NPDES Compliance Inspection Manual

EPA Publication Number: 305-K-17-001
Interim Revised Version, January 2017

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Disclaimer

This Inspection Manual is an inspection support tool provided by the U.S. Environmental Protection Agency (EPA) for use by field personnel conducting inspections under the Clean Water Act (CWA) National Pollutant Discharge Elimination System (NPDES) programs. The statements in this document are intended solely as guidance. The statutory provisions and EPA regulations described in this document contain legally binding requirements. This Inspection Manual is not a regulation and, therefore, does not add, eliminate or change any existing regulatory requirements. While EPA has made every effort to ensure the accuracy of the discussion in this guidance, the obligations of the regulated community are determined by statutes, regulations, or other legally binding requirements. In the event of a conflict between the discussion in this document and any statute or regulation, this document would not be controlling.

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This version of the NPDES Compliance Inspection Manual is released as an interim version in order to allow time for inspectors to use the Manual and provide feedback to EPA's Office of Enforcement and Compliance Assurance (OECA). OECA is interested in user comments that will enhance a future final version of the Manual. In addition, as OECA's efforts with states through E-Enterprise continue, this Interim Revised NPDES Compliance Inspection Manual will inform development of Smart Tools software and hardware for NPDES inspectors to use in the field.

Please send your comments on this Interim Revised NPDES Compliance Inspection Manual to OECA at NPDEScompliance@epa.gov by December 31, 2017.

Contents

Contents (Continued)

Contents (Continued)

Contents (Continued)

Contents (Continued)

Contents (Continued)

Contents (Continued)

Contents (Continued)

Contents (Continued)

Appendices

Contents (Continued)

List of Tables

List of Tables (Continued)

List of Exhibits

CHAPTER 1 – INTRODUCTION

Contents

List of Tables

List of Exhibits

Associated Appendices

A. EPA Order 3500.1, Training and Development for Individuals who lead Compliance Inspections/Field Investigations.
B. EPA Order 3510, EPA Federal Credentials for Inspections and Enforcement of Environmental Statutes.
C. EPA Order 1440.2, Health and Safety Requirements for Employees Engaged in Field Activities.

A. PURPOSE AND OBJECTIVES

Compliance monitoring is a cornerstone of the Environmental Protection Agency's (EPA's) program to achieve clean water. The primary goal of EPA compliance monitoring efforts, such as on-site inspections, is to ensure and document whether entities regulated under the National Pollutant Discharge Elimination System (NPDES) and pretreatment programs are complying with their Clean Water Act (CWA) obligations. EPA's NPDES inspection program identifies and documents noncompliance, supports authorized state NPDES programs, supports the enforcement process, monitors compliance with enforcement orders and decrees, establishes presence in the regulated community, deters noncompliance, supports the permitting process, and furthers the broad watershed protection and restoration goals of the NPDES program. The purpose of this guidance is to provide inspectors with an in-depth knowledge of the NPDES inspection process.

EPA inspects NPDES facilities where we directly implementation the program (e.g., in states without NPDES program authorization and in Indian country). In addition, EPA sometimes conducts inspections in states with NPDES program authorization at the request of states to complement the state's own inspection efforts and to respond to tips or complaints. EPA regions and states communicate closely throughout the year on inspection planning and targeting to maintain a strong NPDES compliance monitoring program.

Throughout this Manual, EPA has made every effort to avoid references to or identification of particular facilities. Any specific examples of noncompliance found in the Manual are offered as facts with the goal of helping inspectors be well-prepared to conduct thorough inspections that support the enforcement process. Such examples are not a statement about any one facility's compliance status or the adequacy of the authorized state's compliance monitoring program.

Routine EPA NPDES compliance inspections should be performed in a manner designed to:

- Determine compliance status with regulations, permit conditions, and other program requirements.
- Verify the accuracy of information submitted by permittees.
- Verify the adequacy of sampling and monitoring conducted by the permittee.

Other purposes of compliance inspections include:

- Gathering evidence to support enforcement actions
- Obtaining information that supports the permitting process
- Assessing compliance with orders or consent decrees

B. INSPECTION TYPES

This manual provides guidance applicable to each type of inspection an NPDES inspector may be required to conduct at an NPDES permitted facility or an unpermitted facility with discharges. Specifically, this manual provides information and references on the components

necessary to complete the various types of NPDES inspections. Many of the chapters also include checklists. An inspector should not rely solely on the checklist, but use it as one of the tools when conducting an inspection and evaluating compliance. The different types of inspections are described below.

COMPLIANCE EVALUATION INSPECTION (CEI)

The CEI is a non-sampling inspection designed to verify permittee compliance with applicable permit self-monitoring requirements, effluent limits, effluent toxicity, and compliance schedules. Inspectors should review records, make visual observations, and evaluate treatment facilities, laboratories, effluents, and receiving waters. During the CEI, the inspector must examine both chemical and biological self-monitoring, which form the basis for all other inspection types except the Reconnaissance Inspection.

COMPLIANCE SAMPLING INSPECTION (CSI)

The CSI is a sampling inspection designed with the same objectives as a CEI. The inspector conducts the same tasks for a CSI as for a CEI, with the additional task of taking and analyzing representative samples. Inspectors can then verify the accuracy of the permittee's self-monitoring program and reports through chemical and/or bacteriological analysis, determine compliance with discharge limitations and Whole Effluent Toxicity (WET) permit requirements, determine the quantity and quality of effluents, and provide evidence for enforcement proceedings where appropriate.

PERFORMANCE AUDIT INSPECTION (PAI)

The inspector conducts a PAI to evaluate the permittee's self-monitoring program. As with a CEI, the PAI verifies the permittee's reported data and compliance through a records check. However, the PAI provides a more resource-intensive review of the permittee's self-monitoring program and evaluates the permittee's procedures for sample collection, flow measurement, chain-of-custody, laboratory analyses, data compilation, reporting, and other areas related to the self-monitoring program. In a CEI, the inspector makes a cursory visual observation of the treatment facility, laboratory, effluents, and receiving waters. In a PAI, the inspector observes the permittee performing the self-monitoring process from sample collection and flow measurement through laboratory analyses, data workup, and reporting. The PAI does not include the collection of samples by the inspector. However, the inspector may require the permittee to analyze performance samples for laboratory evaluation purposes.

OFF-SITE DESK AUDIT

An Off-site Desk Audit is a comprehensive off-site compliance evaluation of information, data, records, and facility reports to make a facility-level or program-level (for pretreatment and Municipal Separate Storm Sewer Systems) compliance determination. Routine off-site compliance monitoring activities, such as reviewing self-monitoring reports or records of phone calls with the facility, are not enough to be considered an off-site desk audit. An Off-site Desk Audit may include review of agency-gathered testing, sampling and ambient monitoring data, responses to CWA section 308 requests, compliance deliverables submitted pursuant to permits or enforcement orders, remote sensing, aerial or satellite images, Discharge Monitoring

Reports (DMRs), annual reports, conversations with facilities, and tips and complaints. In conducting an Off-site Desk Audit, regions and states may utilize video conferencing with facility personnel to gather additional information as they conduct their evaluation. For example, video conferencing could enable the auditor to join facility personnel on a virtual walking tour of all or part of the facility. The Off-site Desk Audit must be performed by an authorized inspector (consistent with appropriate federal, state, or tribal authority) or other credible regulator (i.e., an individual designated by the EPA or state/local/tribal agency with sufficient knowledge, training, or experience to assess compliance). This individual should select the candidate for the Off-site Desk Audit based on personal knowledge of the facility, in conjunction with information from DMRs, other reports, and prior on-site inspections, and have adequate information about the facility's activities to make a compliance determination.

COMPLIANCE BIOMONITORING INSPECTION

This inspection includes the same objectives and tasks as a CSI. A Compliance Biomonitoring Inspection reviews a permittee's toxicity bioassay techniques and records maintenance to evaluate compliance with the biomonitoring terms of the NPDES permit and to determine whether the permittee's effluent is toxic. The Compliance Biomonitoring Inspection also includes the collection of effluent samples by the inspector to conduct acute and chronic toxicity testing to evaluate the biological effect of a permittee's effluent discharge(s) on test organisms. Each state should be able to conduct biomonitoring inspections, have a designated contractor to conduct inspections, or have an equivalent program to independently verify a discharger's compliance with Whole Effluent Toxicity permit requirements.

TOXICS SAMPLING INSPECTION

A Toxics Sampling Inspection has the same objectives as a conventional CSI. However, it emphasizes toxic substances regulated by the NPDES permit. The Toxics Sampling Inspection covers priority pollutants other than heavy metals, phenols, and cyanide, which are typically included in a CSI (if regulated by the NPDES permit). A Toxics Sampling Inspection uses more resources than a CSI because sophisticated techniques are required to sample and analyze toxic pollutants. A Toxics Sampling Inspection may also evaluate raw materials, process operations, and treatment facilities to identify toxic substances requiring controls.

DIAGNOSTIC INSPECTION

The Diagnostic Inspection primarily focuses on Publicly Owned Treatment Works (POTWs) that have not achieved permit compliance. POTWs that are having difficulty diagnosing their problems are targeted. The purposes of the Diagnostic Inspection are to identify the causes of noncompliance, suggest immediate remedies that will help the POTW achieve compliance, and support current or future enforcement action.

RECONNAISSANCE INSPECTION (RI)

The RI is an on-site inspection that can be conducted with or without sampling and is used to obtain a preliminary overview of a permittee's compliance program. The inspector performs a brief visual inspection of the permittee's treatment facility, effluents, and receiving waters. The RI uses the inspector's experience and judgment to quickly summarize any potential compliance

problems. The objective of the RI is to expand inspection coverage without increasing inspection resources. The RI is the briefest and least resource intensive of all NPDES inspections.

PRETREATMENT COMPLIANCE INSPECTION (PCI)

The PCI evaluates the POTW's implementation of its approved pretreatment program. It includes a review of the POTW's records on monitoring, inspections, and enforcement activities for its industrial users (IUs). The PCI may be supplemented with IU inspections. An IU inspection is an inspection of any IU that discharges to the POTW.

While conducting a PCI, the region or state should ensure that the POTW is following its Enforcement Response Plan when the POTW identifies IU noncompliance. The PCI should include an appropriate number of IU inspections or site visits to evaluate the control authority oversight procedures and to assess accurate application of categorical pretreatment standards. The PCI can include IU sampling, depending on the reason for the inspection. For example, samples may be collected and analyzed to verify the industrial user's self-monitoring program. Inspectors may prefer to conduct the PCI concurrently with an NPDES inspection of the POTW. For additional information on the steps involved in conducting a PCI, see EPA's *Guidance for Conducting a Pretreatment Compliance Inspection* (EPA, 1991), available at http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=50000629.txt.

Noted that a related type of review procedure, the pretreatment audit, is also performed by Approval Authorities. The pretreatment audit is not covered in depth in this manual because it is a program management tool, not an NPDES compliance inspection. The Pretreatment Audit is defined and discussed in the *Control Authority Pretreatment Audit Checklist and Instructions* (EPA, 2010), available at https://www3.epa.gov/npdes/pubs/final_pca_checklist_and_instructions_%20feb2010.pdf.

FOCUSED COMPLIANCE INSPECTION (FCI)

The FCI is an on-site inspection that evaluates compliance for one or more specific portions of a facility (e.g., specific operation or process stream), permit or program (e.g., a pretreatment control authority's oversight of industrial users) to make a compliance determination. A fact-driven analysis determines whether a comprehensive inspection or an FCI is appropriate for the particular facility. Some industries that typically require full process-based inspections may not qualify for an FCI. The scope of an FCI should be informed by the facility's compliance history, information about recent changes in the facility's operation, and other data that indicates a portion of the program or facility that is more likely to have associated compliance issues.

An FCI is more detailed than an RI, but not as comprehensive as a CEI, CSI, DI, or PCI. Although the scope of an FCI is narrower than a CEI, the level of detail required for the portion of the facility, permit or program aspect reviewed should be comparable to the level of detail required for a CEI. An RI, which only requires a preliminary overview of a permittee's compliance program and brief inspection of the facility, does not qualify as an FCI.

FOLLOW-UP INSPECTION (FUI)

The FUI is a resource intensive inspection conducted when a routine inspection or complaint identifies a compliance problem. For an FUI, the appropriate resources are assembled to deal effectively with a specific enforcement problem. A Legal Support Inspection (LSI) is a type of follow-up inspection that is appropriate when an enforcement problem has been identified during a routine inspection or in response to a complaint. An LSI focuses on a collecting information that may be used in an enforcement action. Information gathered during the inspection may be used to determine the appropriate enforcement action.

SEWAGE SLUDGE/BIOSOLIDS INSPECTION

The objective of a Sewage Sludge/Biosolids Inspection is to assess facilities engaged in a regulated sludge or biosolids activity (see 40 CFR Part 503) to evaluate compliance with applicable regulatory provisions, including sludge monitoring, recordkeeping and reporting, treatment operations, sampling and laboratory quality assurance, and use or disposal practices. Sewage Sludge/Biosolids Inspection are on-site activities that may be conducted in conjunction with compliance inspections at major and non-major POTWs. The PCI, CEI, and PAI are the most likely vehicles for evaluating compliance with sludge requirements.

SIGNIFICANT INDUSTRIAL USER (SIU) INSPECTION

The SIU Inspection of an indirect discharger is performed where agencies are acting as the pretreatment control authority pursuant to 40 CFR 403.10 in the absence of a local POTW with an approved pretreatment program, or where EPA or the state is otherwise performing oversight. The SIU Inspection is an on-site activity that includes a close review of the indirect discharge permit and the SIU's compliance, recordkeeping, and reporting since the last inspection. The pretreatment regulations provide that state and local control authorities must conduct sampling inspections of all SIUs at least annually to evaluate compliance with applicable pretreatment standards independent of the IU's self-monitoring reports (see 40 CFR 403.8(f)).

COMBINED SEWER OVERFLOW (CSO) INSPECTION

During a CSO inspection, the inspector conducts an on-site inspection in response to information received regarding a known or suspected overflow event. A CSO inspection evaluates compliance with the CWA and CSO Policy requirements as written in the NPDES permit, an enforcement order, a consent decree, or another enforceable document. The inspector should verify whether the permittee is preventing CSOs during dry weather, implementing the nine minimum controls, adhering to a schedule for development, submission, and implementation of a long-term CSO control plan, eliminating or relocating overflows to sensitive areas, adhering to effluent limitations, implementing a post-construction compliance monitoring program, and complying with the terms of any consent decrees or enforcement orders.

SANITARY SEWER OVERFLOW (SSO) INSPECTION

During an SSO Inspection, the inspector conducts an on-site inspection in response to information received regarding a known or suspected overflow event. An SSO Inspection evaluates compliance with NPDES permit terms and conditions for system design, operation and maintenance, permit reporting requirements, an enforcement order, a consent decree, or another enforceable document. The inspector collects information to verify that the permittee is complying with the NPDES standard permit conditions (duty to mitigate and proper operation and maintenance) and the required notification procedures. The inspector also determines whether there have been any additional unpermitted discharges, or discharges from a location other than the discharge point specified in the permit, to waters of the United States. When preparing for an SSO Inspection, the inspector should consider Office of Enforcement and Compliance Assurance's *Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems* (EPA, 2005), available at http://www.epa.gov/npdes/pubs/cmom_guide_for_collection_systems.pdf.

STORMWATER INSPECTION

Stormwater inspections at industrial facilities and construction sites are designed to evaluate compliance with NPDES permits for stormwater discharge. A stormwater inspection may also evaluate whether an industrial facility or construction site has obtained NPDES permit coverage if required. Most NPDES permits for construction sites and industrial facilities require the development of a site-specific Stormwater Pollution Prevention Plan (SWPPP) to document how the facility intends to comply with the terms and conditions of the permit, including effluent limits. During the on-site inspection, the inspector reviews the permit and the measures described in the SWPPP to evaluate whether the facility is following its plan for complying with the permit. The inspector also reviews records, such as self-inspection reports, to verify that the facility is complying with its permit and following the SWPPP, and walks the site to verify that the SWPPP is accurate and Best Management Practices (BMPs) are in place and functioning properly.

Construction Stormwater Inspection

Construction site stormwater inspections ensure that regulated facilities have an NPDES permit for stormwater discharge and all relevant controls are implemented and actions are taken at construction sites to prevent pollutants and sediment in stormwater from impacting water quality. The required controls and actions are listed in the permit and typically include required BMPs, documented self-inspections, BMP maintenance, and prohibitions on specific discharges. An inspector must also determine the adequacy of stormwater quality control measures.

Industrial Stormwater Inspection

Industrial facility stormwater inspections ensure that the facility has appropriate NPDES stormwater permit coverage, and that adequate best management practices are utilized at regulated industrial facilities to minimize the discharge of pollutants in stormwater. In general, the inspection will focus on areas related to manufacturing, processing, or raw material storage at an industrial plant. Examples include, but are not limited to, industrial plant yards, material handling sites, refuse sites, shipping and receiving areas, and manufacturing buildings. These

inspections also include evaluation of other permit requirements, such as documented self-inspections, visual monitoring, and sampling.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) AUDIT

An MS4 Audit is used to evaluate overall MS4 stormwater management program implementation, and identify problems the local government may have in implementing the program. MS4 Audits involve an on-site visit and comprehensive review of the MS4 owner/operators stormwater management program including the legal authority, procedures, implementation of procedures, and adequate resources, where applicable, for the following program elements: (1) structural and source control measures; (2) detection and removal of illicit discharges and improper disposal into storm sewers; (3) monitoring and controlling pollutants in stormwater discharges; (4) implementing and maintaining structural and nonstructural best management practices (BMPs); (5) implementation schedules and assignment of appropriate individuals; (6) the inspection and enforcement program for covered industrial facilities and construction sites; and (7) the dry weather screening program. The auditor should decide whether controls are in place and in good working order, and whether facilities have schedules for construction of structural control measures.

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) INSPECTION

An MS4 Inspection is an on-site inspection that involves reviewing some, but not all, elements of the MS4 stormwater management program to evaluate whether the MS4 is implementing an adequate program in the selected program elements. The program elements would be selected by the region or a state after review of the MS4 permit and other relevant information. See the MS4 Audit description for program elements.

