where possible.
- Do not eat or drink in contaminated work areas.
- Do not carry food, beverages, tobacco, or flame-producing equipment into contaminated work areas.
- Minimize the number of personnel and amount of equipment in contaminated areas to that necessary for accomplishing the work.
- Choose tools and equipment with nonporous exterior surfaces that can be easily cleaned and decontaminated.

- Cover monitoring and sampling equipment with clear plastic, leaving openings for the sampling ports, as necessary.
- Minimize the amount of tools and equipment necessary in contaminated areas.

18.2 PERSONNEL AND EQUIPMENT DECONTAMINATION

Personnel exiting an EZ must ensure that they are not spreading potential contamination into clean areas or increasing their potential for ingesting or inhaling potential contaminants. Personal decontamination may range from removing outer gloves as exiting the EZ, to proceeding through an outer layer doffing station, including a boot and glove wash and rinse, washing equipment, or similar. Equipment that has come into contact with contaminated media must also be cleaned and decontaminated when it is brought out of the EZ.

18.3 DECONTAMINATION DURING MEDICAL EMERGENCIES

Standard personnel decontamination practices will be followed whenever possible, although these may need to be abbreviated or omitted for emergency life-saving first-aid or medical treatment. Site personnel must then accompany contaminated victims to advise emergency response personnel on potential contamination and the proper decontamination procedures.

Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

18.4 WASTE COLLECTION AND DISPOSAL

All contaminated material generated through the personnel and equipment decontamination processes (for example, contaminated disposable items, gross debris, liquids, and sludges) will be properly containerized, labeled, stored at a secure location, and disposed of in accordance with the project plans.

18.5 DIAGRAM OF PERSONNEL-DECONTAMINATION LINE

Figure 18-1 presents a conceptual illustration of work zones, including the decontamination line. Work zones should be modified by the SSHO to accommodate task-specific requirements.

Figure 18-1: Work Area—Set-up Appropriately Based On Wind Direction

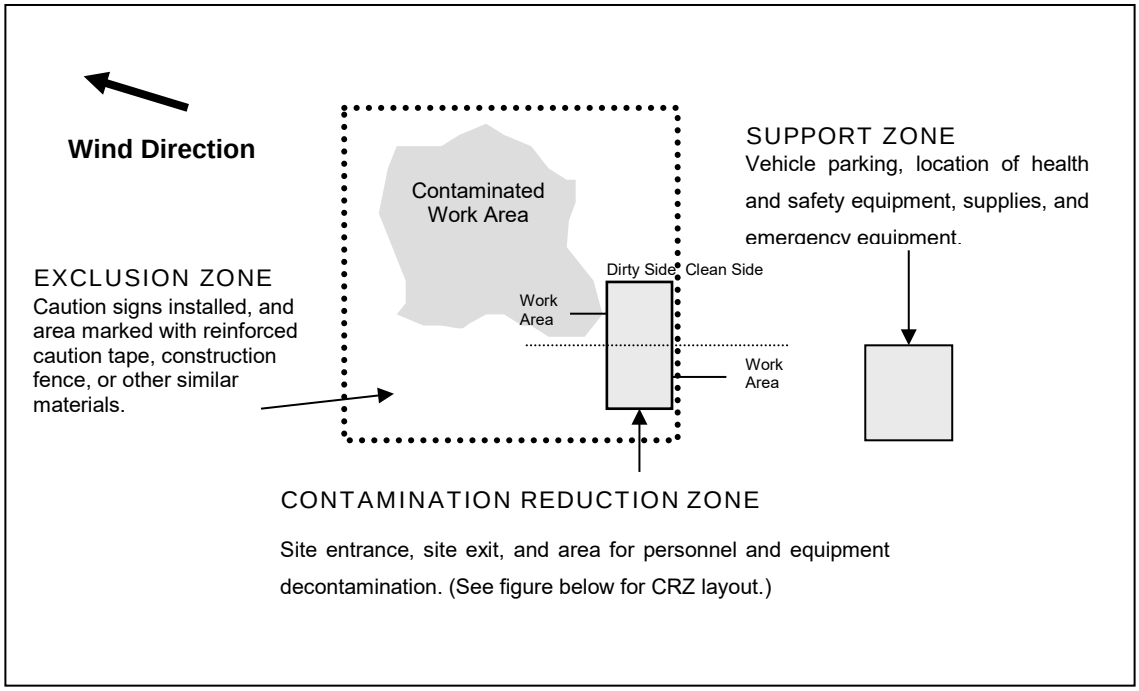
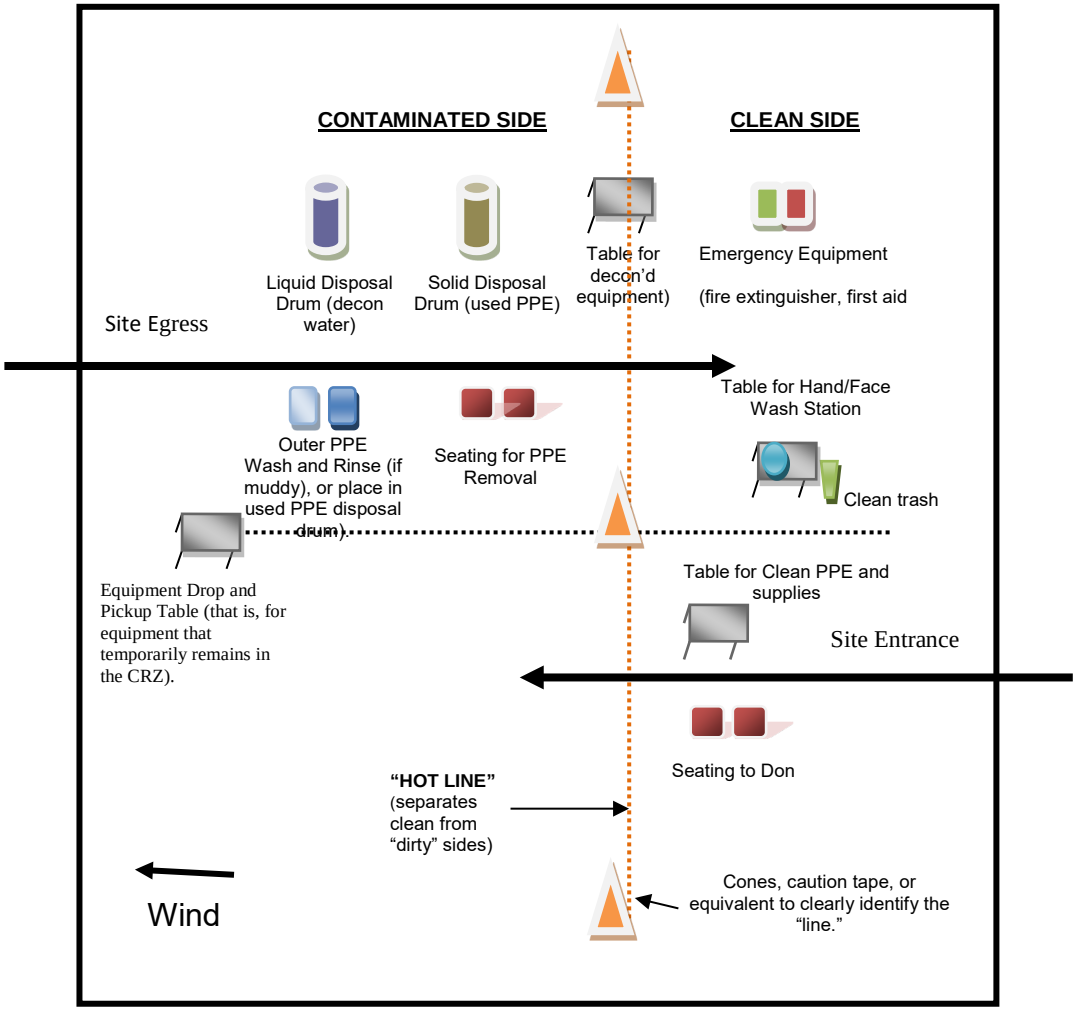


Figure 18-2: Typical Contamination Reduction Zone



19.0 EMERGENCY RESPONSE PLAN

19.1 PRE-EMERGENCY PLANNING

The ERC, typically the SSHO or designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with onsite parties, the facility, and local emergency-service providers as appropriate. Pre-emergency Planning activities performed by the ERC include the following:

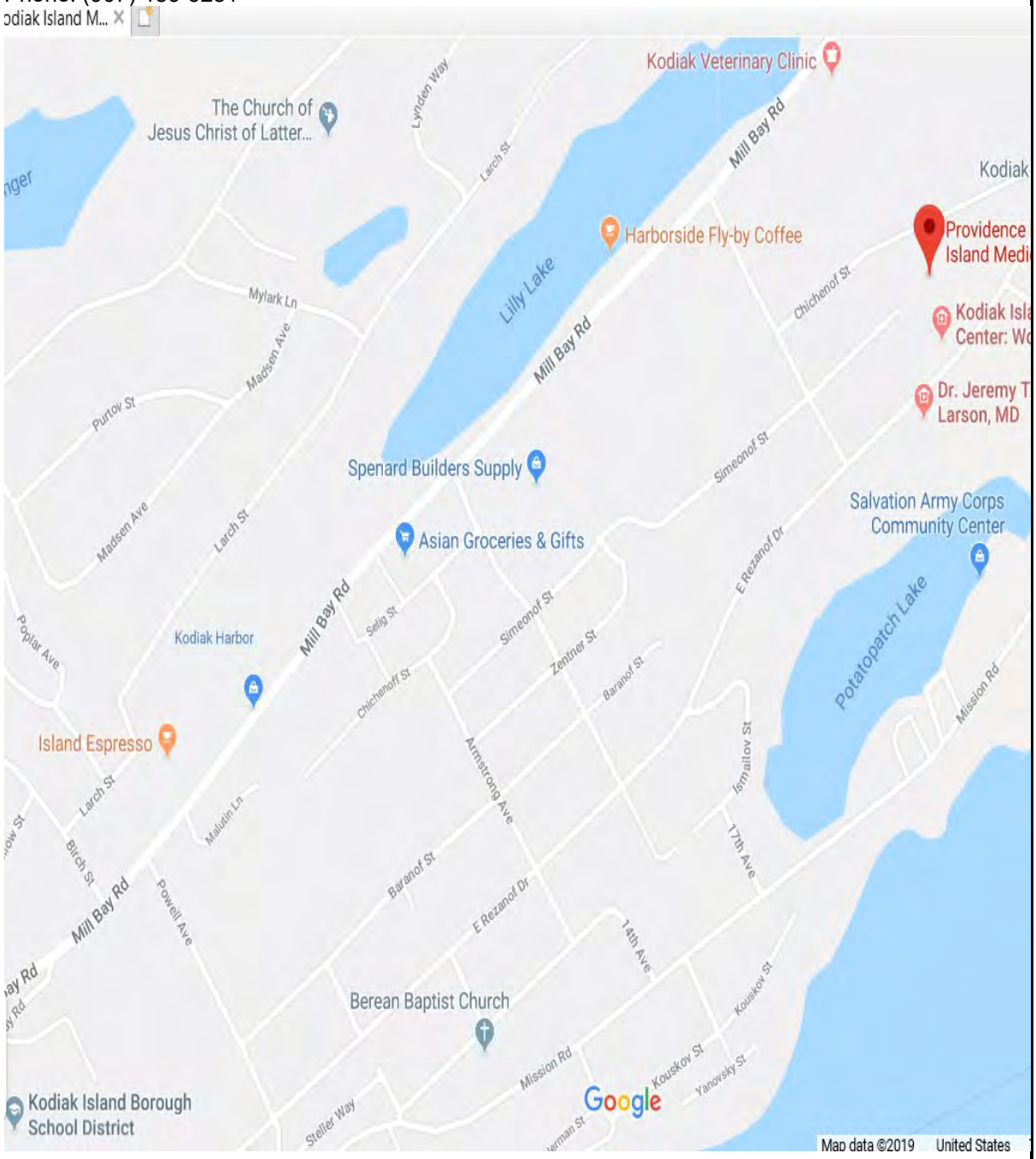
- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (for example, two-way radios or air horns).
- Determine what offsite communication equipment is needed (that is, nearest telephone or cell phone).
- Confirm and post in the project trailer(s) the emergency contacts information and route to the hospital located in Table 19-1 at the end of this section. Keep a copy in field vehicles, along with information on evacuation routes and assembly areas. Communicate the information to onsite personnel and keep it updated.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin. This may include a tabletop exercise or an actual drill, depending on the nature and complexity of the project. Drills should take place periodically, but not less than once a year.
- Brief new workers on the emergency response plan.

The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

Table 19-1
Emergency Contacts

ECC Injury Reporting	
ECC Project Manager Name: Andy Larson Phone: (907) 385-0677	ECC Crisis Coordinator Name: Stanley Seegars Phone: (907) 360-0416
ECC Safety and Health Manager Name: Stanley R. Seegars Phone: (907) 360-0416	ECC Back-up Crisis Coordinator Name: Jessica Bay Phone: (907) 895-1050
24-hour Jacobs Injury Reporting – 1-888-449-7787 **24-hour Jacobs Serious Incident Reporting Contact – Global Assistance and Response HOTLINE # +1-443-221-6281**	
Medical Emergency – Call 911	Jacobs Medical Consultant WorkCare Dr. Peter Greaney, M.D. 300 S. Harbor Blvd, Suite 600, Anaheim, CA 92805 888-449-7787
Fire/Spill Emergency None	Global Environmental Solutions – Health, Safety & Environment Name: Mark Orman/KNV Phone: 414/712-4138
Security & Police Alaska State Trooper Phone: 907-486-4121	Jacobs HSM (for Jacobs controlled tasks) Name: John Culley/SPK Phone: (206) 660-3367
Utilities Emergency Phone Numbers None	Jacobs Human Resources Department Contact Market Sector HR dept.
Jacobs PM Name: Greg Rutkowski Phone: (907) 762-1102	Jacobs Worker's Compensation: Contact HR dept. to have form completed
Jacobs SSHO (for Jacobs controlled tasks ONLY) Name: Jeremiah Knuth Phone: (907) 762-1388	Media Inquiries Corporate Strategic Communications Name: Lorrie Paul Crum/DEN Phone: (303) 525 2916
Federal Express Dangerous Goods Shipping Phone: 800-238-5355	CHEMTEL (hazardous material spills) Phone: 800-255-3924
Facility Alarms: Tsunami Warning Alarm	Evacuation Assembly Area(s): USCG Water Storage Tanks

Facility/Site Evacuation Route(s): From Drury Gulch Access Road, take the road that leads to the USCG Water Storage Tanks.
Coast Guard Emergencies: Kodiak USCG Kodiak Station – 907-487-5015 Kodiak Base – 907-487-5170
Directions to Local Hospital
Providence Kodiak Island Medical Center Address: 1915 E Rezanof Dr, Kodiak, AK 99615 Phone: (907) 486-3281



19.2 EMERGENCY EQUIPMENT AND SUPPLIES

The ERC will ensure the emergency equipment listed in Table 19-2 is onsite. Verify and update the locations of this equipment as needed. The equipment will be inspected in accordance with manufacturer's recommendations. The inspection will be documented in a field logbook or similar means to be kept in the project files.

Table 19-2
Emergency Equipment and Supplies

Emergency Equipment and Supplies	Location
20 (or two 10) class A,B,C fire extinguisher	Field Vehicle/Heavy Equipment
First-aid kit	Field Vehicle
Potable water	Field Vehicle
Bloodborne-pathogen kit	Field Vehicle
Additional equipment (specify): Cellular phones	Field Vehicle/On SSHO

19.3 INCIDENT RESPONSE

The following actions should be taken in case of fire, explosion, or chemical release:

- Notify appropriate response personnel.
- Shut down operations and evacuate the immediate work area.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in Follow the incident reporting procedures in Section 22, Incident Notification, Reporting, and Investigation.

19.4 EMERGENCY MEDICAL TREATMENT

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing or heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify Medevac or other appropriate emergency response authorities as listed in Table 19-1, Emergency Contacts.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first-aid or medical treatment takes priority.
- Initiate first-aid and CPR where feasible.
- Notify supervisor and, if the injured person is a Jacobs employee, the supervisor will call the occupational nurse at 1-888-449-7787.
- Make certain that the injured person is accompanied to the emergency room.
- Notify and submit reports to client as required in contract.

19.5 EVACUATION

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) should be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a buddy will remain onsite after the site has been evacuated (if safe), to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in Section 22, Incident Notification, Reporting and Investigation.

19.6 EVACUATION SIGNALS

All field personnel should be familiar with the signals in Table 19-2, and use them in case of emergency.

Table 19-3
Emergency Signals

Signal	Meaning
Grasping throat with hand	Emergency—help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

19.7 FIREFIGHTING PLAN

(References: Section 01.E.01 & 06.A.02, EM 385-1-1)

The decision on whether or not to try to extinguish a fire using available site personnel and equipment will be made by the SSHO, and is based on whether the fire is small or large, and involves explosives or flammable liquids or gases.

19.7.1.1 Location of Fire Extinguishers

Fire extinguishers will be located around the project sites, as required, in the following places (at a minimum):

- In each vehicle
- Near areas where flammable materials are stored or in use

All fire extinguishers will be kept clearly visible, marked, and placed where they are easily accessible.

19.8 INCLEMENT WEATHER

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area.
- Thinking of trees as cover is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers.
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding.
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The

idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands.

- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. Follow the 30-30 lightning safety recommendation: Seek refuge when thunder sounds less than 30 seconds after a lightning flash, and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

(intentionally blank)

20.0 SPILL CONTAINMENT PROCEDURES

ECC, Jacobs, and subcontractor personnel working at the project site must be aware of the HSE concerns associated with petroleum and other substances that could potentially be released at the project site.

ECC, Jacobs, or subcontractor plans must address response actions in the event of a spill or release. In the event of a large quantity spill, notify emergency services. If safe to do so, personnel discovering a spill should take the following actions:

- Stop or contain the spill immediately (if possible) or note the source. Shut off the source (for example, pump or treatment system), if possible. If unsafe conditions exist, leave the area, call emergency services, inform nearby personnel, notify the site supervisors, and initiate incident reporting process. Notify the SSHO immediately.
- Extinguish sources of ignition (for example, flames, sparks, hot surfaces, or cigarettes).
- Clear personnel from the spill location and barricade the area.
- Use available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, recur, or spread.
- Use sorbent materials to control the spill at the source.
- Construct a temporary containment dike of sorbent materials, cinder blocks, bricks, or other suitable materials to help contain the spill.
- Attempt to identify the character, exact source, amount, and extent of the released materials. Identification of the spilled material should be made as soon as possible so that the appropriate cleanup procedure can be identified.
- Immediately contact the HSM and project environmental manager in the event of a spill or release, so they may evaluate reportable quantity requirements and whether agency reporting is required.
- Assess possible hazards to human health or the environment as a result of the release, fire, or explosion.
- Follow the incident notification, reporting, and investigation procedures in Section 22.