CONCENTRATED ANIMAL FEEDING OPERATION (CAFO) INSPECTION

The objective of this inspection is to evaluate compliance with applicable regulations and permit requirements. To evaluate compliance with requirements and regulations, a CAFO inspection involves review of facility documents and records, such as the facility's permit, nutrient management plan, animal inventory, and all associated records. The on-site inspection also includes assessing the structural integrity, maintenance condition, and storage availability of the facility. For CAFOs that land-apply manure, litter, or process wastewater, the CAFO inspection will include review of in-field and edge-of-field conservation practices, land application protocols and all other factors relevant to determining whether the CAFO has non-agricultural stormwater discharges from land application areas. Where appropriate, CAFO inspections may include sampling of manure, litter, wastewater, and/or soil. A CAFO inspection may also require collection of information necessary to establish whether the receiving water of any CAFO discharge is a water of the United States.

SUMMARY

Compliance personnel should choose the type of inspection to be conducted based on the compliance status of the facility, the information needed from the facility, the type of facility involved, data about the quality of the receiving water, etc. The type of inspection selected will inform what activities will be conducted on-site, such as what additional information the

inspector will gather or verify during the inspection. Where feasible, compliance personnel should perform background and records reviews prior to going on-site to streamline on-site activities and to utilize resources more efficiently. Note that some types of NPDES inspections may encompass several elements from multiple inspection types (e.g., a stormwater inspection may encompass elements from both a CSI and a PAI).

C. LEGAL AUTHORITY FOR NPDES INSPECTIONS

The Federal Water Pollution Control Act of 1956, as amended by the Clean Water Act (CWA) of 1972 and the Water Quality Act of 1987, gives EPA the authority to regulate the discharge of pollutants to waters of the United States. The CWA provides broadly defined authority to establish the NPDES Permit Program, define pollution control technologies, establish effluent limitations, obtain information through reporting and compliance inspections, and take enforcement actions (both civil and criminal) when violations of the CWA occur. Table 1-1 lists applicable NPDES statutes and regulations.

INSPECTION AUTHORITY

Section 301 of the CWA prohibits the discharge of pollutants, unless the discharge complies with, among others, section 402 of the CWA. Under section 402 of the CWA, point source dischargers of pollutants (e.g., municipal wastewater treatment plants, industries, animal feedlots, aquatic animal production facilities, and mining operations) must apply for and receive a permit that sets specific limits and operating conditions to be met by the permittee. To determine whether a person is complying with the prohibition in section 301 of the CWA, section 308 authorizes inspections, monitoring, and information gathering. Relevant to this manual, section 308 of the CWA provides for two types of monitoring:

- Self-monitoring and reporting
- Monitoring by EPA or the state

Accordingly, EPA or authorized states may conduct an inspection, including stormwater, biosolids, combined sewer overflows, sanitary sewer overflows, concentrated animal feeding operations, or pretreatment inspections, to verify compliance with an existing NPDES permit or to determine if discharges are occurring without authorization.

STATE PROGRAM AUTHORITY

Section 402 of the CWA allows EPA to authorize states to administer the NPDES program, including permit issuance, compliance monitoring, and enforcement. EPA retains its enforcement authority, even in authorized states. Federal regulations require EPA and authorized states to enter formal cooperative agreements to ensure timely, accurate monitoring of compliance with permit conditions, among other things. States may implement requirements and regulations that are more stringent or broader in scope than those under the CWA.

Table 1-1. NPDES-Related Statutes and Regulations

Topic	Reference	
	CWA[a] Section	40 CFR[b] Section
Federal NPDES Permit Program	402	122
State Program	510	123
Inspections, Records, and Reports	308	122,123
Technology Standards	304, 306	125
Electronic Reporting of NPDES Information From NPDES-Regulated Facilities	304	127
Toxic Pollutant Effluent Standards	307	129
Water Quality Planning and Management	303, 305	130
Water Quality Standards	303	131
Secondary Treatment Regulations	402	133
Sludge Management	405	257, 501, 503
Pretreatment Standards	307, 402	403
Effluent Guidelines	301, 302	405–471

[a] Clean Water Act.

[b] Code of Federal Regulations, revised as of July 1, 2012.

D. RESPONSIBILITIES OF THE EPA NPDES INSPECTOR

The primary role of an NPDES inspector is to gather information that can be used to determine the reliability of the permittee's self-monitoring data and evaluate compliance with permit conditions, applicable regulations, and other requirements. The NPDES inspector also plays an important role in case development and support. To fulfill these roles, inspectors are required to know and use policies and procedures for effective inspection and evidence collection, accepted safety practices, and quality assurance standards.

INDIAN COUNTRY INSPECTIONS

Each regional inspector should understand and apply the *EPA Policy for the Administration of Environmental Programs on Indian Reservations* (Indian Policy—EPA, 1984a) and their region's policies and procedures when conducting inspections in Indian country. EPA's Indian Policy is available at https://www.epa.gov/tribal/epa-policy-administration-environmental-programs-indian-reservations-1984-indian-policy. States and tribal governments that conduct inspections should follow the requirements outlined in EPA's guidance memorandum entitled *Guidance for Issuing Federal EPA Inspector Credentials to Authorize State/Tribal Governments to Conduct Inspections on Behalf of EPA* (EPA, 2004) available at https://www.epa.gov/compliance/guidance-issuing-federal-epa-inspector-credentials-authorize-employees-statetribal.

Inspectors should research applicable policy and procedures when performing inspections in Indian country. If a facility is owned or managed by a tribal government or owned and managed by a private party, EPA generally will notify tribal governments in advance of visiting a reservation and will inform the tribal government of the results of each inspection. If advance notice is not possible due to circumstances beyond the control of the EPA inspector or if the visit involves an unannounced inspection, the tribal government should be contacted as soon as possible. EPA should address out-of-compliance facilities that are in Indian country (and/or owned or managed by a tribal government) in a manner consistent with the Indian Policy and EPA's *Guidance on the Enforcement Principles Outlined in the 1984 Indian Policy*, (EPA, 2001). Enforcement guidance is located at https://www.epa.gov/enforcement/transmittal-final-guidance-enforcement-principles-outlined-1984-indian-policy-january-17.

Regions should also be familiar with the American Indian Environmental Office's website www.epa.gov/tribal. EPA Indian program contacts can help identify facilities in Indian country. Their contact information is located at https://www.epa.gov/tribal/forms/contact-us-about-environmental-protection-indian-country. Please be aware that while it is often very difficult to identify these facilities, EPA should still follow the applicable guidance concerning working with tribes.

LEGAL RESPONSIBILITIES

Inspectors must conduct all inspection activities within the legal framework established by the CWA, including:

- Presenting proper credentials
- Properly handling confidential business information (CBI)

Inspectors also must be familiar with the conditions of the specific permit, CWA, and regulations.

PROCEDURAL RESPONSIBILITIES

Inspectors must be familiar with general inspection procedures and evidence collection techniques to ensure adequate inspections and to avoid endangering potential legal proceedings on procedural grounds.

INSPECTION PROCEDURES

Inspectors should observe standard procedures for conducting each inspection element. The elements of the inspection process listed in Table 1-2 are common to most NPDES compliance inspections. They are grouped by the major inspection activities:

- Pre-inspection preparation
- Entry
- Opening conference
- Facility inspection
- Closing conference

- Inspection report

Table 1-2. Inspector's Responsibilities

Pre-inspection preparation—Establish purpose and scope of inspection.
• Review background information and EPA/state records, including permit and permittee compliance file.
• Develop plan for inspection.
• Prepare documents and equipment, including appropriate safety equipment.
• Coordinate schedule with laboratory if samples are to be collected.
• Coordinate schedule with other appropriate regulatory authorities.
• Contact party responsible for sample transportation for packing/shipping requirements.
• Ensure state/tribe is notified of pending inspection.
Entry—Establish legal entry to facility.
• Identify self and present official credentials to the responsible official.
• If denied entry, call your supervisor/Office of Regional Counsel.
Opening conference—Orient facility officials to inspection plan.
• Discuss inspection objectives and scope.
• Establish working relationship with facility officials.
Facility inspection—Document compliance/noncompliance with permit conditions; collect evidence including photographs and copies of records.
• Conduct visual inspection of facility.
• Review facility records.
• Inspect monitoring location, equipment, and operations.
• Collect samples, if appropriate.
• Review laboratory records for QA/QC and use of approved methods.
• For on-site analysis, review laboratory procedures to verify analytical methodology and use of approved methods.
• Document inspection activities.
Closing conference—Conclude inspection.
• Collect additional or missing information.
• Clarify questions with facility officials.
• Prepare necessary receipts.
• Review inspection findings and inform officials of follow-up procedures.
• Issue deficiency notice, if appropriate.
Inspection report—Organize inspection findings in a report with field notes, copies of records, photographs, and other relevant information.
• Prepare narrative report, checklists, and documentary information as appropriate. • Enter appropriate data into ICIS, including inspection type data that may be collected on the 3560 Report Form.
• Sign and date the report.

Evidence Collection

Inspectors must be familiar with general evidence gathering techniques. Because the government's case in a civil, criminal, or administrative enforcement action depends on the evidence gathered, inspectors must keep detailed records of each inspection. These notes and

documentation will be used for preparing the inspection report, determining the appropriate enforcement response, and giving testimony in an enforcement case.

Inspectors must know how to:

- Substantiate facts with items of evidence, including samples, photographs, document copies, statements from witnesses, and personal observations.
- Evaluate what evidence should be collected (routine inspections).
- Follow chain-of-custody procedures.
- Collect and preserve evidence consistent with Chapter 5, "Sampling."
- Write clear, objective, and informative inspection reports.

Inspection procedures are discussed in detail in Chapter 2 of this manual.

TRAINING AND CREDENTIALING RESPONSIBILITIES

Training and credential requirements for inspectors are provided in EPA Order 3500.1, *Training Requirements for EPA Personnel Who Are Authorized to Conduct Civil Compliance Inspections/Field Investigations* (Appendix A) and EPA Order 3510, *EPA Federal Credentials for Inspections and Enforcement of Environmental Statutes* (Appendix B). To obtain and maintain inspector credentials, inspectors and their first-line supervisors must certify that the inspector has completed all required training and maintain copies of all required training documentation.

Training

EPA Order 3500.1 establishes consistent EPA-wide training and development programs for employees to conduct environmental compliance inspections/field investigations to ensure that they have working knowledge of regulatory requirements, inspection methodology, and health and safety measures. Those who conduct environmental compliance inspections/field investigations must be properly trained to perform these functions in a legally and technically sound manner. Training required by the Order consists of two parts: Basic Inspector Curriculum and Program-Specific Curriculum (Appendix A). In addition, annual refresher training is required. Inspectors must also complete the required Occupational Health and Safety Curriculum per EPA Order 1440.2 (Appendix C).

Inspector training courses will also be available to federal, state, local, and tribal environmental enforcement personnel, including contractor employees and Senior Environmental Employee enrollees.

Credentialing

EPA Order 3510 addresses roles and responsibilities to issue and manage inspector credentials and letters of authorization, which are provided to employees of EPA, states, tribes, territories, contractors, grantees (e.g., Senior Environmental Employment Program Enrollees (SEE)), and employees of other federal agencies who are authorized by EPA to conduct inspections or investigations and take samples on EPA's behalf. The order states that credentials are issued to qualified individuals who have met the minimum inspector training requirements outlined in EPA Order 3500.1, health and safety requirements outlined in EPA Order 1440.2, and any

subsequent Orders or Guidelines addressing health and safety requirements. Employee credential holders are responsible for:

- Complying with internal policies for training and background investigation.
- Using credentials only for authorized, official duties.
- Safeguarding their credentials.
- Returning credentials to the Program or Regional Office when they expire or when no longer responsible for conducting EPA inspections.
- Adhering to applicable EPA CBI regulations and program-specific CBI requirements.
- Completing annual refresher training, keeping records of training completion dates, and providing the information to first-line supervisors as required.

SAFETY RESPONSIBILITIES

The inspection of wastewater and other environmental pollution control facilities always poses a certain degree of health and safety risk. To avoid unnecessary risks, the inspector should be familiar with all safety obligations and practices. The safety equipment and procedures required for an inspector will be based on either standard safety procedures or the site-specific information from the facility. Inspectors should do the following:

- Use safety equipment in accordance with available guidance and labeling instructions.
- Maintain safety equipment in good condition and proper working order.
- Dress appropriately for the activity and wear appropriate protective clothing. For example, appropriate protective gloves should be worn during sample collection to protect the inspector and to prevent the potential for sample contamination. Disposable gloves are preferred to assure that no cross contamination occurs between sampling points.
- Use any safety equipment customary in the establishment being inspected (e.g., hard hat or safety glasses).
- Never enter confined spaces unless properly trained, equipped, and permitted (if applicable).

For any safety-related questions not covered in this manual, the inspector should comply with the facility's current approved safety requirements for greater detail if one is available. An inspector should look at Appendix C to locate EPA's Order 1440.2, *Health and Safety Requirements for Employees Engaged in Field Activities*.

PROFESSIONAL RESPONSIBILITIES

Inspectors are expected to perform their duties with the highest degree of professionalism. Procedures and requirements ensuring ethical actions have been established through many years of government inspection experience. The procedures and standards of conduct listed below have evolved for the protection of the individual and EPA, as well as industry.

- All inspections are to be conducted within the framework of the U.S. Constitution and with due regard for individual rights regardless of race, sex, religion, or national origin.
- EPA inspectors are to conduct themselves at all times in accordance with the regulations prescribing employee responsibilities and conduct.
- The facts of an inspection must be noted and reported completely, accurately, and objectively.
- During an inspection, any act or failure to act motivated by private gain is illegal. Actions that could be construed as such should be scrupulously avoided.
- A continuing effort should be made to improve professional knowledge and technical skill in the inspection field.

PROFESSIONAL ATTITUDE

The inspector is a representative of EPA and is often the initial or only contact between EPA and the permittees. In dealing with facility representatives and employees, inspectors must be professional, tactful, courteous, and diplomatic. A firm but responsive attitude will encourage cooperation and initiate good working relations. Inspectors should always speak respectfully of any product, manufacturer, or person.

GIFTS, FAVORS, LUNCHEONS

Inspectors may not accept favors, benefits, or job offers under circumstances that might be construed as influencing the performance of governmental duties. It is prudent to avoid even the appearance of compromising federal ethics statutes and regulations. If offered a bribe, the inspector must not accept money or goods. Since this act may violate federal laws, regulations and may also violate criminal statute, report the incident in detail as soon as possible to a supervisor and the Deputy Ethics Officials. If it appears that a federal criminal statute was violated, report this right away to the EPA's Office of the Inspector General (OIG information is at https://www.epa.gov/office-inspector-general/forms/contact-office-inspector-general).

The EPA website on ethics contains extensive information on conflicts of interest, gifts, and luncheons. It is recommended that each inspector go to the Resource Library section and review information in the Conflict of Interest, Gifts, and Travel sections.

Note also that it is prudent for EPA inspectors to decline business luncheons while on EPA business. The inspector must pay his/her own fees for meals. When in doubt about a possible issue, contact a Deputy Ethics Official to clarify what can and cannot be accepted and report any possible infraction of the ethics statutes and rules. See page 20, *U.S. EPA Guidance on Ethics and Conflict of Interest* (EPA, 1984b) and 5 CFR Part 2635, Standards of Ethical Conduct for Employees of the Executive Branch, January 1, 2013.

REQUESTS FOR INFORMATION

EPA seeks to make information concerning EPA and its work freely and equally available to all interested individuals, groups, and organizations. In fact, EPA employees have both a legal and traditional responsibility for making useful educational and safety information available to the

public. This policy, however, does not extend to information about a suspected violation, evidence of possible misconduct, confidential business information, or other information protected from release under the Freedom of Information Act. The disclosure of information is discussed further in Chapter 2, under the "Confidential Information" section.

QUALITY ASSURANCE RESPONSIBILITIES

The inspector must assume primary responsibility for ensuring the quality and accuracy of the compliance inspection and the integrity of samples collected. While other organizational elements play an important role in quality assurance, it is the inspector who must ensure that all data introduced into an inspection file are complete, accurate, and representative of existing conditions. To help the inspector meet this responsibility, Regional Offices have established quality assurance plans that identify individual responsibilities and document detailed procedures, to be used during sampling inspections.

The objective of a quality assurance plan is to establish standards that will guarantee that inspection and analytical data meet the requirements of all users. Many elements of quality assurance plans are incorporated directly into the basic inspection procedures and may not be specifically identified as quality assurance techniques.

The inspector must be aware that following established inspection procedures is critical to the inspection program. These procedures have been developed to reflect the following quality assurance elements:

- Valid data collection
- Approved standard methods
- Control of service, equipment, and supplies
- Standard data handling and reporting

NEXT GENERATION COMPLIANCE

Today's pollution challenges require a modern approach to compliance, taking advantage of new tools and approaches while strengthening vigorous enforcement of environmental laws. Next Generation Compliance is EPA's integrated strategy to do that, designed to bring together the best thinking from inside and outside EPA.

Next Generation Compliance consists of five interconnected components (see Exhibit 1-1), each designed to improve the effectiveness of the compliance program:

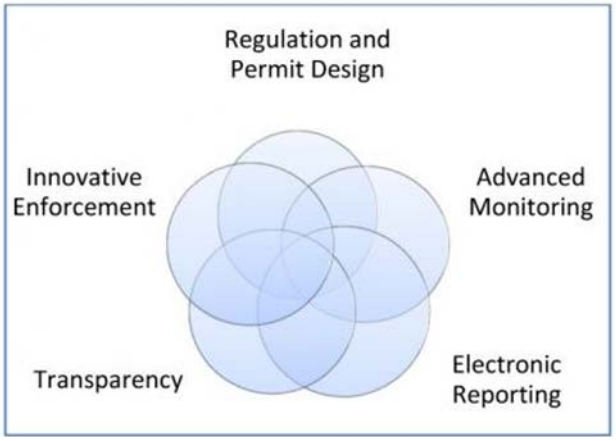


Exhibit 1-1. Next Generation Compliance Components

- Design regulations and permits that are easier to implement, with a goal of improved compliance and environmental outcomes.
- Use and promote advanced emissions/pollutant detection technology so that regulated entities, the government, and the public can more easily see pollutant discharges, environmental conditions, and noncompliance.
- Shift toward electronic reporting to help make environmental reporting more accurate, complete, and efficient while helping EPA and co-regulators better manage information, improve effectiveness and transparency.
- Expand transparency by making information more accessible to the public.
- Develop and use innovative enforcement approaches (e.g., data analytics and targeting) to achieve more widespread compliance.