(intentionally blank)

21.0 INSPECTIONS

21.1 MANAGEMENT HEALTH, SAFETY, SECURITY, AND ENVIRONMENT INSPECTIONS

Periodic management inspections facilitate PM leadership, provide an opportunity for PMs to mentor field staff on HSE, and identify any big picture actions that need to be addressed. Observations that would improve global HSE program can also be identified The PM will take the following actions in support of management inspections:

- Complete one inspection/review (may not be in person) per month during fieldwork. The PM may delegate completion to the task lead, field team leader, or construction manager if the project is short duration and/or a visit is not planned for.
- Address issues with the field team, taking the opportunity to mentor staff by identifying the root cause of observation (for example, why are safe behavior observations not being completed and had this hazard been noted by any other team members?).
- Send a copy of completed documentation to Corporate and Safety Managers for tracking and review. Originals should be kept in the project files.

(intentionally blank)

22.0 INCIDENT NOTIFICATION, REPORTING, AND INVESTIGATION

22.1 GENERAL INFORMATION

The information in this section applies to the following situations:

- All injuries involving employees, third parties, or members of the public
- Damage to property or equipment
- Interruptions to work or public service (hitting a utility)
- Incidents that attract negative media coverage
- Near misses
- Spills, leaks, or regulatory violations
- Motor vehicle accidents

Documentation, including incident reports, investigation, analysis, and corrective measure taken, will be kept by the SSHO and maintained onsite for the duration of the project.

22.2 DEFINITIONS

Incident: An incident is an event that causes or could have caused undesired consequences. An incident may be caused by natural forces, employees, subcontractors, or third parties in any location associated with project operations, including offices, warehouses, project sites, private property, or public spaces. Incidents may include the following:

- Injury or illness to an employee or subcontractor employee, or member of the public
- Property damage
- Spill or release
- Environmental requirement or permit violation
- A near miss
- Other (for example, fire, explosion, bomb threat, workplace violence, or threats)

Accident: An incident involving actual loss through injury, damage to assets, or environmental harm

Near Miss: A near miss occurs when an intervening factor prevented an injury or illness, property damage, spill or release, permit violation, or other event from occurring. Examples of near-miss situations include a hard hat or other PPE preventing an injury, secondary containment or emergency shutoff preventing a spill, or an alert coworker preventing an incident.

Serious Incident: The following are considered serious incidents, and must be immediately reported to senior management:

- Work-related death or life threatening injury or illness of an employee, subcontractor, or member of the public
- Kidnapped or missing persons
- Acts or threats of terrorism
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than $ 500,000 in damage
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community, or the environment

22.3 REPORTING REQUIREMENTS

All employees and subcontractors' employees will immediately report to their supervisor any incident (including near misses) which they are involved in or witness.

The ECC, Jacobs, or subcontractor supervisor, upon receiving an incident report, will inform his immediate superior and the SSHO.

The SSHO will immediately report the following information to the HSM and PM by phone and email:

- Project name and site manager
- Date and time of incident
- Description of incident
- Extent of known injuries or damage
- Level of medical attention
- Preliminary root cause and corrective actions

If the incident was an environmental permit issue (that is, potential permit noncompliance or other situation that result in a notice of violation) or a spill or release, contact the project environmental manager immediately so the reportable quantity requirements and whether agency reporting can be evaluated.

The ECC team will comply with all applicable statutory incident reporting requirements, such as those to OSHA, the police, or state federal environmental agency.

Be aware that many OSHA-designated states require reporting to the area OSHA office if one person is admitted to the hospital (for example, California and Washington), while federal OSHA requires it only if three or more are admitted.

22.4 SERIOUS INCIDENT REPORTING REQUIREMENTS

The serious incident reporting requirements ensure timely notification and allow for positive control over the flow of information so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities. This standard notification process integrates HSE and firmwide security operations requirements for the consistent reporting and managing of serious events throughout our operations.

22.4.1 Serious Incident Determination

The criteria under Serious Incidents in Section 22.2, Definitions, should be used to determine whether an incident is considered serious and must be immediately reported up to the necessary parties through the reporting and notification process.

22.4.2 Serious Incident Reporting

If an incident meets the Serious Incident criteria, the PM is to immediately contact their corporate contact, then follow the standard incident reporting procedure.

For all serious incidents, this standard reporting process is implemented immediately so as to ultimately achieve notification to corporate management within 2 hours of incident onset or discovery, and notification to appropriate corporate management support team.

Major accidents include any occupational hazard exposure or physical injury that requires more than basic first-aid (physical injury/exposure) or fire, explosion, or property damage exceeding $200,000. Major accidents require immediate notification of appropriate personnel as discussed below and must be done within 24 hours to the Contracting Officer or Contracting Officer's Representative.

In the event of an injury that constitutes an OSHA-recordable incident, the SSHO will notify the ECC PM and USACE Alaska District PM (Greg Vanagel) as soon as practical after the incident.

22.5 INCIDENT ROOT CAUSE ANALYSIS

Accident analysis is essential to identify all causes of an incident so that the correct remedial actions may be taken to prevent the same and similar type of incident from recurring. Root cause analysis will be completed for all recordable injuries; property damage incidents in excess of $5,000.00 (U.S.); environmental permit violations, spills, and releases that are required to be reported to regulatory agencies; and any other incident, including near misses where the HSM or PM determines a root cause analysis is appropriate. The HSM or responsible environmental manager is responsible for ensuring the analysis is completed and the results entered in the incident report form in HITS. Root cause analysis must be completed using a team that includes, at a minimum, the HSM or designee, the involved party(ies), a responsible operations representative (for example, PM, construction manager, or crew supervisor), and an independent management representative not associated with the incident.

The root cause analysis form must be completed for all loss incidents and near loss incidents. The form must be submitted to the investigation team for review. For minor losses or near losses, the information may be gathered by the supervisor or other personnel immediately following the loss. Based on the complexity of the situation, the information may be all that is

necessary to enable the investigation team to analyze the loss, determine the root cause, and develop recommendations. More complex situations may require the investigation team to revisit the loss site or re-interview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videos of the scene or damaged equipment should be taken from all sides and from various distances. The point is especially important when the investigation team will not be able to review the loss scene.

22.5.1 Contributing Factors

The investigation team must follow a Root Cause Analysis to assist in identifying the root cause(s) of a loss. Any loss may have one or more root causes and contributing factors. The root cause is the primary or immediate cause of the incident, while a contributing factor is a condition or event that contributes to the incident happening but is not the primary cause of the incident. Root causes and contributing factors that relate to the person involved in the loss, his or her peers, or the supervisor should be referred to as personal factors. Causes that pertain to the system within which the loss or injury occurred should be referred to as job factors.

Examples of personal factors include the following:

- Lack of skill or knowledge
- Correct way taking more time, requiring more effort, or both
- Short-cutting standard procedures is positively reinforced or tolerated
- Person involved thinks there is no personal benefit to always doing the job according to standards

Examples of job factors include the following:

- Lack of or inadequate operational procedures or work standards
- Inadequate communication of expectations regarding procedures or standards
- Inadequate tools or equipment

In the vast majority of losses, the root cause is related to one or more of these seven factors, although it could be any one or a combination of these seven possibilities, or some other uncontrollable factor. Uncontrollable factors should be used rarely and only after a thorough review eliminates all seven other factors.

22.5.2 Corrective Actions

Root cause analysis and incident reports should include all corrective actions already taken or that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a timeframe for completion. Be sure the corrective actions address the causes.

Once the investigation report has been completed, the PM will hold a review meeting to discuss the incident and provide recommendations. The responsible supervisors will be assigned to carry out the recommendations, and will inform the SSHO upon successful implementation of all recommended actions.

- Evaluation and follow-up of the incident response form will be completed by the type of incident by the HSM or environmental manager.
- Incident investigations must be initiated and completed as soon as possible, but no later than 72 hours after the incident.

23.0 RECORDS AND REPORTS

An organized project filing system is essential for good documentation and recordkeeping. Some of the many benefits to an organized filing system include the following:

- Other ECC and project team employees can easily and quickly find documents.
- Records are readily available for review.
- Records may be needed during OSHA investigations, audits, or other legal matters.
- Records may be needed on short notice in case of an accident, illness, or other emergency.
- Systematic recordkeeping aids in overall project organization.

The following types of records must be maintained as the project progresses:

- Exposure records, including air monitoring data (with calibration records), SDSs, and exposure modeling results
- Physical hazard exposure records, including noise, ionizing radiation, nonionizing radiation, vibration, and laser-exposure assessments and measurements
- Respiratory fit test records
- Training records
- Incident reports, investigations, and associated back-up information, such as agency notifications, calculations, and corrective actions taken
- Federal or state agency inspection records

(intentionally blank)

EXHIBIT C1-1

Health and Safety Plan Employee Signoff Form

HEALTH AND SAFETY PLAN EMPLOYEE SIGNOFF FORM

The project employees and subcontractors listed below have been provided with a copy of this SSHP, have read and understood it, and agree to abide by its provisions.

Project Name: **Contract Number:**

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

EXHIBIT C1-2

Chemical Inventory/Register Form

CHEMICAL INVENTORY/REGISTER FORM

Location: _____

HCC: _____

☐ Office ☐ Warehouse ☐ Laboratory ☐ Project:

Project No.: _____

Regulated Product	Location	Container labeled (✓if yes)	SDS available (✓if yes)

SDS for the listed products will be maintained at:

EXHIBIT C1-3

Chemical-Specific Training Form

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # :
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product SDS to provide the following information concerning each of the products listed above.

- ☐ Physical and health hazards
- ☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- ☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of SDSs, chemical inventories, and the written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

EXHIBIT C1-4

Forms

HEAT STRESS PHYSIOLOGICAL MONITORING FORM

Project:								
Date:				Company:				
1. Take and record measurement of temperature or pulse at the frequency indicated in the safety plan. 2. Follow the Physiological Monitoring Protocol in the safety plan. 3. Never continue work if your body temperature is more than 100.4° F/38° C, or if you are experiencing sudden and severe fatigue, nausea, dizziness, or lightheadedness.								
Employee: Describe action taken below if measurements are exceeded:								
Time								
Temp								
Pulse								
Employee: Describe action taken below if measurements are exceeded:								
Time								
Temp								
Pulse								
Employee: Describe action taken below if measurements are exceeded:								
Time								
Temp								
Pulse								
Employee: Describe action taken below if measurements are exceeded:								
Time								
Temp								
Pulse								
Employee: Describe action taken below if measurements are exceeded:								
Time								
Temp								
Pulse								

EXHIBIT C1-5

Key Safety Program Elements

(blank forms for field use)

Activity Hazard Analysis EM 385-1-1 Format

Pre-Task Safety Plan (PTSP)

ACTIVITY HAZARD ANALYSIS (AHA)

ACTIVITY/WORK TASK:		Overall Risk Assessment Code (RAC) (Use highest code)				
	SIGNATURES	Activity #		AHA #		
PWD/OICC/ROICC OFFICE		**Risk Assessment Code (RAC) Matrix**				
NAME & DATE ACCEPTED BY GDA:						
CONTRACT NUMBER:		**Severity**	**Probability**			
TASK ORDER/DELIVERY #:						
PRIME CONTRACTOR:			Frequent	Likely	Occasional	Seldom	Unlikely
SUBCONTRACTOR:							
DATE OF PREPARATORY MEETING:		Catastrophic	E	E	H	H	M
DATE OF INITIAL INSPECTION:		Critical	E	H	H	M	L
CONTRACTOR COMPETENT PERSON:		Marginal	H	M	M	L	L
SITE SAFETY and HEALTH OFFICER		Negligible	M	L	L	L	L
ACCEPTANCE BY GOVERNMENT DESIGNATED AUTHORITY (GDA)		Review each **"Hazard"** with identified safety **"Controls"** and determine (RAC)					
E = EXTREMELY HIGH (PWO/OICC/ROICC)		Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" .Place the highest RAC at the top of AHA. This is the overall risk assessment code for this activity					
H = HIGH RISK (FEAD DIRECTOR)		**"Severity"** is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible after controls are in place					
M = MODERATE RISK (CM or ET or PAR)							
L = LOW RISK (ET or PAR)		**"Probability"** is the likelihood to cause an incident, near miss, or accident did occur and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely after controls are put in place.					

Job Steps	Hazards	Controls	RAC

Equipment to be Used	Training Requirements and Competent or Qualified Personnel name(s)	Inspection Requirements	RAC

Equipment to be Used	Training Requirements/Competent or Qualified Personnel name(s)	Inspection Requirements

Instructions for completing Contractor Activity Hazard Analysis

1. Activity/Work Task – Insert work/task this AHA is written for that is excavation, scaffold building, foundation preparation.
2. PWO/OICC/ROICC – Insert name of Public Works Office, Officer In Charge of Construction Office or Resident Officer in Charge of Construction (PWD/OICC/ROICC
3. Enter name & date AHA accepted by Government Designated Authority (GDA)
4. Enter contract number
5. Enter Task order or Delivery order number
6. Enter Prime Contractors name
7. Enter Subcontractors name
8. Enter date preparatory meeting was held
9. Enter date initial inspection was performed
10. Enter name of contractor competent person onsite for this activity
11. Enter name of Prime Contractor Site Safety and Health Officer
12. Level of government person responsible for accepting the AHA, progressive signatures as level of risk increases.
13. Overall Risk Assessment code is highest code assigned to any Job step after Hazards are assessed and Controls have been assigned
14. Schedule number is activity number from production daily reports
15. AHA number is the sequential number of all AHA's for this contract.
16. Job steps is the complete sequence of work, not general statements to complete the entire activity
17. Hazards is the known safety risks associated with completing the task
18. Controls is the safety measures in place to reduce the hazard to the lowest level possible
19. Risk Assessment code is where Severity and Probability intersect, place that letter E, H, M, or L in the RAC column
20. List all equipment to be used to complete this activity that is crane, backhoe, vehicle, all heavy equipment
21. List the training requirements required by EM 385, Safety Spec 01356 or OSHA that apply to this task.
    List competent person(s) required for specific tasks in EM 385
    List qualified person(s) required for specific tasks in EM 385
    List CPR/First Aid training and qualification dates
22. List all inspection requirements of EM 385, Governmental Safety Requirements Specifications or OSHA 29 CFR 1926

PRE-TASK SAFETY PLAN (PTSP)

Project: _ Location: _____

Date:

Supervisor:

Job Activity:

Attendees:	Print Name	Sign Name
_____		

List Tasks and verify that applicable AHAs have been reviewed:

_____

_____

_____

_____

Tools/Equipment Required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

_____

_____

_____

_____

_____

Potential Health and Safety Hazards, including chemical, physical, safety, biological and environmental (check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__ Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	__ Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__ Heights/fall > 6 feet	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__ Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__ Welding/cutting	__ Demolition
__Underground Utilities	__ Security	__ Poor communications

Other Potential Hazards (Describe):

_____

_____

_____

_____

_____

HAZARD CONTROL MEASURES (CHECK ALL THAT APPLY):

PPE __ Thermal/lined __ Eye __ Dermal/hand __ Hearing __ Respiratory __ Reflective vests __ Flotation device __ Hard Hat __ Safety-Toed Boots	Protective Systems __ Sloping __ Shoring __ Trench box __ Barricades __ Competent person __ Locate buried utilities __ Daily inspections __ Entry Permits/notification	Fire Protection __ Fire extinguishers __ Fire watch __ Non-spark tools __ Grounding/bonding __ Intrinsically safe equipment	Electrical __ Lockout/tagout __ Grounded __ Panels covered __ GFCI/extension cords __ Power tools/cord inspected __ Overhead line clearance __ Underground utils ID'd
Fall Protection __ Harness/lanyards __ Adequate anchorage __ Guardrail system __ Covered opening __ Fixed barricades __ Warning system	Air Monitoring __ PID/FID __ Detector tubes __ Radiation __ Personnel sampling __ LEL/O2 __ No visible dust __ Other	Proper Equipment __ Aerial lift/ladders/scaffolds __ Forklift/heavy equipment __ Backup alarms __ Hand/power tools __ Crane with current inspection __ Proper rigging __ Operator qualified	Welding & Cutting __ Cylinders secured/capped __ Cylinders separated/upright __ Flash-back arrestors __ No cylinders in confined space entry __ Flame retardant clothing __ Appropriate goggles
Confined Space Entry __ Isolation __ Air monitoring __ Trained personnel __ Permit completed __ Rescue	Medical/ER __ First-aid kit __ Eye wash __ First-aid-CPR trained personnel __ Route to hospital	Heat/Cold Stress __ Work/rest regime __ Rest area __ Liquids available __ Monitoring __ Training	Vehicle/Traffic __ Traffic control __ Barricades __ Flags __ Signs
Permits __ Hot work __ Confined space __ Lockout/tagout __ Excavation __ Demolition __ Energized work	Demolition __ Pre-demolition survey __ Structure condition __ Isolate area/utilities __ Competent person __ Hazmat present	Inspections: __ Ladders/aerial lifts __ Lanyards/harness __ Scaffolds __ Heavy equipment __ Drill rigs/geoprobe rigs __ Cranes and rigging __ Utilities marked	Training: __ Hazwaste (current) __ Construction __ Competent person __ Task-specific __ First-aid/CPR __ Confined Space __ Hazcom
Underground Utilities __Dig alert called __3rd Party locater __As-builts reviewed __Interview site staff __Client review __soft locate necessary?	Incident Communications __Work stops until cleared by TM/CM __Immediate calls to TM/CM __Client notification __24 hour notification setup __Clear communications	AHA' s __reviewed and approved by HSM __onsite and current __applicable for this day's work __Communication and incident processes included?	
Field Notes (including observations from prior day, etc.): _____ _____ _____			

Name (Print): _____

Signature: _____ Date: _____

EXHIBIT C1-6

Working Alone Protocol Call-In Contact Form

WORKING ALONE PROTOCOL
CALL-IN CONTACT FORM

Date of site work: _____ Expected start time: _____

Name of employee in the field: _____

Name of employee responsible to receive contact: _____

Client Emergency Contact (if any): _____

Employee's contact numbers:

Radio #_____

Cell Phone #_____

Address and Location of work: _____

Directions/Map:

Planned Activity: _____

Specified Frequency and time for call in: _____

If lone worker fails to call in at specified frequency/time:

1. Call worker's radio and cell to determine if an emergency exists.
2. If no reply, immediately call client security/emergency service if there is one at the site.
3. If there is no client security, call Emergency Services. Inform the dispatcher there is a lone worker that cannot be contacted and there may be an emergency onsite. Provide the lone worker's name, their last known location, and your contact information.
4. After Emergency Services have been contacted, call the other emergency contacts, PM, and Responsible Health and Safety Manager.