Electronic Reporting

EPA promulgated the NPDES Electronic Reporting Rule ("final rule") to modernize CWA reporting for municipalities, industries, and other facilities by converting to an electronic data reporting system (see 80 FR 64064). The final rule requires regulated entities and state and Federal regulators to use existing, available information technology to electronically report data required by the NPDES permit program instead of filing written paper reports. The use of electronic reporting will save time and resources for permittees, states, tribes, territories, and the U.S. Government while increasing data accuracy, improving compliance, and supporting EPA's goal of better protecting the nation's waters. This regulation helps provide greater clarity on who is and who is not in compliance, and enhances transparency by providing a timelier, more complete, more accurate, and nationally-consistent set of data about the NPDES program.

Several commenters during the rulemaking questioned how the Electronic Reporting Rule will affect current records retention requirements. Commenters focused on the durational retention requirements, and sought clarification on electronic reporting requirements in the event of system failure. The final rule requires that the electronic reporting tool used to receive electronic submissions comply with the federal Cross-Media Electronic Reporting Regulation (CROMERR) at 40 CFR Part 3. Information that is reported electronically via a CROMERR-approved reporting tool takes the place of the paper record submission. The final rule changes the form of the record from paper-based to electronic. Therefore, records retained pursuant to record retention requirements—regulation-based or permit-based—can be kept in an electronic format so long as they are compliant with the CROMERR requirements. This rule does not change how long records need to be retained under existing regulations or as specified in permits. NPDES inspectors should identify all available electronic records in EPA's NDPES data system (ICIS-NPDES) such as DMRs or program reports. Inspectors should not assume that the facility has paper copies of records that were previously submitted to their authorized NPDES program (e.g., DMRs or program reports).

Inspection Targeting

Inspectors will now be able to use a more complete and accurate set of NPDES program data to better target facilities. EPA's data access tool, Enforcement and Compliance History Online (ECHO), has a number of tools that inspectors can use to refine their inspection lists and focus on the most important environmental problems.

The ECHO website provides a single place to find up-to-date regulatory compliance and enforcement data. With integrated compliance and enforcement information for more than hundreds of thousands of EPA-regulated facilities nationwide, ECHO's features range from simple to advanced - catering to concerned citizens seeking information about community facilities to those who perform detailed analyses and complex searches.

The site offers a set of search and visualization interfaces, models, management support tools, and reference materials assisting public and government users in accessing and analyzing information related to compliance and enforcement of environmental laws. A password-protected government-only area, ECHO Gov, grants select users access to non-public inspection targeting tools and enforcement-sensitive case information. The next two sections contain examples that NPDES inspectors might find useful for developing inspection lists or for preparation for an inspection. For suggestions for improving ECHO or ECHO Gov, please contact EPA at: https://echo.epa.gov/resources/general-info/contact-us.

Inspection Targeting Model Using ECHO Gov

EPA developed the Inspection Targeting Model (ITM) with the goals of sharpening the focus of inspections and making the inspection planning process more efficient and data driven. The purpose of this model is to distinguish between facilities that have strong records of compliance and those who have records indicating historical compliance problems, with additional data providing context regarding water quality. Inspectors will need to log into ECHO Gov to access the ITM (i.e., the ITM is not available to the public).

The ITM scores facilities based on: inspection frequency; violations/SNC status; compliance schedule; enforcement history; water quality; and facility characteristics. Facility-level scores and the underlying data are made available via a simpler user interface on ECHO Gov. The ITM pulls relevant inspection, violation, enforcement, and water quality data, and then applies weightings to each data point to produce a single-number ranked score. The weighting algorithm is designed to indicate which facilities appear to be in most need of an inspection. Exhibit 1-2 shows a screenshot of an example ITM query and Exhibit 1-3 shows a screenshot of the results of this example query.

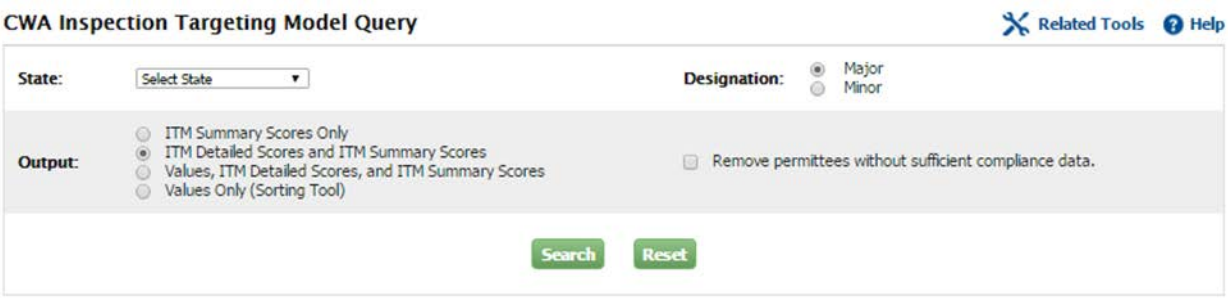


Exhibit 1-2. Example ITM Query

Clean Water Act Inspection Targeting Model Results

View current | Edit current | Revisions

188 Records Returned - Search Controls: State = "AL"; Designation = "Major"; Output Mode = "Scores"; Sufficient Compliance Data Only = "No"

Download a comma delimited text file Help

Facility Identification Information								Total Score	Inspection Frequency (I)		
Facility Identification	SIC Code	NPDES ID Third Character	Permits Issue Agency	Region Code Within State	Compliance Tracking On?	Complete/ Incomplete	Lower Priority?	All Sections	Date since last inspection (CMS) (1a)	Date since any surveillance (1c)	Time since permit expiration (1e)
								Score	Score	Score	Score
CULLMAN WWTP 1437 WELTI ROAD CULLMAN, AL 35056 AL0050423	4952	NPD		04	On	Complete	N	32	0	0	0
HELENA WWTP 590 OLD TOWNE PLACE HELENA, AL 35080 AL0023116	4952	NPD		04	On	Complete	N	25	0	0	0
WRIGHT SMITH JR. WWTP 1879 CONCEPTION STREET ROAD MOBILE, AL 36652 AL0023094	4952	NPD		04	On	Complete	N	24	0	0	0

Exhibit 1-3. Results from Example ITM Query in Exhibit 1-2

Effluent Limit Exceedances Search Using ECHO

The ECHO "Effluent Limit Exceedances Search" provides EPA, states, and the public with an efficient method of identifying and ranking NPDES permittees with violations of their effluent limits (see Exhibit 1-4). The search will identify instances where self-monitoring discharge data (discharge monitoring report (DMR) data) in ICIS-NPDES indicates an exceedance of the NPDES permit effluent limit. Users can search on one or more criteria and then sort the results (see Exhibit 1-5).

Users can also 'drilldown' to a facility and see all the effluent exceedances in one report. This facility level report can be printed out onto 8.5" x 11" paper (see Exhibit 1-6). One potential benefit for this new search is to provide users with the ability to quickly and easily create a

report of effluent violations that could be attached as an appendix or supporting material to a letter or enforcement action.

The new search is meant to be easy to use and includes the following features:

- Intuitive searching.
- Searches can be broad (nationwide) or specific (e.g., watershed-based).
- Searches using facility name (useful for investigations of large companies with multiple facilities).
- Searches from NPDES, Facility Registry (FRS), and the Toxic Release Inventory (TRI) will accept multiple IDs in each text box.

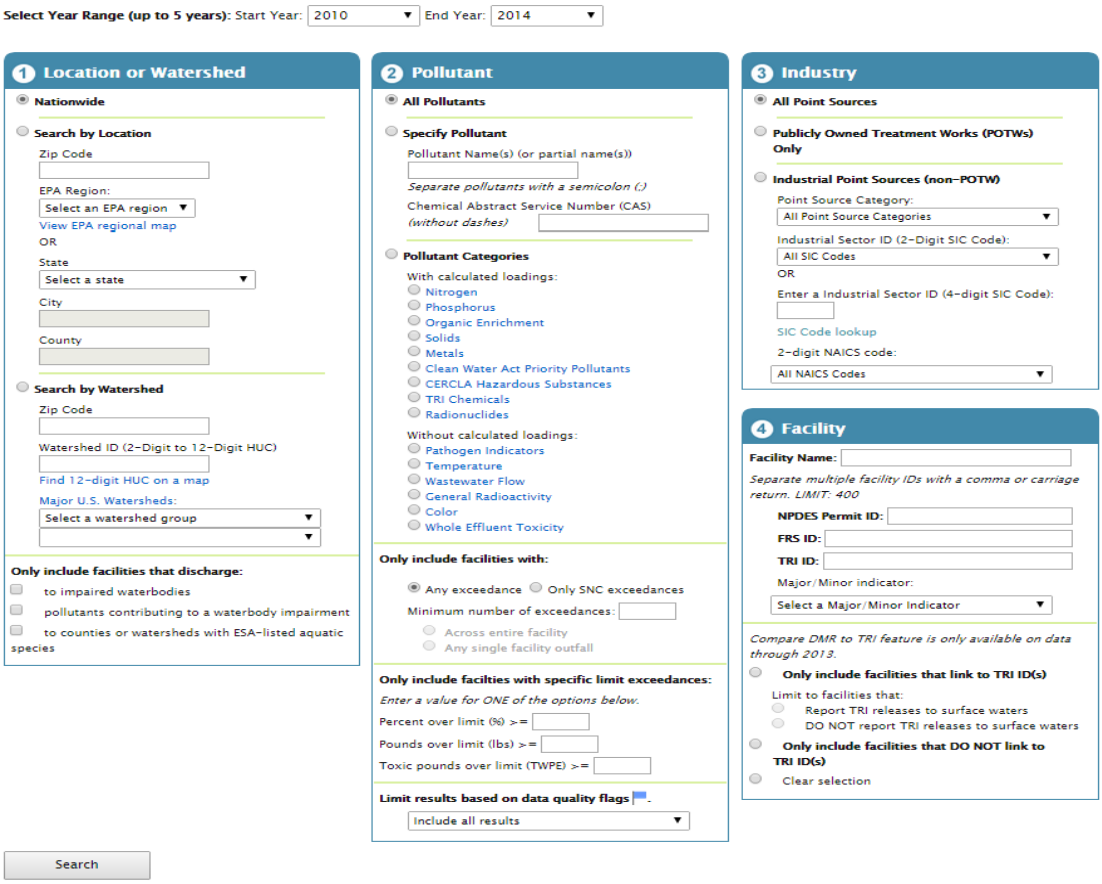


Exhibit 1-4. Effluent Limit Exceedances Search Form

Effluent Limit Exceedances Search Results

Instructions. The table below presents facility-level (and if selected, pollutant-level) information about the facilities that match the selected search criteria. Note that if a pollutant or pollutant category is selected in the search criteria, the E90 exceedance counts and pollutant loadings will not reflect total facility exceedances.

Columns in the results table are organized into four themes. The Facility Identifiers theme always remains visible, but the other themes may be toggled on and off. Click on a NPDES ID to access a facility's Effluent Limit Exceedance Exceedances Report. For more information, see Effluent Limit Exceedances Search Results Help.

Search criteria:
Reporting Years 2010 to 2014 and EPA Region: 01 and Pollutant category: Clean Water Act Priority Pollutants and Non-POTWs and All SIC codes and All point source categories
Loads for the current year are not based on a full reporting year because data are not complete.

Displaying: 1 through 42 of 42 facilities.

Show/Hide Columns: Facility Characteristics ☑ | Enforcement and Compliance ☑ | Pollutant Loadings ☑

Enforcement and Compliance									Pollutant Load				
Most Recent Formal Enforcement Action	E90 Facility Total	E90 Max Outfall	E90 Trend	E90 2010	E90 2011	E90 2012	E90 2013	E90 2014	Total Pounds	Total TWPE (lb-eq)	Total Load Over Limit (lbs)	Total TWPE Over Limit (lb-eq)	2010 L Over Li (lbs
02/22/2012	40	40		1	17	4	14	4	1,710	1,264	75.3	0.75	2.81
11/10/2014	39	39		4	6	13	12	4	379	99.2	0.58	0.36	0.55

Exhibit 1-5. Effluent Limit Exceedances Search Sorting Table

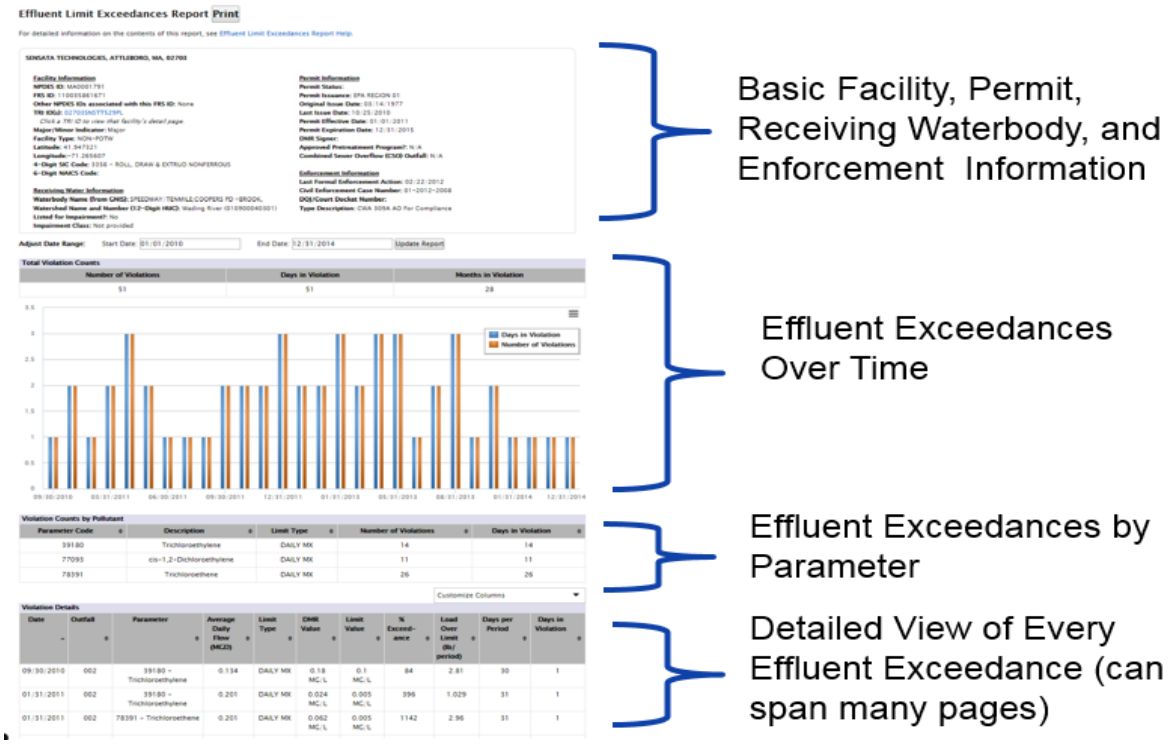


Exhibit 1-6. Effluent Limit Exceedances Search – Facility View

Thus, inspectors can use the results of the Effluent Limit Exceedances Search in ECHO to narrow down facilities that are potential targets for inspection.

E. REFERENCES

The following is a list of resources providing additional information.

U.S. Environmental Protection Agency. (1984a). E*PA Policy for the Administration of Environmental Programs on Indian Reservations.*

U.S. Environmental Protection Agency. (1984b). *U.S. Environmental Protection Agency Guidance on Ethics and Conflict of Interest.*

U.S. Environmental Protection Agency. (1986). *Pretreatment Compliance Inspection and Audit Manual for Approval Authorities.* EPA 833/B-86-100.

U.S. Environmental Protection Agency. (1991). *Guidance for Conducting a Pretreatment Compliance Inspection*. EPA 300/R-92-009.

U.S. Environmental Protection Agency. (2001). *Guidance on the Enforcement Principles Outlined in the 1984 Indian Policy*.

U.S. Environmental Protection Agency. (2003). *Role of the EPA Inspector in Providing Compliance Assistance During Inspections.*

U.S. Environmental Protection Agency. (2005). *Guide for Evaluating Capacity, Management, Operation, and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems.* EPA 305-B-05-002.

U.S. Environmental Protection Agency. (2004). *Guidance for Issuing Federal EPA Inspector Credentials to Authorize State/Tribal Governments to Conduct Inspections on Behalf of EPA.*

U.S. Environmental Protection Agency. (2010). *Control Authority Pretreatment Audit Checklist and Instructions*. EPA 833-B-10-001.

U.S. Environmental Protection Agency. (2011). *Introduction to the National Pretreatment Program.* EPA 833-B-11-001.

CHAPTER 2 – INSPECTION PROCEDURES

Contents

List of Tables

Associated Appendices

D. EPA's Memorandum on Practices to Follow and Avoid When Requesting Information
E. Sample CWA Section 308 Information Collection Request Letter (308 Letter)
F. Final Fact Sheet: The Do's and Don'ts of using U.S. EPA Credentials
G. EPA's Memorandum on Entry Procedures
H. EPA's Policy on the Use of Digital Cameras for Inspections
I. EPA's Memorandum on Deficiency Notice Guidance
J. Inspection Conclusion Data Sheet (ICDS) Form
K. Draft Guidance for Releasing Civil Inspection Reports

A. PRE-INSPECTION PREPARATION

Pre-planning is necessary to ensure that the inspection is focused and is conducted smoothly and efficiently. It involves the following activities:

- Reviewing facility background information
- Developing an inspection plan
- Developing a Quality Assurance Project Plan (QAPP) for sampling, if applicable
- Notifying the facility, if applicable
- Notifying the state, tribe, or POTW of the federal inspection, if applicable
- Preparing equipment

REVIEW OF FACILITY BACKGROUND INFORMATION

The Clean Water Act (CWA) and related NPDES regulations establish procedures, controls, and other requirements applicable to a facility. In addition, state regulations, and local ordinances may be applicable to the same facility. Therefore, collection and analysis of available background information on the candidate facility is essential for effective planning and overall success of a compliance inspection. Materials from available files, company websites, and other information sources can enable inspectors to familiarize themselves with facility operations, conduct a timely inspection, minimize inconvenience to the facility by not requesting data previously provided, conduct a thorough and efficient inspection, clarify technical and legal issues before entry, and develop a sound and factual inspection report.

Various types of information that may be available for review are listed below. The list is not intended to be exhaustive and all listed information may not be relevant for all inspections. The inspector should determine the amount of background information necessary for the inspection and focus on the characteristics unique to the facility (e.g., design, historical practices, legal requirements).

General Facility Information

- Maps showing facility location, drainage inlets, wastewater discharge pipes, sampling points, overflow and bypass points, and geographic features.
- Plant layout and process flow diagram.
- Names, titles, and telephone numbers of responsible facility officials.
- Any special entry requirements (e.g., security).
- Any safety requirements.
- Description of unit operations including design and operating data (e.g., design flow or capacity, typical operating flows, maintenance requirements), if available.
- Description of wastewater discharges (e.g., outfalls, discharge frequency, flowrate).
- Production levels—past, present, and future.
- Hydrological data.
- Geology/hydro-geology of the area.

- Changes in facility conditions since previous inspection/permit application.
- Available aerial photographs.

Requirements, Regulations, and Limitations

- Copies of existing permits and permit applications. Permits provide information on the limitations, requirements, and restrictions applicable to discharges; compliance schedules; and monitoring, analytical, and reporting requirements. Permit applications provide technical information on facility size, layout, and location of pollutant sources; treatment and control practices; contingency plans and emergency procedures; and pollutant characterization—types, amounts, applicability of effluent guidelines, and points/locations of discharge. Permit applications for air, solid, and hazardous waste treatment and disposal permits may provide additional information to the inspector that is not available elsewhere.
- Notices of intent (NOI), regulations, requirements, and restrictions placed on permittee discharges, including Spill Prevention Control and Countermeasure Plans (SPCC Plans) and Stormwater Pollution Prevention Plans (SWPPPs).
- Monitoring and reporting requirements and available monitoring stations.
- Special exemptions and waivers, if any.
- Documents required by SPCC Plans and SWPPPs, including inventories of Material Safety Data Sheets (MSDS), maintenance records, training manuals, and training documentation.
- Receiving stream water quality standards, the condition of the receiving stream (e.g., is the stream impaired and for what parameters), and any Total Maximum Daily Load (TMDL) evaluations for the receiving stream.
- Information concerning sludge, air, solid, and hazardous waste treatment and disposal.

Facility Compliance and Enforcement History

- Previous inspection reports, including local (municipal), state, and federal inspections.
- Correspondence among facility, local, state, and federal agencies.
- Complaints and reports, follow-up studies, findings, and remedial action.
- Documentation on past compliance violations, exceedances, status of requested regulatory corrective action, if any.
- Enforcement actions such as compliance schedules and consent orders.
- Status of current and pending litigation against facility.
- Self-monitoring data and reports.
- Previous EPA, state, or consultant studies and reports.
- Previous deficiency notices issued to the facility.
- Laboratory capabilities and analytical methods used by the facility.
- Name(s) of contract laboratories, if applicable.

- NPDES data including Discharge Monitoring Reports (DMR) and Quality Assurance (QA) files.
- Emergency Planning and Community Right to Know Act (EPCRA) data submittals.
- Reports from special studies (e.g., stream monitoring, internal audits) or compliance schedules.

Pollution Control and Treatment Systems

- Description and design data for pollution control or treatment systems (e.g., design flow or capacity, typical operating flows, maintenance requirements), if available.
- Sources and characterization of discharge.
- Type and amount of wastes discharged.
- Available routes for bypasses or diversions, and spill containment facilities.
- Pollution control units, treatment methods, and monitoring systems.

Pretreatment Information

- Information concerning compliance schedule to install technologies (industrial facilities) or develop a pretreatment program (Publicly Owned Treatment Works (POTWs)).
- Pretreatment reports as required by the NPDES permit and the General Pretreatment Regulations, regional, state, or local requirements.
- The POTW's Enforcement Response Plan and sewer use ordinance, including local discharge limits.
- POTW pretreatment procedures (e.g., sampling, inspection compliance evaluation, SNC).
- POTW annual reports.
- Information concerning industrial discharges to POTWs, such as:
  - Industrial monitoring and reporting requirements
  - POTW monitoring and inspection program
  - Waste contribution to the POTW
  - Compliance status of industry with pretreatment requirements
  - POTW enforcement initiatives

Chapter 9 of this manual discusses pretreatment program requirements in greater detail.

Municipal Separate Storm Sewer System (MS4)

- Legal authority
- Program procedures
- Reports to permitting authority
- A list of construction and industrial stormwater facilities within the MS4

SOURCES OF FACILITY BACKGROUND INFORMATION

Regional and State Files and Websites

EPA Regional Offices and state agencies maintain files that can provide the information listed below. In addition, many states maintain websites where permits and permit applications may be available.

- Compliance, enforcement, and litigation history including copies of inspection reports and citizen complaints and actions taken. Previous inspection reports can provide general facility information, as well as problems or concerns noted in previous inspections.
- Facility self-monitoring data.
- Quarterly Noncompliance Reports (QNCRs).
- DMR QA reports.
- Permits and permit applications including special exemptions and waivers applied for and granted or denied.
- NOI filings.
- Facility files pursuant to other regulatory programs may also contain useful information prior to the NPDES inspection. Some of the other regulatory programs and their reporting requirements include Toxic Substances Control Act (TSCA) reports on PCB activities; Resource Conservation and Recovery Act (RCRA) biannual reports; Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) reportable quantity release reports; EPCRA Section 312 Tier II reports and Section 313 Form R reports; Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) pesticide production registrations; and Clean Air Act (CAA) annual emission inventory reports and permit applications.
- Other correspondence including process operational problems/solutions; pollution problems/solutions; laboratory capabilities or inabilities; and other proposed or historical remedial actions. This information can provide design and operation data, recommendations for process controls, identification of pollutant sources, treatment/control systems improvement, and remedial measures.

EPA Websites and Information Resources

EPA's website contains several data tools that could be reviewed prior to the inspection:

- DMR Pollutant Loading Tool (http://cfpub.epa.gov/dmr/)—This site allows users to determine who is reporting discharges, what pollutants they are discharging and how much, and where they are discharging. The tool calculates pollutant loadings from permit and DMR data from EPA's Integrated Compliance Information System for the National Pollutant Discharge Elimination System (ICIS-NPDES)[1].

[1] ICIS-NPDES has replaced the Permit Compliance System (PCS).

- Electronic Notice of Intent (eNOI) (https://www.epa.gov/npdes/electronic-notice-intent-enoi)—This site allows users to view NOIs for construction projects under EPA's Construction General Permit (CGP) for Low Erosivity Waivers (LEWs) or for industrial facilities seeking coverage under EPA's Multi-Sector General Permit (MSGP).
- Enforcement and Compliance History Online (ECHO) (https://echo.epa.gov/)— This public site allows users to search for facility compliance and enforcement information including permit, inspection, violation, and enforcement actions. ECHO Gov (https://echo.epa.gov/login) includes additional data that is available only to government agencies.

Technical Reports, Documents, and References

These information sources provide general information on waste loads and characterization, industrial process operations, and pertinent specific data on available treatment/control techniques, such as their advantages or disadvantages and limits of application and pollutant removal efficiencies. Such sources include Development Documents for Effluent Limitations Guidelines and Standards.

In addition, general websites and mapping programs (e.g., Google Earth, Geographic Information Systems) can provide an overview of the facility layout, features, and outfalls.

Company Data Sources

Many companies maintain individual web sites that contain valuable information regarding the company's financial status, significant purchases and sales, new business ventures, etc.

Inspectors may follow Appendix D, EPA's *Memorandum on Practices to Follow and Avoid When Requesting Information*, should requesting information be necessary while conducting background research.

DEVELOPING AN INSPECTION PLAN AND/OR CHECKLIST

Inspection plans and inspection checklists are helpful tools for organizing and conducting compliance inspections. A plan is recommended to effectively conduct a compliance inspection. After reviewing the available background information, the inspector prepares a comprehensive plan to define inspection objectives, tasks and procedures, resources required to fulfill the objectives, and inspection schedule. When developing an inspection plan, inspectors should consider the following:

- Objectives
  - What is the purpose of the inspection?
  - What is to be accomplished?
- Tasks
  - What tasks are to be conducted?
  - What information must be collected?
  - What records will be reviewed?

- Procedures
  - What procedures are to be used?
  - Will the inspection require special procedures?
- Resources
  - What personnel will be required?
  - What equipment will be required?
- Schedule
  - What will be the time requirements and order of inspection activities?
  - What will be the milestones?
- Coordination
  - What coordination with laboratories or other regulatory agencies will be required?

An outline of tentative inspection objectives, meetings to be held, and records that will be reviewed can be prepared and presented to the facility officials during the opening conference.

In addition, inspectors may prepare a checklist to use during the inspection to ensure potential compliance issues have been assessed. The checklist content will vary depending on the type of inspection, but should distill the applicable regulatory and permit requirements into a simple format allowing the inspector to easily assess and document compliance. Existing checklists may be used or modified for the inspection.

DEVELOPING A HEALTH AND SAFETY PLAN

Inspectors must comply with the health and safety training requirements under EPA Order 1440.2 (see Appendix C, ("*EPA Order 1440.2, Health and Safety Requirements for Employees Engaged in Field Activities*"). Supervisors are responsible for ensuring that these requirements are met. Additionally, a Health and Safety Plan (HASP) must be prepared prior to the inspection or field investigation to determine any health and safety hazards associated with the inspection. When developing a HASP, inspectors and supervisors should consider factors such as the site conditions, weather conditions (when applicable), required personal protective equipment, any personnel medical conditions, and the job functions that will be performed on-site.

NOTIFYING THE FACILITY

Announced Inspections

EPA conducts both announced and unannounced inspections. When conducting announced inspections, the facility operator is sometimes notified by a CWA section 308 Information Collection Request Letter or "308 Letter" that the facility is scheduled for an inspection (Appendix E is an example of a typical 308 Letter). The signature authority for a 308 Letter may be delegated to a section chief, but each region should verify the delegation. The 308 Letter advises the permittee that an inspection is imminent and usually requests information regarding on-site safety regulations to avoid problems concerning safety equipment at the time

of inspection. This letter many request items such as facility contact names and updated process information. The 308 Letter may specify the exact date of inspection, if coordination with the permittee is required. The 308 Letter can also inform the permittee of the right to assert a claim of confidentiality.

In cases where an inspection will be announced, inspectors should:

- Explain the nature and extent of the inspection.
- Provide a timeframe for the scheduled activities.
- Document any contact with the facility (e.g., phone call, letter, email).
- Request the availability of facility personnel and records/documents during the inspection.
- Inquire about special safety and security requirements.
- Inform the facility of its right to asset a confidentiality claim

The inspector should also determine whether there are program-specific forms or requirements that must be completed during the notification process.

Unannounced Inspections

When the facility is not notified in advance, the inspector has an opportunity to observe normal facility operations, rather than a facility that has been prepared for an inspection. However, the inspector may miss interviews with unavailable personnel. The inspector may find that announced inspections are valuable when inspecting large or complex facilities. Decisions on whether an inspection will be announced or unannounced should be made in consultation with the inspector's management and, if necessary, counsel. Unannounced inspections are appropriate if there is concern that the facility may conceal or alter evidence of noncompliance, or if the inspection team suspects that illegal discharge(s) may be occurring.

NOTIFYING STATE OF FEDERAL INSPECTION

The inspector should notify the appropriate state regulatory agency, tribe, or POTW in a timely manner of inspections to be conducted in its jurisdiction, if notification is deemed appropriate. Notification should also be provided at the municipal level for delegated programs. The state should be notified of all federal inspections unless disclosing inspection information would jeopardize an unannounced inspection. Applicable agreements and policy should be reviewed regarding this notification. This responsibility may vary depending on the region.

PREPARING EQUIPMENT AND SUPPLIES

The inspector must prepare all equipment and supplies required for the inspection. Safety equipment and procedures required for a facility are based on the response to the 308 Letter or standard safety procedures. Safety requirements must be met, not only for safety reasons, but to ensure that the inspector is not denied entry to the facility or parts of it. If the inspector will use a checklist, it should be developed or obtained during the pre-inspection preparation.

If sampling is to be performed, part of the pre-inspection process may involve preparing sampling equipment and the development of a Quality Assurance Project Plan (QAPP). A QAPP is a tool for planners to document the type and quality of data needed and to describe the methods for collecting and assessing those data. QAPPs are discussed further in Chapter 5, Section B of this manual. Sampling requires additional equipment, which may vary according to the facility inspected and the type of inspection. Table 2-1 includes a list of inspection and field sampling equipment that may be needed.

All equipment must be checked, calibrated, and tested before use. The inspector also must ensure that all materials necessary to complete an inspection are taken to the inspection site.

Table 2-1. Inspection Equipment List

Typical Inspection Equipment	
Documents and Recordkeeping Tools	
• Credentials • Background files • Checklists • Bound, waterproof, chemical-resistant logbook	• Shipping labels • Analysis request forms • Waterproof pen • Calculator
Personal Protective Equipment[a]	
• Hardhat • Hearing protection • Safety shoes • Gloves	• Coveralls • Reflective safety vest (Class III) • Safety glasses/goggles • Rainwear
Safety Equipment[b]	
• First-aid kit • Meters (oxygen content, explosivity, and toxic gas) • Safety harness and retrieval system • Ventilation equipment	• Respirator • Filter cartridges • Self-contained breathing apparatus (If appropriate)
Tools	
• Multi-tooled jack knife (Swiss Army Type) • Electrical and duct tape • Tape measure • Handheld range finder and level • Extra batteries • Extra memory cards for camera, digital camera, video camera • Flashlight	• Screwdriver • Adjustable wrench and vise grips • Bucket (plastic or stainless steel, as appropriate) • Nylon cord • GPS • Laptop computer • Cell phone
Additional Equipment for Sampling	
Sampling Documentation	
• Sampling plan	• Sampling QAPP
Sampling Materials	

Table 2-1. Inspection Equipment List

• Automatic samplers • Tubing • Sample containers for all potential analytical methods, including extras • Sample bottle labels • Bottle dipper • Decontamination supplies • Batteries/extension cords • Sample bottle labels/sample seals • Plastic security tape	• Chain-of-custody forms • Dissolved oxygen meters • pH meter • TRC meter • pH buffer • Deionized water • Chart paper • Thermometer • Coolers/ice • Preservatives
Sample Transportation Materials	
• Bubble pack material • Filament tape	• Airbill/Bill of Lading
Flow Measurement Devices	
• Measurement devices (e.g., flumes, weirs, portable ultrasound or bubble systems) • Flow discharge tables	• Ruler • Stopwatch or watch with second hand • level

[a] Additional personal protective equipment (PPE) and safety equipment may be required for specific types of inspections.

[b] Some of the equipment listed may be used for confined space entry. Only personnel trained in confined space entry should enter confined spaces.

B. OFF-SITE SURVEILLANCE

CONSIDERATIONS

Often many potential concerns can be identified prior to entering the facility, such as illegal discharges, stressed vegetation, spills, smoke, or illegal dumping. Off-site surveillance also provides an opportunity for the inspector to observe traffic patterns into and out of the facility, and determine material/product handling procedures in areas such as loading docks or equipment staging areas. Off-site surveillance also provides the inspector with geographical coordinate information, which can be used to reference photos, locations, violations, etc., and allows the inspector to determine the layout of the facility and make judgments about how to prioritize the inspection.

The inspector should document the following information when conducting off-site surveillance:

1. Location of the off-site surveillance: Was the off-site surveillance conducted from a public right-of-way?
2. Facility layout and orientation: A brief sketch of the layout and orientation (as viewed from the public right-of-way) should be noted.

3. Visible concerns: What are some obvious concerns visible from public right-of-way (e.g., containers, loading areas, tanks, obvious discharges, improper disposal)?

C. ENTRY

ENTRY PROCEDURES

Authority

The authority for entry is found in section 308(a)(4)(B) of the CWA, which states:

> …the Administrator or his authorized representative (including an authorized contractor acting as a representative of the Administrator), upon presentation of his credentials (i) shall have a right of entry to, upon, or through any premises in which an effluent source is located or in which any records are required to be maintained…and (ii) may at reasonable times have access to and copy any records, inspect any monitoring equipment or method…and sample any effluents which the owner or operator of such source is required to sample…

In addition, NPDES permits may contain inspection authority provisions.

Arrival

The facility inspection should occur during normal working hours unless information indicates another time would be more appropriate. The inspector should announce him/herself and ask to speak to a facility official. Prior to entering a facility, inspectors should observe it as thoroughly as possible from public right-of-way (e.g., roads, sidewalks).

Credentials

When the proper facility officials have been located, the inspector must introduce himself or herself as an EPA inspector and present the proper EPA credentials. Contractors performing the inspection on EPA's behalf should identify themselves as contractors and present their credentials or authorization letter. Credentials indicate that the holder is a lawful representative of the regulatory agency and is authorized to perform NPDES inspections. The credentials must be presented regardless of whether identification is requested. The inspector should document that credentials were presented.

If the facility officials question the inspector's credentials after the credentials have been reviewed, the officials may telephone the appropriate state or EPA Regional Office for verification of the inspector's identification. Credentials must never be relinquished or allowed to be copied. For more detailed information on the use of EPA Credentials, please refer to the fact sheet "The Do's and Don'ts of Using EPA Credentials" (Appendix F).

Consent

If the inspector is allowed to enter, entry is considered voluntary and consensual.

The receptiveness of facility officials toward inspectors is likely to vary among facilities. Most inspections will proceed without difficulty. In other cases, officials may be reluctant to give entry consent because of misunderstood responsibilities, inconvenience to a facility's schedule,

or other reasons that may be overcome by diplomacy and discussion. If consent to enter is denied, the inspector should follow denial of entry procedures (see Problems with Entry or Consent below).

Whenever there is a difficulty in gaining consent to enter, inspectors should tactfully probe the reasons and work with officials to overcome the problems. Care should be taken, however, to avoid threats of any kind, inflammatory discussions, or deepening of misunderstandings. If the situation is beyond the authority or ability of the inspector, the inspector should leave the facility and contact the supervisor or Office of Regional Counsel for further guidance.