LONE WORKER PROTOCOL

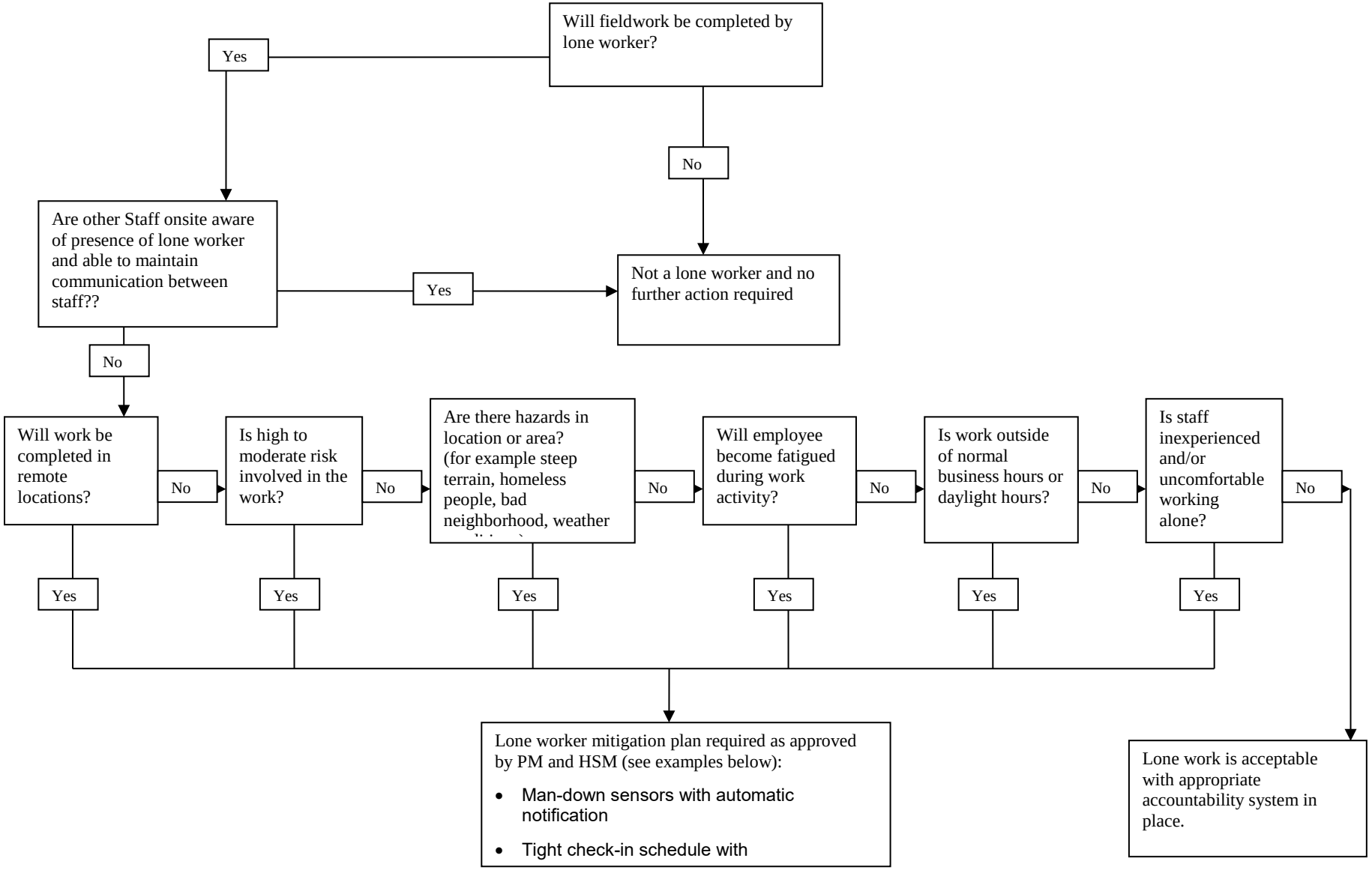


EXHIBIT C1-7

Completed Activity Hazard Analyses

ACTIVITY HAZARD ANALYSIS 01, POST-REMEDIAL ACTION AND POST-STORM EVENT MONITORING

Activity/Work Task: Post-Remedial Action and Post-Storm Event Monitoring	**Overall Risk Assessment Code (RAC) (Use highest code)**					**M**
Project Location: Kodiak Island	**Risk Assessment Code (RAC) Matrix**					
Contract Number: W911KB-17-D-0017	**Severity**	**Probability**				
Date Prepared: November 2019		**Frequent**	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Prepared by: John Culley	**Catastrophic**	**E**	**E**	**H**	**H**	**M**
	Critical	**E**	**H**	**H**	**M**	**L**
Reviewed by:	**Marginal**	**H**	**M**	**M**	**L**	**L**
	Negligible	**M**	**L**	**L**	**L**	**L**
Notes: (Field Notes, Review Comments, etc.)	Step 1: Review each Hazard with identified safety Controls and determine RAC (See above)					
	Probability is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely				**RAC Chart**	
	Severity is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible				**E=**	**Extremely High Risk**
					H=	**High Risk**
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each Hazard on AHA. Annotate the overall highest RAC at the top of AHA.				**M=**	**Moderate Risk**
					L=	**Low Risk**

Job Steps	Hazards	Controls	RAC
General Site Activities, Surveying, and Reconnaissance	Accidents from lack of training	• All site workers will have completed OSHA 3-day on-the-job training (OJT). • All site workers will have completed OSHA 40-hour HAZWOPER training with yearly updates. • Worker will be trained before performing new activities. Copies of records will be kept by the SSHO. • Daily tailgate safety meetings will be held before starting each shift.	L
	Head injury	• ANSI-approved hard hats will be worn at all times when overhead hazards are present, in the manner they are designed (i.e., brim forward, no modifications, and no ball caps).	L
	Eye injury	• Workers will wear protective eyewear that meets ANSI Z-87 at all times.	L
	Hearing damage	• Workers will wear hearing protection whenever voices must be raised above normal conversational speech or when noise levels exceed 85 decibels because of a load noise source, such as working around heavy equipment. Minimum of 30 dB NRR. • Hearing protection will be worn by equipment operators when working in open cab equipment, or when doors or windows are open.	L

Job Steps	Hazards	Controls	RAC
	Foot injury	• Workers will wear safety-toed leather work boots at all times.	L
	Hand injury	• Leather gloves should be worn when handling sharp, rough, or slippery surfaces.	L
	Injuries resulting from manually lifting	• Workers will be instructed in safe lifting techniques (i.e., back straight, bend at knees, load close to body, lift smoothly, and do not twist). • Two workers will be required for manual lifts of over 50 pounds. • Workers are encouraged to get help with any lift that appears excessive or awkward. • Heavy loads will be split into smaller loads whenever possible. • The path of travel will be confirmed to be clear before the lift.	L
	Injuries from being caught on equipment	• Workers will avoid wearing loose-fitting clothing. • Workers will keep hands away from moving parts. • All ground personnel will wear high vis-reflective vests.	L
	Injuries from slips, trips, and falls	• Walking and working surfaces will be kept free of clutter, debris, and congestion to the greatest extent possible. • Personnel will be briefed on the hazards of wet, muddy soil hazards and traversing uneven grades. • Only equipment and surfaces that are designed for personnel access will be walked on or climbed on. • Workers will be aware of potential for poor footing while working on uncompacted backfill materials. • Workers will use three-point contact when climbing onto equipment.	M
	Injuries from contact with equipment	• Workers on the ground will maintain visual contact with the equipment operator when heavy equipment is used. • Workers on the ground will not enter an equipment swing radius. • Equipment requiring an operator will not be permitted to run unattended. • All heavy equipment will be equipped with a functional backup alarm. • All ground personnel will wear high vis-reflective vests.	L
	Contact with other vehicles, collisions	• Always use defensive driving skills. • Follow the UTV safety procedures outlined in the SSHP. • Slow for bad weather conditions. • Do not operate when not feeling well, or using any type of medications that may affect your driving.	M
	Emergencies	• Follow working alone protocol. • Cellular telephone communications capabilities areas will be available to contact emergency response or report spills and releases. • All personnel will be familiar with emergency procedures and egress routes.	M

Job Steps	Hazards	Controls	RAC
		• Personnel who have medical conditions that may be exacerbated by working conditions should notify the PM, SSHO, or both of these conditions.	

Equipment to be used	Training Requirements/Competent or Qualified Personnel Names(s)	Inspection Requirements
PPE	Valid driver's license PPE training	Before use and daily written inspections

ACTIVITY HAZARD ANALYSIS 01, POST-REMEDIAL ACTION AND POST-STORM EVENT MONITORING

	PRINT NAME	**SIGNATURE**	
Supervisor Name:			**Date/Time:**
SSHO Name:			**Date/Time:**
Employee Name(s):			**Date/Time:**
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:

ACTIVITY HAZARD ANALYSIS 02, UTILITY CLEARANCE

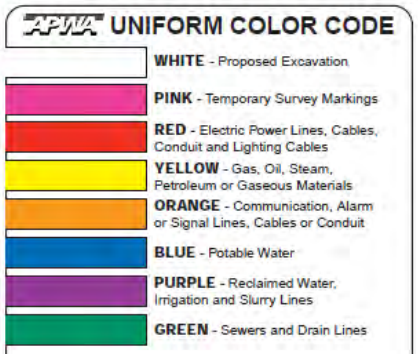
Date: November 2019						Task Risk Assessment Code (RAC):	L
Project: Kodiak Island	L = Low		**Probability**				
Site Supervisor:	E = E xtremely High Risk						
SSHO:	H = High Risk						
AHA Preparer: John Culley	M = Moderate Risk		**Frequent**	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Job/Activity: Utility Assessment and Utility Locate	**Severity**	**Catastrophic**	E	E	H	H	M
		Critical	E	H	H	M	L
		Marginal	H	M	M	L	L
		Negligible	M	L	L	L	L