Claims of Confidentiality

The inspector should explain the permittee's right to claim material as confidential business information (CBI). The facility representative should be made aware that the inspector may examine areas related to effluent production or storage even if the permittee has asserted claims of confidentiality. CBI is discussed in greater detail later in this chapter.

Waivers, Releases, and Sign-In Logs

When the facility provides a blank sign-in sheet, log, or visitor register, it is acceptable for inspectors to sign it. However, EPA employees must not sign any type of "waiver" or "visitor release" that would relieve the facility of responsibility for injury or that would limit the rights of EPA to use data obtained from the facility.

If such a waiver or release is presented, the inspectors should politely explain that they cannot sign and request a blank sign-in sheet. If the inspectors are refused entry because they do not sign the release, they should leave and immediately report all pertinent facts to the appropriate supervisor and/or legal staff. All events surrounding the refused entry should be fully documented. Problems should be discussed cordially and professionally.

Less desirable and as a last resort the inspector may cross-out and initial any wording that is unacceptable due to its restrictive nature. The facility must agree with this option.

PROBLEMS WITH ENTRY OR CONSENT

Because a facility may consider an inspection to be an adversarial proceeding, the facility employees may question the legal authority, techniques, and competency of inspectors. Facility officials also may display antagonism toward EPA personnel. In such cases, inspectors should cordially restate the statutory authority that they are inspecting under and seek an explanation for the denial of entry. If entry is still denied, the inspector should leave and obtain further direction from their EPA supervisor or legal staff. Professionalism and politeness must prevail at all times.

Entry Procedures

The following summarizes procedures that EPA developed as a result of the 1978 U.S. Supreme Court decision in Marshall v. Barlow's, Inc. Appendix G contains EPA's Memorandum on Entry Procedures, “Conduct Inspections After the Barlow’s Decision,” in its entirety.

- Ensure that all credentials and notices are presented properly to the facility owner or agent in charge.
- If entry is not granted, ask the reason for the denial to see if obstacles (such as misunderstandings) can be cleared. If resolution is beyond the authority of the inspector, he or she may suggest that the officials seek advice from their attorneys (if they have them) to clarify EPA's inspection authority under section 308 of the CWA.
- Sometimes it can be unclear if entry is being denied. If this is the case, clearly ask if entry is being denied. If entry is still denied, the inspector should withdraw from the premises and contact his or her supervisor or regional counsel. The supervisor will confer with attorneys to discuss the desirability of obtaining an administrative warrant.
- All observations pertaining to the denial are to be carefully noted in the field notebook and inspection report. Include such information as the facility name and exact address, name and title of person(s) approached, name and title of the person(s) who refused entry, date and time of denial, detailed reasons for denial, facility appearance, and any reasonable suspicions of regulatory violations. All such information will be important should a warrant be sought.

Actions to Take if Entry is Denied

If entry is denied, either to the entire facility or parts of the facility, the inspector should:

- Cite the appropriate EPA inspection authority to the company official, ask if he/she understands the reason for your presence, and record the answer and any reason given for entry denial.
- Record the name, title and telephone of the individual denying entry, as well as the date and time.
- Leave the premises.
- Document any site conditions and the events related to the entry denial after leaving the facility and inform your immediate supervisor or regional counsel.

Important Considerations

Inspectors should use discretion and avoid potentially threatening or inflammatory situations. If a threatening confrontation occurs, the inspector should document it and then report it immediately to the supervisor or staff attorney. If feasible, statements from witnesses should be obtained and included in the documentation.

Withdrawal of Consent During Inspection

If the facility representative asks the inspector to leave the premises after the inspection has begun, the inspector should leave as quickly as possible following the procedures discussed previously for denial of entry. All activities and evidence obtained before the withdrawal of

consent are valid. The inspector should ensure that all personal and government equipment is removed from the facility.

WARRANTS

The inspector may be instructed by EPA attorneys, under certain circumstances, to conduct an inspection under search warrant. A warrant is a judicial authorization for appropriate persons to enter specifically described locations to inspect specific functions. A pre-inspection warrant possibly could be obtained where there is reason to believe that entry will be denied when the inspector arrives at the facility or when the inspector anticipates violations that could be hidden during the time required to obtain a search warrant. This would be done only in unusual circumstances.

D. OPENING CONFERENCE

Once credentials have been presented, the inspector can proceed to outline inspection plans with facility officials. At the opening conference, the inspector provides names of the inspectors, the purpose of the inspection, authorities under which the inspection is being conducted, and procedures to be followed. EPA encourages cooperation between the inspectors and the facility officials to facilitate assignments and ensure the success of the inspection.

CONSIDERATIONS

Inspection Objectives

A discussion of inspection objectives will inform facility officials of the purpose and scope of the inspection and may help avoid misunderstandings.

Order of Inspection

A discussion of the order in which the inspection will be conducted will help eliminate wasted time by allowing officials time to make records available and start up intermittent operations.

Meeting Schedules

A schedule of meetings with key personnel will allow facility officials adequate time to spend with the inspector.

List of Records

A list of facility records that will need to be reviewed as part of the inspection should be provided to facility officials (i.e., permits, DMRs, chain-of-custody forms, sampling data, operation and maintenance records, training records, lab data sheets, and other records can be requested depending on the inspections type being performed). This will allow the officials adequate time to gather the records and make them available for the inspector.

Accompaniment

It is important that a facility official accompany the inspector during the inspection (unless the facility is unmanned) not only to answer questions and describe the plant and its principal operating characteristics, but also for safety and liability considerations. Discussion of such

needs with facility officials will provide them the opportunity to allocate personnel for this purpose, however, in some circumstances, the facility official may choose not to accompany the inspector. Even in these situations, the inspector should talk to the personnel responsible for performing sample collection and analysis, or other relevant functions, to gather specific information on these procedures (including required knowledge of responsible personnel).

Permit Verification

The inspector should verify pertinent information included in the permit, such as facility name and address, receiving waters, and discharge points. The inspector should also validate (or obtain) accurate outfall location data (i.e., the precise latitude and longitude of each outfall using a handheld, calibrated GPS unit).

Safety Requirements

The inspector should be prepared with the appropriate safety equipment (e.g., hard hat, safety shoes, safety glasses, safety vest) The inspector should reaffirm which Occupational Safety and Health Administration (OSHA) and other facility safety regulations will be involved in the inspection and should determine whether his safety equipment is adequate.

Split Samples

Facility officials should be informed during the opening conference of their right to receive a split or duplicate of any physical sample collected for laboratory analysis if sufficient sample volume is collected. Officials should indicate at this point their desire to receive split and duplicate samples so that arrangements can be made to secure the samples during inspection. It is the responsibility of the facility to provide its own sample bottles, preservatives, etc.

Photography

Photography is an essential tool used to help the inspector prepare a thorough and accurate inspection report, to present evidence in enforcement proceedings, and to document conditions found at a site. The CWA gives the inspector the authority to collect and copy records including digital images during an inspection. See Section E, “Documentation,” for additional information on documenting digital images.

The inspector should work with facility personnel during the opening conference to ensure photography meets the sites requirements. Prior to taking digital images, the inspector should obtain the permittee's approval. The inspector should be tactful in handling any concerns or objections a permittee may have about the use of a camera. In some cases, the inspector may explain to the permittee's representative that wastestreams, receiving waters, and wastewater treatment facilities are public information, not trade secrets. If the facility representative expresses reservations about allowing the inspector to take digital images, these concerns should be discussed to seek a mutually acceptable solution. This can be as simple as agreeing to avoid photographing sensitive items which are irrelevant to the inspection, and/or allowing the representative to view each digital image as it is taken. The facility may also have concerns about the safety of taking photographs in areas where there are explosive vapors and may require equipment be intrinsically safe or may need to issue a “hot work” permit allowing the

use of the camera in certain areas. The inspector should work with the facility personnel to determine areas that may not allow digital cameras.

The facility representative can claim digital images as CBI if they contain confidential information, but inspection photographs should not be deleted except for rare circumstances. An inspection image may be deleted if the image is claimed as CBI and the inspector is not authorized to receive CBI. Additionally, the image may be deleted if it contains CBI that is not relevant to the inspection or if it captures facility staff, and it is against the facility's policy to photograph its employees. In cases where an image is deleted, the inspector should note why it was deleted in the inspection notebook.

If the facility would like to retain copies of digital images taken during the inspection, the inspector should suggest that the facility staff accompany the inspector and take their own digital images of the same areas that the inspector is taking. According to *EPA's Information Security National Rules of Behavior*, to maintain EPA Information Technology (IT) security, an EPA computer, tablet or other electronic device should never be physically connected to a facility computer or device. Additionally, the inspector must only use EPA-authorized internet connections that meet the required security and communication standards to wirelessly transmit digital images. The inspector may provide the facility copies of digital images taken during the inspection upon request via email.

As a general rule, it is considered a denial of entry when a facility imposes any photographic restrictions that limit the inspector from properly performing the inspection. In the event the permittee's representative still refuses to allow digital images, and the inspector believes the images will have a substantial impact on future enforcement proceedings, the inspector's supervisor or regional attorneys should be consulted for further instructions.

Facilities may claim that certain digital images are CBI, in which case the inspector must handle the digital images following all CBI procedures. If there are other circumstances such as national security issues, the inspector should try to collect the evidence needed without taking digital images. The inspector should inform the site representative that he or she will be taking digital images as a routine part of their inspection. If entry is denied, the inspector may photograph areas of the facility exposed to public view, when standing outside the facility.

Small Businesses

The inspector should provide the facility with EPA's "Small Business Resources Information Sheet," where applicable. The information sheet provides resources to help small businesses understand and comply with federal and state environmental laws. EPA's "Small Business Resources Information Sheet" can be found at: https://www.epa.gov/compliance/small-business-resources-information-sheet.

Closing Conference

A post-inspection meeting should be scheduled with appropriate officials to provide a final opportunity to gather information, answer questions, present initial observations of deficiencies, and complete administrative duties. The inspector should not make

determinations of compliance or noncompliance while on-site or during the closing conference. Determinations of compliance or noncompliance should be made back at the office in consultation with appropriate management.

New Requirements

The inspector should discuss and answer questions pertaining to any new rules and regulations that might affect the facility. If the inspector is aware of proposed rules that might affect the facility, he or she may wish to encourage facility officials to obtain a copy.

E. DOCUMENTATION

Providing documentation of an inspection is an inspector's basic responsibility. Documentation serves to "freeze" the actual conditions existing at the time of inspection so that evidence can be examined objectively by compliance personnel.

Documentation is a general term referring to all printed information and electronic media produced, copied, or taken by an inspector to provide evidence of suspected violations. Forms of documentation include the field notebook, statements, photographs, videotapes, drawings, maps, printed matter, mechanical recordings, and copies of records.

INSPECTOR'S FIELD NOTEBOOK

The core of all documentation relating to an inspection is the field notebook, which provides accurate and inclusive documentation of all inspection activities. A bound notebook with sequentially numbered pages should be used, and entries should be made in permanent, waterproof ink. A new inspection notebook should be used for each new inspection. Multiple inspections from different facilities should not be kept in a single notebook as they lose their validity if separated from the notebook, such as when one set of notes is needed for the court record. You will lose all notes from other inspections contained in the notebook if inspection notes are subpoenaed.

The notebook will form the basis for written reports and should contain only facts and pertinent observations. Language should be objective, factual, and free of personal feelings or terminology that might prove inappropriate. Cross out and initial any errors in the notebook. The field notebook should never leave the inspector's possession during the inspection. Do not allow a facility to copy the field notebook. Notebooks become an important part of the evidence package and can be admissible in court. The field notebook is a government record and subject to record retention schedules.

Inspection Notes

An inspector may need to testify in an enforcement proceeding. Therefore, it is imperative that each inspector keep detailed records of inspections, investigations, samples collected, and related inspection functions. An inspector should note the date and time of arrivals and departures each day of the inspection and document the sequence of events during each day of the inspection. Types of information that should be entered into the field notebook include the following:

Observations

Record all conditions, practices, and other observations that will be useful in preparing the inspection report or that will validate other types of evidence. For example, weather conditions such as rain/snowfall events prior to and during the inspection are useful and can assist the inspector in determining whether inflow/infiltration is a problem with the facility, or whether stormwater controls were adequate.

Documents and Digital Images

All documents taken or prepared by the inspector such as the completed checklists for the inspection report should be noted and related to specific inspection activities. The inspector should adequately document each digital image so that its content can be properly identified with the site, date, GPS coordinates (if available), photographer name, and description of the digital image. The “Digital Images” section below contains additional documentation information.

Unusual Conditions and Problems

Note and describe unusual conditions and problems in detail.

General Information

List names and titles of all facility personnel contacted during the inspection and the activities they perform. Business cards of facility representatives may be useful. Any statements made by facility personnel during the inspection should be included in the field notebook along with other general information. Information about a facility's recordkeeping procedures may also be useful in later inspections.

SAMPLES

For sample analytical results to be admissible as evidence, a logical and documented connection must be shown between samples taken and analytical results reported. This connection is shown by using a chain-of-custody form that identifies and accompanies a sample between the time it is collected and the time it is analyzed. Sampling techniques and procedures are discussed in Chapter 5, "Sampling."

INTERVIEWS AND STATEMENTS

Inspectors may attempt to obtain a formal statement from a person who has personal, firsthand knowledge of facts pertinent to a potential violation. In most inspections, the majority of information will be collected through informal statements and interviews. The inspector should interview as many of the facility personnel as possible to prepare an accurate description of the facility and its operations. It is useful to talk with people throughout the work area. For informal statements and interviews, attribute assertions to specific facility personnel as much as possible. Do not tape record without the individual’s knowledge. When conducting an interview, ask how, what, where, when, and why. Allow adequate time for the personnel to respond.

For interviews, open-ended questions are usually the most useful for gathering information. However, the yes/no, or close-ended questions are also sometimes necessary when the inspector is trying to collect specific information.

The principal objective of obtaining a formal statement is to record in writing, clearly and concisely, relevant factual information. Request the person making the statement sign and date the statement to certify that the document reflects an accurate summary of what they said.

Procedures and Considerations

- Determine the need for a statement. Will it provide useful information? Is the person making the statement qualified to do so by personal knowledge?
- Ascertain all the facts. Make sure all information is factual and firsthand. Record statements that are relevant and that the person can verify in court. Avoid taking statements that cannot be personally verified.
- In preparing a statement, use a simple narrative style with clear, plain stilted language.
  - Narrate the facts in the words of the person making the statement.
  - Use the first-person singular ("I am manager of . . .").
  - Present the facts in chronological order (unless the situation calls for another arrangement).
- Positively identify the person making the statement (name, address, position).
- Show why the person is qualified to make the statement.
- Present the pertinent facts.
- Have the person read the statement and make any necessary corrections before signing. If necessary, read the statement to the person in the presence of a witness.
  - All mistakes that are corrected must be initialed by the person making the statement.
- Ask the person making the statement to write a brief concluding paragraph indicating that he or she read and understood the statement and have that person sign this declarative statement. This safeguard will counter a later claim that the person did not know what he or she was signing.
- If he or she refuses to sign the statement, elicit an acknowledgment that it is true and correct. Ask for a statement in his or her own hand ("I have read this statement and it is true, but I am not signing it because…"). Failing that, declare at the bottom of the statement that the facts were recorded as revealed and that the person read the statement and avowed it to be true. Attempt to have any witness to the statement sign the statement including the witness' name and address.
- Provide a copy of the statement to the signer if requested.

DIGITAL IMAGES

The documentary value of digital images ranks high as admissible evidence. Clear digital images of relevant subjects provide an objective record of conditions at the time of inspection. If possible, keep "sensitive" operations out of the photographed background. To avoid capturing confidential information, the inspector should confer with the permittee to determine if the intended digital image will contain confidential information. If the inspector must take a digital image of an area containing confidential information, the facility representative can claim the image as CBI. Facilities may claim that certain digital images are CBI, in which case the inspector must handle the images following all CBI procedures. Digital images can also be used to collect copies of paper records where photocopiers are not available.

The primary objective of inspection photography is to create an image that accurately documents the inspector's observations and that can be used to testify that the image is a "true and accurate representation of what he or she saw on that date."

Digital cameras offer the advantage of immediate viewing of the image to assure proper composition and exposure. Date and time information is stored with the digital image and should be downloaded and stored with the image. Prior to taking digital images, the inspector should ensure the date and time settings on the camera are accurate. The site, photographer name, GPS coordinates (if available), weather conditions, and a description of the photograph (including compass direction if known (e.g., looking north or facing northwest)) should be recorded in the inspector's field notebook or a separate photograph log. Some digital cameras have built in GPS capability. If the camera does not, a separate GPS unit could be used to record the location. Video cameras and some digital cameras allow information about the digital image to be voice recorded. Refer to Appendix H, "EPA's Policy on the Use of Digital Cameras for Inspections," for EPA guidance on using digital cameras for inspections.

Equipment

Depending on the situation, there are normally three types of digital images that can be taken: 1) the establishing shot, 2) the subject, and 3) the detail shot. The "establishing shot" or wide-angle shot is a digital image taken from a distance that shows the subject in relation to permanent landmarks that can be used for reference in establishing the location of the subject. The "subject" shot emphasizes a specific object or event. The "detail" shot or close-up is typically an area of interest within the subject, such as a nameplate or leaky valve. It may be helpful to include an object of known size for scale reference such as a notebook or pen.

Safety

In areas where there is a danger of explosion, flash images should not be taken. In some situations, where explosive vapors may be present, such as petroleum refineries, hot-work permits, provided by the facility, may be necessary to take digital images. If there is a danger of electrical shock, digital images should be taken from a distance known to be safe. As mentioned previously, inspectors can work with facility personnel during the opening conference to ensure photography meets the sites requirements.

VIDEO

For some inspections, video cameras can be more effective in documenting your findings. Video cameras not only can document motion relative to a violation, but record sound, have extreme zoom capabilities, and can operate in very low light conditions. When recording sound, inspectors must be aware that all comments are recorded.

GPS

GPS units can document the latitude, longitude, and altitude for photographs, samples, or facility unit operations and features. The GPS coordinates can be entered into the field notebook or can be electronically downloaded.