TYPES OF POTENTIAL ENERGY:

1	2	3	4	5	6	7	8	9	10
BIOLOGICAL	CHEMICAL	ELECTRICAL	GRAVITY	MECHANICAL	MOTION	PRESSURE	RADIATION	SOUND	TEMPERATURE

Work Task Sequence (List steps you need to take to complete the activity.)	**Potential Health and Safety Hazards** (How can you be harmed? Cut, struck, exposed…)	**Potential Energy(ies) Associated with Task**	**Hazard Controls** (List the specific controls for each potential hazard. Refer to EN&N HSE Handbook for required controls)
Background and Records Assessment	Utility strike by project team	Fire, electrical, chemical, pressure	• Conduct a background and records assessment of known utilities or other subsurface obstructions. • Identify any client- or location-specific permit and/or procedural requirements (e.g., dig permit or intrusive work permit) for subsurface activities • Obtain available utility diagrams and/or as-built drawings for the facility. • Review locations of possible subsurface utilities including sanitary and storm sewers, electrical lines, water supply lines, natural gas lines, fuel tanks and lines, communication lines, lighting protection systems, etc. Note: Use caution in relying on as-built drawings as they are rarely 100 percent accurate. • Request that a facility contact (e.g., site owner or site manager) with knowledge of utility locations review and approve proposed locations of intrusive work. Meet contact onsite when feasible. • White line the proposed intrusive locations (drilling locations, trench, or excavation) with white paint or similar methods. Never use red, orange, or yellow paint for proposed locations.

Work Task Sequence (List steps you need to take to complete the activity.)	**Potential Health and Safety Hazards** (How can you be harmed? Cut, struck, exposed…)	**Potential Energy(ies) Associated with Task**	**Hazard Controls** (List the specific controls for each potential hazard. Refer to EN&N HSE Handbook for required controls)
Contact the Designated Utility Locate Service	Utility strike by project team	Fire, electrical, chemical, pressure	• Contact your designated local utility locating service (e.g., Base CE) to identify and mark the location of utilities, as applicable.
Set up Work Zone (Roadway or Shoulder Work)	Equipment	Motion	• Wear high-visibility traffic vests near heavy equipment or traffic. • Contractor to use traffic control equipment (e.g., cones and delineators) to route traffic around work area, as needed. • Always remain aware of an escape route (e.g., behind an established barrier, parked vehicle, or guardrail). • Always pay attention to moving equipment – never assume operators are looking out for you. • Work as far from traveled way as possible to avoid creating confusion for operators.
Independent Field Survey (Utility Locate)	Utility strike by project team	Fire, electrical, chemical, pressure	• Verify utility locator is qualified, trained, and experienced. • Determine the most appropriate instrumentation, technique, or combinations of both to identify subsurface utilities based on their experience and expertise, types of utilities anticipated to be present, and specific site conditions. • Ensure SSHO is present during the independent field survey to observe the utility locate and verify that the work area and utilities have been properly identified and marked. • Physically walk the area to verify the work location and identify, locate, and mark underground utility location. • Obtain documentation of the survey and clearances in writing and signed by the party conducting the clearance. Maintain all documentation in the project file.
Utility Visual Assessment	Utility strike by project team	Fire, electrical, chemical, pressure	• Perform a 360-degree assessment. Walk the area and inspect for utility-related items such as valve caps, previous linear cuts, patchwork in pavement, hydrants, manholes, utility vaults, drains, and vent risers in and around the proposed intrusive work area. • The visual survey should include all surface landmarks, including manholes, previous liner cuts, patchwork in pavement, pad-mounted transformers, utility poles with risers, storm sewer drains, utility vaults, and fire hydrants. • If any unanticipated items are found, conduct further research before initiating intrusive activities and implement any actions needed to avoid striking the utility or obstruction.
	Slips, trips, and fall hazards	Biological, motion, gravity	• Be cautious of drilling and sampling equipment laying on the ground. • Maintain good housekeeping. • Beware of uneven ground surface. • Work at a steady pace.

Work Task Sequence (List steps you need to take to complete the activity.)	**Potential Health and Safety Hazards** (How can you be harmed? Cut, struck, exposed…)	**Potential Energy(ies) Associated with Task**	**Hazard Controls** (List the specific controls for each potential hazard. Refer to EN&N HSE Handbook for required controls)
			• Keep walking paths open to help prevent tripping hazards. • Be aware that escarpments can slough. Avoid these areas. • Exercise caution in relying on rocks and trees or tree stumps to support yourself – many times they are loose. • Whenever possible, switchback your way up and down steep areas, and maintain a slow pace with firm footing. • When walking in ditches, swales and other drainage structures adjacent to roads or across undeveloped land, use caution to prevent slips and falls that can result in twisted or sprained ankles, knees, and backs. • Whenever possible, observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed. • If steep terrain must be negotiated, coordinate with HSM to evaluate the need for ladders or ropes to provide stability.
Placing Utility Marks, Updating Records	Utility strike by project team	Fire, electrical, chemical, pressure paint exposure	• Ensure locator always follows the APWA color code marking requirements:  • Use pink for temporary or unknown lines, never red, orange, or yellow. • The markings from utility surveys must be protected and preserved until the markings are no longer required. Use whiskers or similar means if necessary. • If the utility location markings are destroyed or removed before intrusive work commences or is completed, the PM, SSHO, or designee must resurvey and remark the area. • Use paint only in well-ventilated areas. Minimize skin contact, wear gloves where necessary, do not inhale vapors. Paint may be combustible. Reference can label and SDS sheet. • Update site map with all utilities found onsite. Take pictures of locations and nearby utility marks. Ensure site map is available and reviewed with excavator or driller before intrusive work.

Work Task Sequence (List steps you need to take to complete the activity.)	**Potential Health and Safety Hazards** (How can you be harmed? Cut, struck, exposed…)	**Potential Energy(ies) Associated with Task**	**Hazard Controls** (List the specific controls for each potential hazard. Refer to EN&N HSE Handbook for required controls)
Preparing For Intrusive Activities	Utility strike by project team	Fire, electrical, chemical, pressure	• When aggressive intrusive activities will be conducted within 5 feet (1.5 meters), either laterally or vertically, of an underground utility or when there is uncertainty about utility locations, locations must be physically verified by non-aggressive means such as air or water knifing, hand digging, or manual posthole digging. • Non-conductive tools must be used if electrical hazards may be present. If intrusive activities are within 5 feet (1.5 meters) and parallel to a marked existing utility, the utility location must be exposed and verified by non-aggressive methods every 100 feet (30.5 meters). In addition, check to see if the utility can be isolated (locked out/tagged out and either de-energized [and purged as necessary] or blocked) during the subsurface activity • Use non-aggressive methods (e.g., hand digging or air-knifing) to perform intrusive activities within 2 feet of a high-risk utility (i.e., a utility that cannot be de-energized or would cause significant impacts to repair or replace). Hazardous utilities should be de-energized whenever possible. • Consider moving proposed intrusive locations if utility conflicts exist. Discuss conflicts with the PM and site personnel. Contact the HSM for guidance if necessary.

Equipment to be used (List equipment to be used in the work activity)	**Inspection Requirements (List inspection requirements for the work activity)**	**Training Requirements (List training requirements including hazard communication)**
• PPE	• Daily inspections of PPE by user. Replaced as necessary.	• FA/CPR, fire extinguisher, eye wash • OSHA 40-hour HAZWOPER initial training, current refresher, 3-day OJT, and medical clearance. • Hazard Communication training • Documented training on SDSs for any chemicals used. • Qualified SSHO
• Hand and Power Tools	• Daily inspections by user. Replaced as necessary. • Check to ensure good working order and fully charged, calibrate each morning	
• Traffic Control Equipment • Delineators, Caution Tape, Signage	• Daily inspections.	
• Utility Locate Equipment • RF, GPR, Ferromagnetic Detectors • GPS • Paint, Whiskers	• Daily inspections.	

ACTIVITY HAZARD ANALYSIS 02, UTILITY CLEARANCE

	PRINT NAME	**SIGNATURE**	
Supervisor Name:			**Date/Time:**
SSHO Name:			**Date/Time:**
Employee Name(s):			**Date/Time:**
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:

ACTIVITY HAZARD ANALYSIS 03, DRILLING OBSERVATION

Activity/Work Task: Drilling observation of direct push system (DPS) technology			**Overall Risk Assessment Code (RAC) (Use highest code)**			**M**
Project Location: Kodiak Island	**Risk Assessment Code (RAC) Matrix**					
Contract Number: W911KB-17-D-0017	**Severity**	**Probability**				
Date Prepared: November 2019		**Frequent**	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Prepared by: John Culley	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by:	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Notes: (Field Notes, Review Comments, etc.)	**Step 1: Review each Hazard with identified safety Controls and determine RAC (See above)**		
All project observation activities may be exposed to the following drilling hazards.	Probability is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely	**RAC Chart**	
	Severity is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	E=	Extremely High Risk
		H=	High Risk
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each Hazard on AHA. Annotate the overall highest RAC at the top of AHA.	M=	Moderate Risk
		L=	Low Risk