DRAWINGS AND MAPS

Schematic drawings, maps, charts, and other graphic records can be useful supporting documentation. They can provide graphic clarification of site location relative to the overall facility, relative height and size of objects, and other information which, in combination with samples, photographs, and other documentation, can produce an accurate, complete evidence package. Electronic maps of the facility, available through Google Earth, should be obtained prior to the inspection and used to verify any changes that may have occurred since the Google Earth image was taken.

Drawings and maps should be simple and free of extraneous details. Include basic measurements and compass points to provide a scale for interpretation. Identify drawings and maps by source, inspector's initials, and date.

PRINTED MATTER

Brochures, literature, labels, and other printed matter may provide important information regarding a facility's conditions and operations.

Collect these materials as documentation if they are relevant. The inspector should create a receipt of documents and samples taken from the facility, ensuring that all printed matter obtained during the inspection is listed on this receipt.

ELECTRONIC RECORDS

Properly date and sign printouts of electronic records so they can be entered as evidence. Charts, graphs, and other hard copy documents produced from computer output should be treated as printed documentation and handled accordingly.

COPIES OF RECORDS

Facility records should be reviewed to verify the facility properly reports and maintains the required records and to verify permit compliance. The facility may store records in a variety of information retrieval systems, including written or printed materials or electronic format.

Obtaining Copies of Necessary Records

When copies of records are necessary for an inspection report consider, storage and retrieval methods.

Written or printed records generally can be photocopied on-site. Portable photocopy machines may be available to inspectors through the Regional Office. Where possible, inspectors should ask the facilities in advance if copying equipment would be available. When necessary, inspectors can obtain approval from the appropriate EPA authority to pay a facility a "reasonable" price for use of copying equipment. If the facility does not have a photocopier and a portable photocopier is not available, a photocopy machine is usually accessible at a nearby site (e.g., post office, convenience store). However, inspectors must obtain permission from the permittee prior to taking records off-site for copying. Information on some records may also be gathered with a camera.

- At a minimum, all copies made for or by the inspector should be listed in a document receipt, along with any printed matter or samples taken.
- When photocopying is impossible or impractical, close-up photographs or videotape or hand copying could be used.

Computer or electronic records may require the generation of hard copies for inspection purposes. Arrangements should be made during the opening conference, if possible, for these copies. Records could also be transferred electronically to a flash drive or disc. Photographs of computer screens or electronically saved screen shots may provide adequate copies of records if other means do not exist.

Identification Procedures

The records reviewed during an inspection should immediately be adequately identified to ensure the records can be differentiated and tracked throughout the EPA custody process and are admissible in court. When inspectors are called to testify, they must be able to identify each document and state its source and the reason for its collection if asked.

The inspector should log the records taken on the receipt of documents and samples taken from the facility, to be signed by both a facility representative and the inspector. The document receipt should clearly list each item taken with a descriptive title and assign each item a number. Once a facility representative and the inspector sign off on the receipt, the facility should make a copy of this receipt for their records. This receipt can also include other relevant information about what is taken from the facility, such as the number of pages in a document. The document and sample receipt thus provides a valuable reference for what records, copies, samples, etc. were obtained during the inspection.

Logging

Documents obtained during the inspection should be entered in the field notebook by a logging or coding system. The system should include the identifying number, date, and other relevant information:

- The reason for copying the material (i.e., the nature of the suspected violation or discrepancy).
- The source of the record (i.e., type of file, individual who supplied record).
- The manner of collection (i.e., photocopy, other arrangements).

GENERAL CONSIDERATIONS

- Return originals to the proper person or to their correct location.
- Group related records together.
- Handle CBI records according to the special confidential provisions discussed below.

Routine Records

The inspector may find it convenient to make copies of records, such as laboratory analysis sheets and data summaries, to refresh his or her memory when preparing the inspection report. It is not always necessary to follow the formal identification and logging requirements when such records are obtained for general information purposes or to aid in the preparation of routine inspection reports.

CONFIDENTIAL BUSINESS INFORMATION (CBI)

Handling of CBI or Trade Secrets during Inspections

Section 308(b)(2) of the CWA (40 CFR Part 2) protects and defines trade secrets and Confidential Business Information (CBI) from public disclosure. Section 308(a)(4) of the CWA states that an inspector may sample an effluent, request information, have access to the location of the effluent, and inspect any monitoring equipment. The information that is collected is available to the public, unless the information is claimed as CBI. If a permittee does not want inspection information to be available to the public, he or she must request that EPA consider the information confidential.

When conducting compliance inspections, an inspector may have to deal with claims of business confidentiality as authorized under section 308 of the CWA and as defined under 40 CFR Part 2, Subpart B. This section of the statute is designed to protect CBI from unauthorized disclosure. CBI includes information considered to be trade secrets (including chemical identity, processes, or formulation) or commercial or financial information that could damage a company's competitive position if they became publicly known. Inspectors that handle CBI must complete applicable CBI training and be cleared to handle CBI.

Any business being inspected has the right to claim all or any part of the information gathered during that inspection, other than effluent data or publicly available information, as CBI. See section 308(b) of the CWA; 40 CFR 2.302(e) and 2.20. EPA often notifies the business of its right to assert a claim of confidentiality at the time of the 308 letter. Frequently, the 308 Letter is used for this notification. After the business has responded to the 308 letter and, in that response, has asserted whatever claims of business confidentiality for eligible information it intends to make, EPA generally will be aware of any issues related to the handling of the information claimed as CBI.

The affected business may assert a CBI claim at any time, per 40 CFR 2.203(c), unless EPA requires the business to assert all CBI claims at the time of submission of a response to the 308 Letter and failure to do so may result in disclosure without further notice. See 40 CFR 2.203(a). If no such timing requirement is provided in the 308 Letter, the business can make such a claim at the time of the inspection or at any time after the inspection. Any CBI claim must be in writing and signed by a responsible company official. Information claimed as CBI can be later reviewed to determine whether the claim is valid. The CBI claim relates only to the public availability of such data and cannot be used to deny facility access to inspectors performing duties under section 308 of the CWA. Therefore, a business is entitled to assert a CBI claim for all information that an inspector requests or has access to; however, a business may not refuse to release information requested by the inspector under the authority of section 308 of the CWA on the grounds that the information is considered CBI or a trade secret.

While the business is entitled to make a CBI claim on all information that an inspector requests or has access to while on-site (other than effluent data or publicly available information), these CBI claims are subject to review by EPA's Office of General Counsel or Office of Regional Counsel and the business may be asked to substantiate its CBI claims. See 40 CFR 2.204(e). If a CBI claim for certain information is received by EPA after the information itself is received by EPA, EPA will make such efforts as are administratively practicable to associate the late claim with copies of the previously submitted information in EPA's files. See 40 CFR 2.203(c). However, EPA cannot assure that such efforts will be effective, considering the possibility of prior disclosure or widespread prior dissemination of the information.

When a business makes the CBI claim, the Regional Office normally will not determine the validity of that claim until there is a request for the information from a third party, if EPA desires to determine whether the business information is entitled confidential treatment, if it is likely the EPA will be requested to disclose this information, or if EPA believes that the information should be included in the public record in connection with a proceeding. The exact procedures for making and handling CBI determinations are contained in 40 CFR Part 2, Subpart B. Until the EPA makes an adverse determination on the CBI claims, the information is entitled confidential treatment and protected from release.

In some cases, entry to a facility may be denied based on the claim by a permittee that there is CBI at the facility. In such cases, the inspector should recite the relevant subsections of 308 so they are clearly understood by all parties involved. The inspector should then explain the provisions of 40 CFR Part 2, Subpart B, concerning EPA's handling of CBI and information claimed as CBI. For example, the inspector could suggest that the protected material or process be segregated from other non-CBI information or processes. If the facility representative still refuses entry, the inspector should not contest the issue but should treat the matter as denial of entry and immediately notify the appropriate EPA enforcement office for instructions.

Types of Information Excluded from Confidential Treatment

To understand CBI claims, an inspector should know the types of information entitled confidential treatment as defined in 40 CFR Part 2. The regulations specifically exclude certain types of information from confidential treatment. This "public information" includes the NPDES

permit application and all "effluent data" as defined in 40 CFR 2.302(a)(2)(i). According to this definition, effluent data include all information necessary to determine the identity, amount, frequency, concentration, temperature, and other characteristics (to the extent they are related to water quality) of:

- Any pollutant that has been discharged by the source (or any pollutant resulting from any discharge from the source).
- The pollutant which, under an applicable standard or limitation, the source was authorized to discharge (including, to the extent necessary for such purpose, a description of the manner or rate of operation of the source).

Effluent data may also include a general description of the location and/or nature of the source to the extent necessary to distinguish it from other sources (e.g., a description of the device, installation, or operation constituting the source).

Confidentiality Agreements and Nondisclosure

Inspectors, whether EPA, the state, or EPA contractors conducting NPDES compliance inspections, shall not sign any pledge of secrecy or confidentiality agreements or any agreement that would limit the EPA's ability to disclose information received while inspecting a facility or inconsistent with 40 CFR Part 2, Subpart B. See 40 CFR 2.215. Section 308 of the CWA does not specify that a secrecy agreement must be executed as a condition of entry. Unauthorized disclosure of confidential information by EPA or state employees and authorized contractors is prohibited by law (33 U.S.C. 1318(b) and 18 U.S.C. Part 1905). In addition, all contractor inspectors must sign a statement that they will be personally bound by 40 CFR Part 2, Subpart B, and not disclose trade secrets or CBI.

It is not appropriate for the compliance inspector to determine whether a permittee's CBI claim is appropriate or justified. Once such a claim is made, the information must not be disclosed and must be kept confidential until a determination is made by the appropriate EPA legal office. EPA employees who violate these requirements may be subject to dismissal, suspension, or fines. Criminal action may be taken against EPA employees and authorized contractors or subcontractors who are unauthorized to disclose CBI.

Best Practices for Handling Confidential Business Information

Routine security measures will help ensure that reasonable precautions are taken to prevent unauthorized persons from viewing CBI or information claimed as CBI. When practical circumstances prohibit the inspector from following the procedures exactly, he or she should take steps to protect the information and note those procedures in the field notebook. He or she should mark all information claimed as CBI received as such and place in a locked filing cabinet or a safe immediately after the inspection is completed. Maintain a chain-of-custody record for all CBI and information claimed as CBI. Since CBI and information claimed as CBI requires special handling procedures, it may be useful to keep it in a separate notebook in a secure/locked location. By doing this, only the CBI material, and not the entire notebook of inspection findings, would have to be kept in a locked filing cabinet.

- While traveling. The inspector may be on the road for several days while conducting inspections. The inspector is responsible for ensuring that the information collected is handled securely.
  - Maintain physical possession of the documents. Documents and field notes are considered secure if they are in the physical possession of the inspector and are not visible to others while in use.
  - Keep inspection documents that contain sensitive information in a locked briefcase. If it is impractical to carry the briefcase store the briefcase in a locked area, such as the trunk of a motor vehicle.
  - Place physical samples in locked containers and store in a locked portion of a motor vehicle. The chain-of-custody procedures provide further protection for ensuring the integrity of the sample.
  - CBI should not be stored in checked baggage if travelling by airplane.
- In the office. Each region should develop CBI standard operating procedures. It is useful to indicate who the Regional Administrator, Division Director, Branch Chief or Document Control Officer has authorized to have access to CBI. An access log should be maintained for all transactions. Do not copy information marked "trade secret" and/or "confidential business information" unless there is written authority from the Regional Administrator, Division Director, Branch Chief, or Document Control Officer. Requests for access to CBI or information claimed as CBI by any member of the public, or by an employee of a federal, state, or local agency, must be handled according to the procedures contained in the EPA Freedom of Information Act regulations under 40 CFR Part 2, Subpart B. All such requests should be referred to the responsible regional organizational unit.

F. CLOSING CONFERENCE

To achieve the most effective results from compliance inspections, the inspector should communicate results promptly to the facility management and personnel. The inspector should limit the discussion to preliminary findings of the inspection. If appropriate, the inspector may compare findings with the permittee's NPDES permit requirements, consent decrees, administrative orders, and other enforcement actions. At no time should inspectors state whether any of the observed deficiencies are violations.

Facility officials are usually anxious to discuss the findings of an inspection before the inspector(s) leave. Inspectors should hold a closing meeting or conference for the presentation and discussion of preliminary inspection findings. The closing conference provides an opportunity to describe areas of concern (e.g., unpermitted discharge; parts of a SWPPP missing; routine inspections not being done; silt fence not installed; discharge to a storm drain). During this meeting or conference, inspectors can answer final questions, prepare necessary receipts, provide information about the NPDES program, and request the compilation of data that were not previously available during the inspection. It also presents an opportunity to deliver compliance assistance materials and/or information in accordance with EPA's *National Policy on the Role of the EPA Inspector in Providing Compliance Assistance During Inspections*

(EPA, 2003), available at: https://www.epa.gov/compliance/policy-role-epa-inspector-providing-compliance-assistance-during-inspections.

Inspectors should be prepared to discuss follow-up procedures, such as how results of the inspection will be used and what further communications the region, state, tribe, or locality may have with the facility. Inspectors should conduct closing conferences in accordance with any applicable guidelines or standard operating procedures (SOPs) established by the EPA Regional Administrator, State Commissioner, Tribal Official, or Local Director.

The inspector may issue a Deficiency Notice that specifies existing or potential problems in a permittee's self-monitoring program. Issuing a Deficiency Notice on-site or after the site inspection provides a swift and simple method for improving the quality of data from NPDES self-monitoring activities. An example Deficiency Notice and EPA's "Memorandum on Deficiency Notice Guidance" are provided in Appendix I.

G. INSPECTION REPORT

The adequacy of compliance follow-up to correct problems or deficiencies noted during the inspection greatly depends on the report prepared by the inspector. The following sections of this chapter detail procedures for collecting and substantiating the information used to prepare this report. Once collected, however, the inspector should organize and arrange the material so that compliance personnel can make maximum use of the evidence or inspection information. The information presented in this section provides general guidelines for organizing evidence and preparing an inspection report.

OBJECTIVE OF THE NPDES INSPECTION REPORT

The objective of a NPDES inspection report is to organize and coordinate all inspection information and evidence into a comprehensive, usable document. To meet this objective, information in an inspection report must be presented in a clear, well-organized manner. The information should be objective and factual; the report must not speculate on the ultimate result of the inspection findings. Inspectors must avoid using of the term "violation" and should instead use words like finding or deficiency. The following are particularly important:

- Information in the report should be factual and based on sound inspection practices. Observations should be the verifiable result of firsthand knowledge. Compliance personnel must be able to depend on the accuracy of all information.
- Information in an inspection report should be relevant to the subject of the report. Extraneous data that clutters a report and may reduce its clarity and usefulness should not be included in the report. Avoid personal comments and opinions.
- Substantiate suspected deficiency(s) by as much factual information as is feasible to gather. Organize all information pertinent to the subject into a complete package. Documentation (e.g., photographs, statements, sample documentation) accompanying the report should be referenced clearly so that anyone reading the report will get a

complete, clear overview of the situation. The more comprehensive the evidence is, the better and easier to determine compliance or noncompliance.

EFFECTIVELY COMMUNICATE AND DOCUMENT FINDINGS IN THE INSPECTION REPORT

This is especially critical when the findings and observations support that an alleged deficiency has occurred. The following includes examples of how to effectively communicate alleged deficiencies.

1. First, state the requirement in the actual language of the statute, permit, or regulation and then describe and present the evidence that shows how the facility failed to meet the requirement. It can be helpful to repeat the same words used in the statute, permit, or regulation when describing what was observed at the facility. Each alleged deficiency should be made obvious to the reader by thoroughly and clearly describing all documents, photographs, statements, and other evidence in the inspection report. This should include the inspector's own observations. For example:
    a. **Failure to meet Missouri State Operating Permit (MSOP) conditions.** The Missouri MSOP, MO0023456, issued to the City of Pollutionville, at Section C. Special Conditions, Subsection 6. General Criteria, contains the following requirement: "a) Waters shall be free from substances in sufficient amounts to cause formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses." On January 5, 2002, at the WWTP's outfall 32 (see map—attachment 3), I observed the receiving water body, Greenfoot Stream, to have approximately 4–5 inches of sludge deposit on the bottom 9 inches (see photos #10–14, approximation of depth made with 12" ruler) as well as a blood worm population (photos #15–16, estimate of blood worm population based on counting the number of blood worms per square foot of water surface to a depth of about 1 foot). Greenfoot Stream is on the Missouri 303(d) list for nutrient content. Mr. Smith, the plant operator, signed a statement that the plant had been losing solids to the stream for four months due to an increased organic load from Acme Meat Packing Co. (see attachment 5) …
    b. **Failure to properly operate and maintain treatment system; failure to meet the TSS daily maximum limit.** Part IV.B.3 of the EPA Region 8 NPDES Permit, WY0112233, (the permit) states, "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." During the inspection, I observed that the secondary clarifier was not operating. Mr. Helpful, the superintendent, stated that the secondary clarifier had been offline for the past month until money for a new drive unit could be procured, and the old drive unit became jammed and no longer works. Based on sampling records I reviewed at the facility, the facility effluent has exceeded the daily maximum total suspended solids limit of 45 mg/L listed in Part II.B.1 of the permit on March 23, 2014 (190 mg/L); March 31, 2014 (104 mg/L); April 6, 2014 (188 mg/L); and April 11, 2014 (154 mg/L).

Use a separate, indented paragraph to highlight each alleged deficiency along with an obvious font change.