Job Steps	Hazards	Controls	RAC
General drilling operations	Struck by debris or equipment; slips, trips, and falls	Properly train personnel, maintain a safe distance a way from the rig unless necessary, use mandatory PPE as specified in the SSHP for this task, remain aware of surroundings and equipment operation.	M
	Fire	Require subcontractors to turn off steam cleaner and allow cooling before refueling. A minimum of one 10-pound fire extinguisher should be staged within reach of the drill rig/box truck. All cabs of trucks should be equipped with 5-pound fire extinguishers.	
	Hoisting and rigging hazards	Require wire rope(s) be inspected daily. Ensure wire rope clamps are constructed properly. Do not exceed the rated capacity of the wire rope or any attachment.	
	Unauthorized operation	Only trained and authorized personnel will operate or assist in drilling operations.	
	Noise	Wear properly rated hearing protection (mandatory). Minimum of 30 decibels NRR.	
	Falling debris	Wear hardhats, steel-toed boots, and safety glasses (mandatory).	
Lifting	Back injuries	Do not lift more than 40 pounds without a lifting aid. If needed, use a helper to lift heavy load.	M

Job Steps	Hazards	Controls	RAC
		Use correct lifting techniques; do not twist back or lift with the back. Use your legs, bring lift close to body. Review of online training for manual lifting required for all staff.	
General working conditions/all site activities	Weather extremes	Wear proper weather gear. Consume fluids, take necessary breaks, have an awareness of potential for inclement weather. Weather forecasts will be checked each morning and field efforts modified as necessary.	M
Sampling activities/ sample recovery	Exposure to chemicals during handling of drill pipe and sample retention	Wear PPE for conditions as noted in the PPE section of the SSHP; review material safety data sheet for sample chemicals.	
Drilling, digging	Power lines/underground utilities	• If work is near an overhead line, care will be taken to ensure when raising the mast. • While working near power lines, drill rods will not be leaned against the mast. • Mast must not come within 50 feet of aboveground power lines. • Ensure underground utilities have been located and marked. Remain outside disatnces specified in the SSHP. • A site plan with marked utilities will be provided to site personnel performing drilling operations.	M
All site activities	Heat stress	Drink plenty of liquids and take breaks as necessary. Be aware of signs of heat stress.	M
	Contact with flora and fauna	Be aware of biological hazards.	
Operating/driving field trucks	Death or injury	Use of seatbelts while driving vehicles or operating heavy equipment is MANDATORY, no exceptions. No cell phone use while operating vehicle.	M
Drilling operations/driving/set up/ demob	Fuel spill/hydraulic spills	Box truck must be equipped with spill- cleanup materials. At a minimum, the spill kit should contain absorbent pads, shovels, oil dry, empty 55-gallon drum(s), and plastic sheeting. If a release occurs, secure the leak. Contain spill from entering storm drains using an earthen dam, if necessary. Call the proper authorities.	L
Drilling/well installation/ well abandonment	General	• Only qualified operators should operate equipment. • Daily, or before first operation of the day, the equipment should be inspected for proper operation. • No passengers will be carried except in an approved safety platform. • Loads will not be suspended or travel over personnel. • A spotter should be used if operators view is obstructed. • Operator should be aware of all equipment and worker(s) near the operating area. • Operator should ensure load is proper equipment rigging and positioning. • Operator should not exceed safe operating conditions. • Operator should not operate equipment other than in accordance with the manufacturers operating manual.	M

Job Steps	Hazards	Controls	RAC
		• Hands and loose clothing and material should be kept clear of all moving parts.	
Equipment decontamination	• Slips, trips, falls • Struck by or against heavy equipment or protruding objects	• Clear walkways, work areas of equipment, vegetation, tools, and debris. • Mark, identify, or barricade other obstructions. • Wear reflective warning vests when exposed to vehicular traffic. • Isolate equipment swing areas. • Make eye contact with operators before approaching equipment. • Understand and review hand signals. • Provide workers with proper skin and eye protection based on the exposure hazards present. • Review hazardous properties of site contaminants with workers before operations begin. • Staff should wear hard hats, safety glasses with side shields or goggles with splash shields, and steel-toed safety boots	M
Refueling of drill rig and support equipment	Fire and spills	Ensure rigs and equipment are turned off before refueling operations. Contain and cleanup spill.	M

Equipment to be used	Training Requirements/Competent or Qualified Personnel Names(s)	Inspection Requirements
Field vehicle PPE	Valid drivers license PPE training	Daily and before use

ACTIVITY HAZARD ANALYSIS 03, DRILLING OBSERVATION

	PRINT NAME	**SIGNATURE**	
Supervisor Name:			**Date/Time:**
SSHO Name:			**Date/Time:**
Employee Name(s):			**Date/Time:**
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:

ACTIVITY HAZARD ANALYSIS 04, ENVIRONMENTAL SAMPLING (SOIL, SEDIMENT, AND OTHER MEDIA)

Activity/Work Task: Environmental Sampling (Soil, Sediment, and other media)	**Overall Risk Assessment Code (RAC) (Use highest code)**	**M**

Project Location: Kodiak Island	**Risk Assessment Code (RAC) Matrix**					
Contract Number: W911KB-17-D-0017	**Severity**	**Probability**				
Date Prepared: November 2019		**Frequent**	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Prepared by: John Culley	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by:	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Notes: (Field Notes, Review Comments, etc.)

Step 1: Review each Hazard with identified safety Controls and determine RAC (See above)

Probability is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely

Severity is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible

Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each Hazard on AHA. Annotate the overall highest RAC at the top of AHA.

RAC Chart	
E=	Extremely High Risk
H=	High Risk
M=	Moderate Risk
L=	Low Risk

Job Steps	Hazards	Controls	RAC
Sampling	Bodily injury from sampling tools	• Leather gloves should be worn when handling sharp, rough, or slippery surfaces. • Keep hands and body parts clear of hand drill augers when rotating. • Keep back straight and use foot pedal for leverage when pushing soil coring probe or other tools into surface soil. • Take turns collecting increments to avoid ergonomic stress. • Technicians should perform a pre-operational inspection of their equipment. Do not use any equipment that is unsafe. • Use tools in the correct manner to avoid tool damage and personal injury. • Keep all bystanders, children, and pets out of the work area. • Allow ample space for each employee to work safely. • Allow the tool to do the work by using a grip light enough to maintain control. • Be alert to protruding nails or spikes, concrete barriers, or other buried materials. • Clear walkways work areas of equipment, tools, vegetation, excavated material, and debris • Mark, identify, or barricade other obstructions.	M

Job Steps	Hazards	Controls	RAC
		• The employee is responsible for complying with all applicable HSE training requirements relating to hand and power tool safety and for providing any additional training necessary to complete their tasks safely. • All hand and power tools should be maintained in a safe condition • Tools are to be inspected and tested before use. If a tool is found to be defective, it is to be tagged "Do Not Use" and removed from service until repaired. • Power tools are not to be carried or lowered by the cord or hose. • Disconnect tools from energy sources when not in use, before servicing and cleaning, and when changing accessories such as blades, bits, and cutters. • Do not perform any electrical wiring maintenance unless qualified to do so. • Safety guards on tools are to remain installed while the tool is in use and promptly replaced after repair or maintenance has been performed. • Tools are to be stored properly, where they will not be damaged or come in contact with hazardous materials. • Only use a knife or blade if it is the best tool for the job, a separate AHA has been developed, and hand protection (e.g. Kevlar gloves) is provided. Cut away from the body. • Organize work, sequencing to prevent muscular skeletal, repetitive motion, and cumulative trauma stressors. • Only employees who have been trained in the operation of the particular tool in use should be allowed to operate a powder-actuated tool. Training and certification must be provided to the safety coordinator before using the tool.	
	Generator safety	• If a generator is used to power sampling equipment, inspect the generator for potential leaks. If there are any leaks, do not use generator. • If a generator is used to power sampling equipment, use a ground-fault circuit interrupter. • Always shut down and allow for cooling before refueling the generator. • Use lifting aids when moving the generator. • Use approved safety cans for fuel; keep out of direct sunlight and extreme temperatures.	L
	Contact with potentially contaminated soil and sediment	• Ensure level D PPE (see SSHP) is worn: body PPE, eye protection, and nitrile gloves. • Avoid all contact with product and unprotected skin.	L
	Chemicals spilled or splashed into eyes or spilled on hands	• Handle samples slowly and deliberately. • Follow company policy for transportation of samples. • Seal containers properly so they do not come open when transporting.	L
	Back injury	• Proper lifting techniques must be used when lifting any object. • Plan storage and staging to minimize lifting or carrying distances. • Use mechanical lifting aids whenever possible.	M

Job Steps	Hazards	Controls	RAC
		• Have someone assist with the lifting, especially for heavy or awkward equipment and supplies. • Make sure the path of travel is clear before the lift.	
	SLIPS, Trips, and Fall Hazards	• Be cautious of drilling and sampling equipment laying on the ground. • Maintain good housekeeping. • Beware of uneven ground surface. • Work at a steady pace. • Keep walking paths open to help prevent tripping hazards. • Be aware that escarpments can slough. Avoid these areas. • Exercise caution in relying on rocks and trees or tree stumps to support yourself; many times they are loose. • Whenever possible, switchback your way up and down steep areas, and maintain a slow pace with firm footing. • Employees walking in ditches, swales, and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls, which can result in twisted or sprained ankles, knees, and backs. • Whenever possible, observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed. • If steep terrain must be negotiated, coordinate with HSM to evaluate the need for ladders or ropes to provide stability.	L
	Hand injuries, cuts, and bruises	• Wear protective gloves. • Use hand tools in a safe manner and keep hand tools in good working condition. • Leather gloves should be worn when handling sharp, rough, or slippery surfaces.	L
	Mechanical hazards of sampling around drilling operation, including hammer system and flying debris and objects	• Only authorized personnel are permitted to operate drill rigs. • Stay clear of areas surrounding drill rigs during every startup. • Stay clear of the rotating augers and other rotating components of drill rigs. • Stay as clear as possible of all hoisting operations. Loads should not be hoisted overhead of personnel. • Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair must be restrained. • If equipment becomes electrically energized, personnel should be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party should be contacted to have line de-energized before approaching the equipment. • Smoking around drilling operations is prohibited. • Wear the appropriate PPE when sampling (refer to APP). • Use the appropriate lifting procedures when unloading equipment and sampling. • Allow ample space for personnel to lift/store drilling rods.	M