Each inspector should use the following techniques to ensure a well-documented inspection report:

1. Write the report as soon as possible upon return from the field. As noted earlier, excessive delays or reports not written "near-in-time" to the inspection can compromise EPA's ability to conduct timely enforcement.
2. Write the report in the active voice and in a "compare and contrast" style. Each alleged deficiency identified should be stated in a manner where the facts are presented and then compared, against the statute, permit or regulatory requirement.
3. Use simple, direct language, short sentences and paragraphs, and avoid repetition.
4. Identify, by name and relationship to the facility, who said what and when.
5. Clearly identify all alleged deficiencies observed during the inspection or evaluated prior to the report write-up.
6. Reference the applicable statute, permit, or regulation for each alleged deficiency identified. If the inspection is conducted in a state that is authorized to implement the regulation, then the applicable state law or regulation should be referenced.
7. Provide a complete and detailed description of all materials (e.g., all photographs, maps, diagrams) gathered to support the potential violation.
8. Identify, number, and reference all attachments in the text of the field report.
9. Use consistent word choice; e.g., if a particular device is called a "Waste-o-matic," use the term "Waste-o-matic" throughout the report to describe that device.
10. Do not use negative inferences. For example, avoid saying "...the only drums found were...," which is not first person and implies that no other drums were at the facility. Simply state what was observed; e.g., "During the inspection, I observed five drums which were..."
11. Do not use vague and ambiguous terms or statements. For example, avoid using words like indicated, implied, suggested, several, many, some, or it was determined.
12. Do not use absolute terms like all, always, or every, unless the findings and observations have been fully verified and documented. Be as precise and accurate as possible.
13. Do not repeat or use information obtained from previous inspection reports that was not verified during the inspection unless the purpose of stating previous alleged violations is to establish that there is a pattern of the same alleged violations.
14. Describe all actions (including timeframes) that the facility said they would complete as a result of the inspection.

ELEMENTS OF A REPORT

Although specific information requirements for an inspection report will vary, most reports will contain the same basic elements:

- Supplementary narrative information
- Copies of completed checklists
- Documentation
- Inspection Conclusion Data Sheet (if required by the regional office Standard Operating Procedures)

Supplementary Narrative Information

Supplementary narrative information could be a memorandum in the case of routine inspections or a narrative report when major violations are detected. When a narrative report is necessary to fully describe a compliance inspection, the contents of the report should focus on supporting or explaining the information provided.

The narrative report should be a concise, factual summary of observations and activities, organized logically and legibly, and supported by specific references to accompanying documentation.

Basic steps in writing the narrative report include the following:

- **Reviewing the information**
  - The first step in preparing the narrative is to collect all information gathered during the inspection. Review the inspector's field notebook in detail. Review all evidence for relevance and completeness. A telephone call or, in unusual circumstances, a follow-up visit may be needed to obtain additional or supplementary information. Record any phone call relating to the inspection in the inspector’s logbook with date and time.

- **Organizing the material**
  - Organize the information according to need, present it logically and comprehensively. Organize the narrative so that it is easily understood.

- **Referencing accompanying material**
  - Reference all documentation accompanying a narrative report clearly so that the reader will be able to easily locate the items. The “Documentation” section in this chapter provides details on document identification. The inspector should check all documentation for clarity before writing the report.

- **Writing the narrative report**
  - Once the material is reviewed, organized, and referenced the narrative can be written. The purpose of the narrative is to factually record the procedures used in, and findings resulting from, the evidence-gathering process. The inspector should refer to routine procedures and practices used during the inspection, but should

detail facts relating to potential violations and discrepancies. The field notebook is a guide for preparing the narrative report.

- If the inspector has followed the steps presented in this manual, the report will develop logically from the organizational framework of the inspection. In preparing the narrative, the inspector should strive to use plain and simple language and always proofread the narrative carefully.

- **Copies of completed checklists**
  - Refer to comprehensive checklists in the technical chapters of this manual and in the appendices. When appropriate, use these checklists to collect information during the inspection, the region may modify these to specific concerns. Include copies of all completed checklists in the inspection report.

- **Documentation**
  - Include or reference all documentation produced or collected by the inspector to provide evidence of suspected violations in the inspection report. The "Documentation" section in this chapter provides details on obtaining and organizing this material.

INTEGRATED COMPLIANCE INFORMATION SYSTEM (ICIS)

The inspection office should ensure that all required data are entered into ICIS, which is used for national tracking of NPDES permit information. EPA does not credit the inspection until it is coded/entered into ICIS. Therefore, timely completion of reports and data entry into ICIS is essential as part of the compliance inspection follow-up. Make every effort to ensure that data are entered no later than 30 days after the inspection is completed.

Integrated Compliance Information System (ICIS)

ICIS supports the information needs of the National Enforcement and Compliance program as well as the unique needs of the NPDES program. ICIS integrates data that is currently located in more than a dozen separate data systems. The web-based system enables individuals from states, communities, facilities, and EPA to access integrated enforcement and compliance data from any desktop connected to the Internet. EPA's ability to target the most critical environmental problems will improve as the system integrates data from all media.

ICIS features include:

- Desktop access
- Internet access
- Integrated data
- Real-time entry and retrieval of data
- Powerful reporting capabilities
- User-friendliness

Inspection Conclusion Data Sheet (ICDS)

In FY 2002, EPA began collecting information on EPA NPDES compliance inspection outcomes using a manual ICDS form. In FY 2003, the Office of Enforcement and Compliance Assurance (OECA) launched ICIS to electronically capture compliance and enforcement information, including ICDS data. Regions have the option of submitting ICDS information by submitting summary information at mid-year and end-of-year to EPA Headquarters similar to other manually reported information or entering the ICDS data directly into ICIS. Regions must decide whether EPA inspectors or central data entry personnel will be responsible for entering the data into ICIS. If EPA inspectors enter the data, no manual ICDS form will be needed since the information to fill out the form should be included in the inspector's notes. If central data entry personnel enter the data, EPA inspectors should complete the manual ICDS form and forward it to their first-line supervisor for review prior to data entry into ICIS. The ICDS form is included in Appendix J.

H. REFERENCES

Suarez, J.P. (2003). *Role of the EPA Inspector in Providing Compliance Assistance During Inspections.* U.S. Environmental Protection Agency Memorandum, Final National Policy.

CHAPTER 3 – DOCUMENTATION/RECORDKEEPING AND REPORTING

Contents

Associated Appendices

A. INSPECTION AUTHORITY AND OBJECTIVES

AUTHORITY AND OBJECTIVES

Statutory Recordkeeping Authority:	Clean Water Act (CWA) Sections 308 and 402
Regulatory Requirements:	Title *40 Code of Federal Regulations (CFR)* Parts 122, 136, 401, 403, 405–471, and 503, as applicable
Inspection Authority:	CWA Section 308

The National Pollutant Discharge Elimination System (NPDES) permit system requires facilities to maintain records and report periodically on the quantity and type of discharged effluent. The permit stipulates recordkeeping and reporting conditions. Evaluations are conducted at selected permitted facilities to determine compliance with permit requirements. The procedures listed below should be used for these routine inspections. If suspected violations are disclosed during the routine evaluation, a more intensive investigation should be conducted.

A review of facility records should determine that recordkeeping requirements are being met. In particular, the following questions should be answered:

- Is facility verifying data being collected as required by the permit?
- Is all required information available?
- Is the information current?
- Is the information being maintained for the required time period?
- Do the records reviewed indicate areas needing further investigation?
- Do the records show compliance?
- Are the records certified?

During the site inspection, the inspector does not have the authority to require the following:

- A specific organizational method for the facility records.
- Facility copies of the records or access to a copier. The inspector should be prepared to make their own copies with a portable scanner/printer or plan to copy the records at a professional copier.

B. EVALUATION PROCEDURES

VERIFICATION, RECORDKEEPING, AND REPORTING EVALUATION PROCEDURES

During the inspection

During the facility site inspection, the inspector should verify the following requirements of the permit:

- The number and location of discharges are as described in the permit.
- All discharges, if permitted, are in accordance with the general provisions of the permit, such as no noxious odors, no visible entrained solids in discharge, no deposits at or downstream of the outfall, no color change in the receiving stream, and no fish or vegetation kills near the outfalls.

The inspector should review the permit to determine recordkeeping and reporting requirements. Throughout the inspection, the inspector should compare facility's operations with the permit to verify that required permit activities are correct, current, and complete. Obtain some of the information needed to verify the permit during the opening conference and compare with the facility permit. This information includes the following:

- Correct name and address of facility
- Correct name and location of receiving waters
- Number and location of discharge points (if any)
- Principal products and production rates (where appropriate)

The inspector should check for records that will verify that notification has been made to the Environmental Protection Agency (EPA) or to the state when: 1) discharges differ from those stated in the permit, 2) a discharge violates the permit, and 3) a bypass has occurred. The inspector should also check to ensure that the facility maintains the appropriate records for a minimum of three years (or five years for sewage sludge). These records may include the following:

- Sampling and analysis data:
  - Dates, times, and locations of sampling
  - Sample types collected
  - Analytical methods and techniques
  - Results of analyses
  - Dates and times of analyses
  - Name(s) of analytical and sampling personnel

- Monitoring records:
  - Discharge Monitoring Reports (DMRs), including information on flow, pH, Dissolved Oxygen (DO), etc., as required by permit. A blank DMR form is included in Appendix L.
  - Original charts from continuous monitoring instrumentation.
  - Verification of the validity of the data on the DMRs. An inspector can perform this verification by tracking the raw data from the laboratory bench sheets or other databases to the final reported DMR entries.

- Laboratory records:
  - Calibration and maintenance of equipment
  - Calculations (i.e., on bench sheets or books)
  - Quality assurance/quality control (QA/QC) analysis data
  - Laboratory standard operating procedures (SOPs)
  - Results of DMR QA studies

- Facility operating records:
  - Daily operating log.
  - Summary of all laboratory tests run and other required measurements, including reference test method used (Inspectors should reference the most recent version of the Standard Methods or 40 CFR Part 136 methods for test procedures).
  - Chemicals used (pounds of chlorine per day, etc.).
  - Weather conditions (temperature, precipitation, etc.).
  - Equipment maintenance completed and scheduled.
  - Equipment downtime and failures.
  - Spare parts inventory.
  - Monitoring equipment calibration records.

- Treatment plant records (required under the Federal Construction Grants program):
  - Plant Operations and Maintenance (O&M) Manual
  - Percent removal records
  - "As built" engineering drawings
  - Copy of construction specifications
  - Equipment supplier manual
  - Data cards (i.e., maintenance records) on all equipment

- Management records:
  - Average monthly operating records
  - Annual reports
  - Emergency conditions (power failures, bypass, upsets, chlorine failure reports, etc.)

- Pretreatment records:
  - Publicly Owned Treatment Works (POTW) and industrial monitoring and reporting requirements.
  - Industrial user discharge data.
  - Compliance status records (IU inspection reports, SNC evaluations, POTW sampling information, etc.).
  - POTW enforcement initiatives and Enforcement Response Plan.
  - POTW procedures listed in 40 CFR 403.8(f)(2).
  - Industrial waste survey information.
- Risk Management Plan (RMP)
- Stormwater Pollution Prevention Plan (SWPPP)
- Self-inspection records
- Spill Prevention Control and Countermeasure (SPCC) Plan

When required, a properly completed RMP, SWPPP, and/or SPCC Plan should be available. The inspector also may gather information on the SPCC and forward this information to the appropriate program office for follow-up action plans.

- Best Management Practices (BMPs) (where required).
- Two types of BMP plans are included in NPDES permits:
  - BMP plans to minimize or prevent release of significant amounts of any toxic or hazardous pollutants to public waters. The plans may discuss general operations and maintenance of the plant, good housekeeping procedures on the facility grounds, and other plans and procedures specific to best management of the facility.
  - Site-specific BMP plans to address particular toxic or hazardous chemicals or other conditions particular to the facility. Site-specific BMP may include procedures, monitoring requirements, construction of barriers such as dikes and berms, or other appropriate measures for solving specific problems.

In addition, inspectors should ensure that sludge records to verify compliance with 40 CFR Part 503 are maintained for a minimum of five years. The facility needs to keep records to be reviewed (such as sludge records and laboratory records) on-site for the inspector.

The inspector should document all inspection activities (see Chapter 2, Section E). Inadequacies, discrepancies, or other problems disclosed during this review may warrant more intensive investigation.

The inspector should validate (or obtain) accurate outfall locational data during the inspection. Locational data includes the precise latitude and longitude of each outfall (including metadata such as source, datum, precision, etc.). EPA collects this information as part of the EPA permit applications for inclusion in ICIS-NPDES. Locational data are becoming increasingly critical for

Agency-wide geospatial applications, including everything from mapping to prioritizing enforcement and permitting efforts.

COMPLIANCE SCHEDULE STATUS REVIEW

If the permit contains a compliance schedule or if the facility is under an enforcement action with a compliance schedule, the inspector should determine:

- Whether the permittee is conforming to the compliance schedule and, if not, whether final requirements will be achieved on time.
- The accuracy of reports relating to compliance schedules.
- The length of delay associated with a construction violation.
- Whether any schedule violations are beyond the control of the discharger.
- Whether requests for permit modifications are valid.

If the permit contains a compliance schedule, only review the schedule in detail if the need becomes apparent during records review and preparation of the inspection plan. Actions to review should include beginning new construction, contract and equipment orders, authorization and financing arrangements, and/or attainment of operational status. The specific compliance schedule actions are described below.

Construction Progress

The inspector must know whether contracts for labor and material have been fulfilled and whether the permittee or the permittee's engineering consultant is monitoring progress. These aspects are extremely important, particularly in plants where numerous contracts are likely for labor and equipment.

If the permittee or the engineering consultant reports that construction or acquisition of equipment is behind schedule, the inspector should:

- Ask to see the permittee's or the resident engineer's progress report and determine whether the report indicates that the final compliance schedule required by the permit can be met.
- If the report indicates that the final date will not be met, advise the permittee that the compliance schedule of the NPDES permit requires the permittee to notify the permit-issuing authority promptly of any possible delay in achieving compliance and of measures taken to minimize the delay.
- Inquire whether the facility superintendent or chief operator and operating personnel are receiving adequate training concerning the operational aspects of the new treatment unit while construction is under way. They must be prepared to perform the essential operating functions when the facility is placed in service.

Construction Contracts and Equipment Orders

The inspector should review the appropriate documents to determine whether the permittee has obtained the necessary approval to begin construction. The inspector should note the start and completion dates (or scheduled delivery dates in service or equipment contracts).

Authorization and Financing

If construction is incomplete, the inspector should determine whether the permittee has the authority and financial capability (mortgage commitments, corporate resolution, etc.) to complete the required structures.

Attainment of Operational Status

If construction has been completed but the facility is not yet operational, the inspector should determine whether the facility is using appropriate procedures to ensure attainment of working status at the earliest possible time. The inspector should verify the following:

- Appropriate self-monitoring procedures that the facility has initiated. It is especially important that the result of operational and effluent quality monitoring be reviewed to determine whether progress is being made toward optimum efficiency in each treatment unit and in the entire plant.
- Appropriate recordkeeping procedures.
- Appropriate work schedules and assignments. (For municipal facilities, the O&M Manual should provide essential guidance.)

POTW PRETREATMENT REQUIREMENTS REVIEW

The inspector must collect specific information to evaluate compliance with pretreatment requirements. A summary of inspector procedures for this review is provided below and for more detail see Chapter 9, "Pretreatment."

As part of the inspection, the inspector must collect information about the POTW's compliance with its approved pretreatment program and applicable regulations, as well as the compliance status of its industrial users (IUs) with categorical pretreatment standards or locally developed discharge limitations. POTW's that do not have an approved pretreatment programs should have pretreatment requirements in its permit, such as the requirement to notify the permitting authority of new significant industrial users in its service area or requirements to prevent pass-through and interference. The inspector should review POTW records to determine the following:

- Whether all the contributing industries, including the number of significant industrial users (SIUs) are accounted.
- Whether all IUs are properly identified and classified.
- Whether IUs have submitted required reports and notifications to the POTW. These include baseline monitoring reports (BMRs), compliance schedule progress reports, 90-day compliance reports, periodic compliance reports, notifications of changed

discharge, potential problem discharges, violation and resampling, and hazardous waste discharge.

- Whether all the contributing IUs are in compliance with applicable standards, such as categorical pretreatment standards, local limits, general and specific prohibitions, etc.
- Whether permits containing all required elements have been issued to significant IUs in a timely manner.
- Whether inspections and sampling (including evaluation of the need for slug control plans) of SIUs are conducted at the required frequency.
- Whether the POTW has notified all affected IUs of classification and applicable standards and requirements, including Resource Conservation and Recovery Act (RCRA) obligations.
- Whether appropriate enforcement actions have been taken against all noncompliant IUs in accordance with the POTW's Enforcement Response Plan and whether the names of all IUs in significant noncompliance are published at least annually.
- Whether contributing IUs with compliance schedules are meeting applicable schedule deadlines and compliance schedule reporting requirements.

IN-DEPTH INVESTIGATIONS

The inspector should conduct an in-depth inspection of a permittee's records and reports to substantiate a suspected violation; to verify self-monitoring data to use as corroborative evidence in an enforcement action; or to confirm apparent sampling, analysis, or reporting discrepancies discovered during the limited inspection. For example, discrepancies warrant an in-depth review if the inspector:

- Suspects the discharge does not meet required standards and no definite operational problems have been established.
- Suspects grossly inaccurate self-reporting data with recordkeeping procedures and/or the filing of reports.
- Suspects the cursory review indicates omissions or laxity in the preparation of records.
- Suspects evidence of falsification of records
- Suspects laboratory review of analytical data indicates errors in QC or data management.

Confer with supervisor for more guidance and assistance as needed in performing an in-depth investigation.

In-depth Investigation Procedures

The following procedures should guide the inspector in conducting an in-depth investigation:

- Determine investigation objective. What is the specific purpose of the investigation?
- Determine information needed. What specific data will substantiate a violation or respond to the investigation objective?

- Determine data source. What records will contain these required data?
- Review inspection authority. Authority to inspect under section 308 is limited to those records required by the permit/regulations.
- Inspect direct and indirect data sources. Examine records likely to provide the required data directly. In the absence of direct data, use indirect sources of information to develop a network of information relevant to the data being sought.
- Take statements from qualified facility personnel. See Chapter 2, Section E, for specific procedures.
- Prepare documentation. Copy and identify all records relevant to the information being sought. See Chapter 2, Section E, for specific procedures.
- Follow confidentiality procedures. Any record inspected may be claimed by the facility as confidential. Treat such records in accordance with EPA procedures. See the discussion on Confidential Business Information in Chapter 2, Section E.

C. VERIFICATION, RECORDKEEPING, AND REPORTING EVALUATION CHECKLIST

This section provides an example of the type of checklist inspectors should use during inspections. The checklist should capture facility information and whether permit conditions are being met, as well as provide documentation for each suspected violation. The purpose of such a checklist is to concisely and thoroughly keep track of all the necessary information. Additionally, when required by regulations, inspectors should ensure records are certified.