Job Steps	Hazards	Controls	RAC
		• Avoid movement near rig. Do not place hands near hammer. • If dermal contact with the groundwater and acid used in sample preservation occurs, wash exposed skin thoroughly with soap and water. • Avoid eating and drinking onsite and during sampling. • Use ear plugs during sampling if sampling involves a generator. • The drill rig must be equipped with a kill wire or switch, and personnel are to be informed of its location. • Be aware and stand clear of heavy objects that are hoisted overhead. • The driller is to verify that the rig is properly maintained in accordance with the drilling company's maintenance program. • The driller is to verify that all machine guards are in place while the rig is in operation. • The driller is responsible for housekeeping (maintaining a clean work area). • The drill rig should be equipped with at least one fire extinguisher. • The drill rig should be leveled and stabilized with jacks and adequate cribbing before raising the mast and during drilling operations. Cribbing materials should be made from materials that are capable of supporting the weight of the rig. Care should be taken in muddy, soggy soils, or partially frozen areas. In addition to cribbing, guy wires should be used to improve stability if the rig is located on wet, partially frozen ground, or in areas with loose, caving soil, or in an area subject to frequent gusty winds.	
	Struck by or against heavy equipment	• Wear reflective warning vests when exposed to vehicular traffic. • Isolate equipment swing areas. • Make eye contact with operators before approaching equipment. • Understand and review hand signals.	M
	Falling into surface water	• Employees to wear USCG-approved PFDs if there is a risk of drowning • Inspect PFDs before each shift; do not use damaged items.	L

Equipment to be used	Training Requirements/Competent or Qualified Personnel Names(s)	Inspection Requirements
Hand Tools	40-hour Hazwoper/8-hour refresher First-aid/CPR Bloodborne Pathogens Dangerous Goods Shipping Waste Management Fire Extinguisher	Inspect tools before each use; look for defects; remove damaged and broken tools from service.

ACTIVITY HAZARD ANALYSIS 04, ENVIRONMENTAL SAMPLING (SOIL, SEDIMENT, AND OTHER MEDIA)

	PRINT NAME	**SIGNATURE**	
Supervisor Name:			**Date/Time:**
SSHO Name:			**Date/Time:**
Employee Name(s):			**Date/Time:**
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:

ACTIVITY HAZARD ANALYSIS 06, IDW MANAGEMENT

Activity/Work Task: IDW Management	**Overall Risk Assessment Code (RAC) (Use highest code)**					**M**
Project Location: Kodiak Island	**Risk Assessment Code (RAC) Matrix**					
Contract Number: W911KB-17-D-0017		**Probability**				
Date Prepared: November 2019	**Severity**	**Frequent**	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Prepared by: John Culley	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
Reviewed by:	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Notes: (Field Notes, Review Comments, etc.)	**Step 1: Review each Hazard with identified safety Controls and determine RAC (See above)**		
	Probability is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely	**RAC Chart**	
	Severity is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible	**E=**	**Extremely High Risk**
		H=	**High Risk**
	Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each Hazard on AHA. Annotate the overall highest RAC at the top of AHA.	**M=**	**Moderate Risk**
		L=	**Low Risk**

Job Steps	Hazards	Controls	RAC
General Site Hazards	Site access/security: access to the area requires that personnel coordinate with Base RPM, public affairs, housing, and the residents	• Site access will be coordinated with all required personnel at least 1 week before the start of fieldwork. Carry a copy of the approved letter at all times. • Secure work areas with cones, caution tape, or both as necessary to maintain site control and prevent unauthorized access.	L
	Slips, trips, and falls	• Clear walkways of equipment; maintain good housekeeping. • Mark, identify, or barricade other obstructions. • Do not run. • Move carefully when travelling over slippery or wet surfaces (especially wet metal plates, smooth surfaces, and where traction/footing could be lost • Maintain good housekeeping around work areas. Care MUST be taken to reduce the potential for FOD on the helicopter landing pad. • Maintain high visibility onsite by using high-visibility (orange) vests or coveralls, high-visibility cones, yellow construction tape, and similar to demarcate work zones.	L

Job Steps	Hazards	Controls	RAC
		• Be aware of the activities and machinery around the work.	
	Strains from material, bucket, and drum handling	• No individual employee is permitted to lift any object that weighs over 40 pounds. Multiple employees using proper lifting techniques or the use of mechanical lifting devices are required for lifting objects over the 40-pound limit. • Personnel should be directed to use proper lifting techniques such as keeping back straight, lifting with legs, limiting twisting, getting help in moving bulky or heavy loads, and using mechanical equipment to move material and equipment. • Personnel should make sure the path of travel is clear before moving to prevent awkward or unbalanced lifting of the load. • Drum-dolly, cart, or hand-truck use should be encouraged. • Personnel should work at a steady pace and avoid sharp, awkward movements, especially while carrying a load. • Steel-toed boots, safety glasses, and leather gloves should be worn.	M
IDW handling, storage, and sampling	Sharp objects and hand tools	• Wear cut-resistant gloves when the possibility of lacerations or other injury may be caused by sharp edges or other objects. • Maintain all hand and power tools in a safe condition. • Use the appropriate tool for task.	M
	Pinch injuries when opening and closing drum lid	• Keep fingers away from pinch points when opening or closing the drum lid.	L
	Exposure to contaminants	• Physical contact with contaminated media or hazardous chemicals should be avoided by using the proper PPE and respirator protection as specified in the SSHP. • Personnel who sustain skin contact should immediately wash the affected area with soap and water (eyes should be irrigated for 15 minutes with potable water) and report the incident to the SSHO or site superintendent. Use proper decontamination procedures for personnel and sample equipment. • Air monitoring should be performed in areas where there is the possibility of elevated concentrations of toxic chemicals, flammable vapors, or oxygen deficient atmospheres. Personnel should immediately notify the SSHO or site superintendent if odors are detected. Administrative controls, upgraded PPE, or both will be implemented. • Do not eat or drink during the sampling. • Use proper hygiene techniques after handling IDW and before eating, drinking, smoking, or using the restroom.	L
	Using hand tools	• Technicians should perform a pre-operational inspection of their equipment. Do not use any equipment that is unsafe.	M

Job Steps	Hazards	Controls	RAC
		• Never use a tool to do a job it was not designed to do. • Use tools in the manner for which they are designed to avoid tool damage and personal injury. • Keep all bystanders, children, and pets out of the work area. • Allow ample space for each employee to work safely • Prevent back injuries and take frequent breaks to avoid ergonomic stress. • Allow the tool to do the work by using a grip light enough to maintain control. • Be alert to protruding nails or spikes, concrete barriers, or other buried materials. • Clear walkways work areas of equipment, tools, vegetation, excavated material and debris • Mark, identify, or barricade other obstructions • The employee is responsible for complying with all applicable HSE training requirements relating to hand and power tool safety and for providing any additional training necessary to complete their tasks safely. • Operate all tools according to the manufacturer's instructions and within design limitations. • All hand and power tools should be maintained in a safe condition • Tools are to be inspected and tested before use, if a tool is found to be defective, tag it "Do Not Use" and remove from service until repaired • PPE, such as gloves, safety glasses, earplugs, and face shields are to be used when exposed to a hazard from the tool. • Power tools are not to be carried or lowered by the cord or hose. • Disconnect tools from energy sources when not in use, before servicing and cleaning, and when changing accessories such as blades, bits, and cutters. • Safety guards on tools are to remain installed while the tool is in use and promptly replaced after repair or maintenance has been performed. • Tools are to be stored properly, where they will not be damaged or come in contact with hazardous materials. • If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications. • Only use a knife or blade if it is the best tool for the job, a separate AHA has been developed, and hand protection (e.g. Kevlar gloves) is provided. Cut away from the body. • As alternatives to manual and pistol-grip hand tools that involve work with highly repetitive movement, extended elevation, constrained postures, or positioning of body members (e.g., hand, wrist, arm, shoulder, or neck):	

Job Steps	Hazards	Controls	RAC
		• Consider alternative tool design • Improve posture • Select appropriate materials • Organize work—sequencing to prevent muscular skeletal, repetitive motion, and cumulative trauma stressors • Only employees who have been trained in the operation of the particular tool in use should be allowed to operate a powder-actuated tool—training and certification must be provided to the SSHO before using the tool.	

Equipment to be used	Training Requirements/Competent or Qualified Personnel Names(s)	Inspection Requirements
Drum truck or drum dolly	Inspect instrument body for damage.	Review AHA before using.
Hand Tools	Review operator's manual, receive on-the-job training	Inspect before use, red tag and remove if found defective.
Photoionization detector and other devices	HAZWOPER	Test each morning with proper calibration. Have a backup meter, fully charge batteries night before each day's use.

ACTIVITY HAZARD ANALYSIS 06, IDW MANAGEMENT

	PRINT NAME	**SIGNATURE**	
Supervisor Name:			**Date/Time:**
SSHO Name:			**Date/Time:**
Employee Name(s):			**Date/Time:**
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:
			Date/Time:

EXHIBIT C1-8

Safety Data Sheets

(To be provided with onsite copy)

This page intentionally blank