A. PERMIT VERIFICATION			
Facility Name and Mailing Address:			
Brief Facility Description:			
Permit Number and Facility Representative:			
Inspection Date and Time, Inspector Names:			
Yes	No	N/A	1. Inspection observations verify information contained in permit.
Yes	No	N/A	2. Current copy of permit is on-site.
Yes	No	N/A	3. Name and mailing address of permittee are correct.
Yes	No	N/A	4. Records accurately identify name and location of receiving waters.
Yes	No	N/A	5. Number and location of discharge points are as described in permit.
Yes	No	N/A	6. All discharges are permitted.
Yes	No	N/A	7. Facility is as described in permit.

Yes	No	N/A	8. Notification was given to EPA/state of new, different, or increased discharges.
Yes	No	N/A	9. Facility maintains accurate records of influent volume, when appropriate.
Yes	No	N/A	10. The facility used Federal Construction Grant funds to build the plant.
B. RECORDKEEPING AND REPORTING EVALUATION			
Yes	No	N/A	1. Maintain records and reports as required by permit.
Yes	No	N/A	2. All required information is available, complete, and current.
Yes	No	N/A	3. Information is maintained for three years (or five years for sewage sludge).
Yes	No	N/A	4. If the facility monitors more frequently than required by permit (using approved methods), these are results reported.
			5. Analytical results are consistent with data reported on DMRs:
Yes	No	N/A	a. The data is transcribed accurately from the bench sheets to the DMRs.
Yes	No	N/A	b. The calculations are performed properly (including loading, averages, etc.).
			6. Sampling and analyses data include:
Yes	No	N/A	a. Dates, times, and location of sampling.
Yes	No	N/A	b. Sample types collected.
Yes	No	N/A	c. Instantaneous flow at grab sample stations.
Yes	No	N/A	d. Name of individual performing sampling.
Yes	No	N/A	e. Analytical methods and techniques.
Yes	No	N/A	f. Results of analyses and calibration.
Yes	No	N/A	g. Dates and times of analyses.
Yes	No	N/A	h. Name of person performing analyses.
			7. Monitoring records include:
Yes	No	N/A	a. Flow, pH, DO, etc., as required by permit.
Yes	No	N/A	b. Monitoring charts maintained for three years (or five years for sewage sludge).
Yes	No	N/A	c. Flowmeter calibration records maintained.
Yes	No	N/A	d. Locational data (latitude and longitude of each outfall).
Yes	No	N/A	8. Laboratory equipment calibration and maintenance records are adequate.
			9. Treatment plant records include (Note—these records are only required for facilities built with Federal Construction Grant Funds):
Yes	No	N/A	a. O&M Manual.
Yes	No	N/A	b. Percent removal records.
Yes	No	N/A	c. "As-built" engineering drawings.
Yes	No	N/A	d. Construction specifications.
Yes	No	N/A	e. Schedules and dates of equipment maintenance repairs.
Yes	No	N/A	f. Equipment supplies manual.
Yes	No	N/A	g. Equipment data cards.
			10. Management records include:

Yes	No	N/A	a. Average monthly operating records.
Yes	No	N/A	b. Annual reports.
Yes	No	N/A	c. Emergency conditions.
			11. Pretreatment records contain inventory of industrial waste contributors, including:
Yes	No	N/A	a. Monitoring data.
Yes	No	N/A	b. Inspection reports.
Yes	No	N/A	c. Compliance status records.
Yes	No	N/A	d. Enforcement actions.
C. COMPLIANCE SCHEDULE STATUS REVIEW			
Yes	No	N/A	1. Permittee is meeting or has met compliance schedule.
Yes	No	N/A	2. Permittee has obtained necessary approvals to begin construction.
Yes	No	N/A	3. Financial arrangements are complete.
Yes	No	N/A	4. Executed contracts for engineering services.
Yes	No	N/A	5. Completed design plans and specifications.
Yes	No	N/A	6. Construction has begun.
Yes	No	N/A	7. Facility superintendent/chief operator and operating personnel have received adequate training on use of the new treatment unit.
Yes	No	N/A	8. Construction is on schedule.
Yes	No	N/A	9. Equipment acquisition is on schedule.
Yes	No	N/A	10. Facility has completed construction.
Yes	No	N/A	11. Operational startup has begun.
Yes	No	N/A	12. Permittee has requested an extension of time.
D. POTW PRETREATMENT REQUIREMENTS REVIEW			
Yes	No	N/A	THE FACILITY IS SUBJECT TO PRETREATMENT REQUIREMENTS.
			1. Status of POTW pretreatment program:
Yes	No	N/A	a. EPA approved the POTW pretreatment program. (If not, is approval in progress?)
Yes	No	N/A	b. The POTW is in compliance with the pretreatment program compliance schedule. (If not, note why, what is due, and intent of the POTW to remedy.)
			2. Status of Compliance with Categorical Pretreatment Standards.
Yes	No	N/A	a. How many POTW IUs, federal or state, are subject to pretreatment standards?
Yes	No	N/A	b. Are these IUs aware of their responsibility to comply with applicable standards?
Yes	No	N/A	c. Has the facility submitted BMRs (403.12) for these industries?
Yes	No	N/A	i. Have categorical IUs in noncompliance (on BMR reports) submitted compliance schedules?

Yes	No	N/A	ii. How many categorical IUs on compliance schedules are meeting the schedule deadlines?
Yes	No	N/A	d. If the compliance deadline has passed, have all IUs submitted 90-day compliance reports?
Yes	No	N/A	e. Are all categorical IUs submitting the required semiannual report?
Yes	No	N/A	f. Are all new industrial discharges in compliance with new source pretreatment standards?
Yes	No	N/A	g. Has the POTW submitted an annual pretreatment report?
Yes	No	N/A	h. Has the POTW taken enforcement action against noncomplying IUs?
Yes	No	N/A	i. Is the POTW conducting inspections of industrial contributors?
Yes	No	N/A	3. Are the IUs subject to Prohibited Limits (403.5) and Local Limits more stringent than EPA in compliance? (If not, explain why, including need for revision of limits.)
Document any issues below:			

CHAPTER 4 – FACILITY SITE REVIEW—WASTEWATER TREATMENT PLANTS

Contents

List of Tables

List of Exhibits

A. OBJECTIVES

The objectives of a facility site review are to:

- Assess the physical conditions of the facility's current treatment processes and operations.
- Evaluate the permittee's operation and maintenance activities that impact plant performance.
- Check the completeness and accuracy of the permittee's performance/compliance records.
- Determine whether the treatment units are achieving the required treatment efficiencies.

To accomplish this, a National Pollutant Discharge Elimination System (NPDES) inspector should conduct a physical inspection of the facility (i.e., site survey), interview various levels of management and staff, and review facility records.

The information in this chapter is based on a comprehensive inspection at a Publicly Owned Treatment Works (POTW). The information is applicable to Wastewater Treatment Plants (WWTPs). This chapter includes an example of a Facility Site Review Checklist at the end of this chapter.

B. PHYSICAL INSPECTION OF THE FACILITY

This section pertains to inspections of WWTPs. To conduct a proper NPDES inspection the inspector must fully understand the wastewater treatment processes used at the facility and how each process fits into the overall treatment scheme. A General Wastewater Treatment Plant Flow Diagram is included at the end of this chapter (

Exhibit 4-1).

The inspector should conduct an examination of process treatment units, sampling and flow monitoring equipment, outfalls, and the receiving stream, particularly focusing on areas of the permittee's premises where pollutants are generated, pumped, conveyed, treated, stored, or disposed of. As the inspector becomes more knowledgeable about the facility being inspected, they should focus on areas that are likely to impact permit compliance and evaluate overall performance of the treatment facility. Inspectors should not enter confined spaces during the inspection of the facility unless they are properly training for confined space entry procedures.

During the inspection, the inspector should pay attention to the operational factors listed below and carefully document all the observations.:

- Influent characteristics, including:
  - Appearance (color, odor, etc.)
  - Combined sewer loads

  - Infiltration/inflow
  - Industrial contributions
  - Diurnal/seasonal loading variations

- Process control and settings
- Unit operations including supply of treatment chemicals
- Equipment design and current operating conditions
- Maintenance and operation staff
- Safety controls and equipment
- Effluent characteristics, including:
  - Appearance of discharge
  - Receiving stream appearance including any staining, deposits, or eutrophication
  - Evidence of toxicity of the discharge
- Other conditions particular to the plant

The inspector should evaluate the facility in terms of solids management, looking for evidence of excessive solids levels in clarifiers and sludge thickeners, insufficient solids wasting capabilities, the need for temporary sludge holding tanks, dewatering systems such as belt presses out of service, and sludge drying beds with excessive amounts of sludge. The Environmental Protection Agency's (EPA's) *Field Manual for Performance Evaluation and Trouble Shooting at Municipal Wastewater Facilities* (EPA, 1978) is a good reference for operational characteristics of plants. Additional resources for inspectors to learn more about wastewater treatment processes and facilities are provided at the end of this chapter in Section D, “References.”

The physical inspection, along with staff interviews and record reviews (discussed in subsequent sections of this chapter), may lead the inspector to determine:

- Whether a major facility design problem requires an engineering solution.
- Whether problems can be solved through proper operation and maintenance of the treatment facilities.
- Whether periodic equipment malfunctions at the facility indicate the need for equipment overhaul or replacement.

When conducting the inspection, the inspector should be aware of and look for physical conditions that indicate past, existing, or potential problems. Conditions to look for in the plant (generally and in specific processes) are listed in the following subsections. The presence of these conditions will give the inspector an idea of the types of problems present, the parts of the treatment process causing the problems, and the potential solution to existing problems.

GENERAL CONDITIONS IN OVERALL PLANT

General Indicators

- Suspected poor water quality of the effluent discharge.
- Excessive scum buildup; grease, foam, or floating sludge in clarifiers; high sludge blanket levels in the secondary clarifiers, or excessively high solids inventories in the aeration basins (unusually high mixed liquor suspended solids (MLSS).
- Sludge washout occurrences, or any other ineffective or inadequate sludge wasting capabilities.
- Hydraulic overload caused by storms, discharges of cooling water, or undersized facility or process.
- Noxious odors in wet wells and grit chambers and around aerobic and anaerobic biological units, scum removal devices, and sludge handling and treatment facilities.
- Evidence of severe corrosion at the treatment plant and in the collection system.
- Discoloration of the ground or a strong chemical smell may indicate past spills at the plant; further investigation of spills may be warranted.
- Vital treatment units out of service for repairs. Determine when the units went out of service, the type of failure, and when they will be put back in service.
- Excessive noise from process or treatment equipment.
- Any unusual equipment intended to correct operation problems (e.g., special pumps, floating aerators in diffused air systems, chemical feeders, temporary construction or structures, or any improvised system).
- Ruptures in chemical feed lines.

Flow Indicators

- Surging of influent lines, overflow weirs, and other structures.
- Hydraulically overloaded process or equipment.
- Flow through bypass channels.
- Overflows at alternative discharge points, channels, or other areas.
- Excessive septage dumping by septic tank pumpers.
- Flow from unknown source or origin.
- Open-ended pipes that appear to originate in a process or storage area and periodically discharge to the ground or to surface water. Although these pipes have been disconnected from a closed system or otherwise removed from service, they can still be connected to a discharge source.
- Flow charts indicating acute Infiltration and Inflow (I/I) problems following rain events.

Unusual Waste Indicators

- Collected screenings, slurries, sludges, waste piles, or byproducts of treatment. Their disposal, including runoff of any water, must be such that none enters navigable waters or their tributaries.
- Improper or lack of recycling of filtrates and supernatants from sludge dewatering and treatment.
- Improper storage of chemicals and hazardous substances with attention to the proper diking of chemicals and hazardous substances and segregation of incompatible chemicals. Generally, spill containment should be such that the dike could contain the contents of the largest tank.
- Spills or mishandling of chemicals.

WASTEWATER COLLECTION SYSTEM

Piping/Transport

- Degrading quality of piping material. Most commonly used materials are ductile iron, concrete, or polyvinyl chloride (PVC).

Pumping Station

- Dangerously high wet well levels at the pump station.
- Malfunctioning alarm system to notify of low-high wet well levels, pump failure, and power failure.
- Inadequate pumping capacity when wet well levels are high.
- Inoperable pumps.

PRELIMINARY TREATMENT AT THE HEADWORKS

Screening

- Spacing of screening bars outside the range of 0.25 to 2.0 inches
- Surcharge conditions in the influent sewer lines
- Excessive screen clogging
- Excessive buildup of debris against screen
- Oil and grease buildup
- Excessive scouring velocities through the screen during cleaning
- Improper disposal of screened material
- Excessive odors
- Pass through of grease and debris that shows up in the final effluent

Shredding/Grinding

- Blockage in sludge pumps or lines
- Bypass of shredding/grinding equipment
- Equipment removed or inoperable

Grit Removal

- Velocity-controlled grit removal processes with wastewater velocity exceeding or significantly less than 1 foot per second.
- Grit chamber clogged or subject to odors.
- Clogging in pipes and sedimentation basin sludge hoppers.
- Less than typical grit accumulation in subsequent processes.
- Inoperable air diffusers leading to excessive organic content of grit.
- Wear of grit removal/handling equipment.
- Excessive odors in grit removal area.

Influent Pumping

- Inadequate pumping capacity during periods of high influent flow
- Inoperable pumps

Flow Equalization

- Equalization tank never empty
- Excessive odors
- Inoperable aerators, if aerated
- Ability to bypass directly to surface water

PRIMARY CLARIFIER

General Indicators

- Excessive gas bubbles or grease on surface
- Black and odorous wastewater
- Poor removal of suspended solids in primary clarifier
- Excessive buildup of solids in center well of circular clarifier
- Unlevel discharge weirs
- Fouling of overflow weirs
- Evidence of short circuiting
- Ineffective scum rake
- Scum overflow or lack of adequate scum disposal, full scum pit
- Excessive floating sludge and/or scum (high sludge blanket level)
- Excessive sludge on bottom, inadequate sludge removal
- Noisy sludge scraper drive
- Broken sludge scraper equipment
- Poor maintenance of sludge pumps (leaking) or pump gallery

SECONDARY BIOLOGICAL TREATMENT UNITS

Trickling Filter/Activated Biofilters

- Filter ponding (indicating clogged media)
- Dried or collapsed media
- Leak at center column of filter's distribution arms
- Uneven distribution of flow on filter surface
- Uneven or discolored growth
- Excessive growth of biomass
- Excessive sloughing of growth
- Odor
- Clogging of trickling filter's distribution arm orifices
- Restricted rotation of distribution arms
- Filter flies, worms, or snails
- Ice buildup on trickling filter media or distribution arms
- Inappropriate recirculation rates of filter or secondary effluent

Rotating Biological Contactors

- Odor
- Development of white biomass on rotating biological contactor (RBC) media
- Excessive sloughing of growth
- Excessive breakage of rotating disks or shafts in RBC units
- Shaft, bearing, drive gear, or motor failure
- Solids accumulation in RBC units

Activated Sludge Tanks

- Excessive breakage of paddles on brush aerators.
- Shaft, bearing, drive gear, or motor failure on disk or brush aerators.
- Dead spots in aeration tanks.
- Use of floating aerators in basins designed with bottom air diffusers.
- Failure of surface aerators.
- Inoperative air compressors.
- Air rising unevenly.
- Excessive air leaks in compressed air piping.
- Dark mixed liquor in aeration tank (grey or black).
- Dark foam or bad odor on aeration tanks.
- Stable dark tan foam on aeration tanks that sprays cannot break up.
- Thick billows of white, sudsy foam on aeration tank.

- Low Dissolved Oxygen (DO, < 1.0 mg/l) in aeration tank (except in areas used for denitrification).
- Inadequate return activated sludge rates.
- Solids-related measurements outside of expected range (e.g., MLSS and/or Mixed Liquor Volatile Suspended Solids (MLVSS) concentration, Food to Mass ratio (F:M), sludge age, or mean cell residence time).

Stabilization Ponds/Lagoons

- Trees growing on the bank or within the root zone distance from the bank
- Erosion of stabilization pond bank or dike
- Excessive foliage or animal burrows in pond bank or dike
- Excessive weeds in stabilization ponds
- Foaming and spray in aerated lagoon
- Dead fish or aquatic organisms
- Buildup of solids around influent pipe
- Excessive scum on surface

SECONDARY CLARIFIER

General Indicators

- Excessive gas bubbles on surface.
- Fouling of overflow weirs.
- Unlevel overflow weirs.
- Evidence of short circuiting.
- Excessive buildup of solids in center well of circular clarifier.
- Deflocculation in clarifier.
- Pin floc in overflow.
- Ineffective scum rake.
- Floating sludge on surface; rising sludge or bulking sludge.
- Billowing sludge.
- Excessively high sludge blanket.
- Clogged sludge withdrawal ports on secondary clarifier for either sludge wasting or sludge return.
- Unequal sludge blanket levels in parallel units.
- Inappropriate return and wasting rates.
- Poor maintenance of sludge pumps (leaking) or pump gallery.

ADVANCED PHYSICAL TREATMENT UNITS

Filtration

- Filter surface clogging

- Short filter run
- Air displacement of gravel media
- Formation of mud balls in filter media
- Air binding of filter media
- Loss of filter media during backwashing
- Recycled filter backwash water exceeding 5 percent
- Effluent TSS and BOD levels exceeding 10 mg/L
- Excessive effluent turbidity

Microscreening

- Erratic rotation of microscreen drums
- Plugging
- Drive system noisy or overheating
- Backwash exceeding 5 percent of flow treated

Activated Carbon Adsorption

- Excessive biological growth resulting in strong odor
- pH above 9.0 standard units (S.U.)
- Plugged carbon pores
- Presence of carbon dust in effluent
- Excessive carbon regeneration

Nitrification

- Hydraulic overload
- Inadequate pH control/chemical addition
- Low DO (<2 mg/L) in the aeration basin
- Pin floc in final effluent
- Sludge rising because of gasification in secondary clarifier

Denitrification

- Air temperature below 15°C
- pH below 6.0 S.U. or above 8.0 S.U.
- Excessive methanol or other chemical additions
- Septic sludge conditions.

Ammonia Stripping

- Excessive hydraulic loading rate
- Tower packing coated with calcium carbonate
- pH below 10.8 S.U.
- Inadequate tower packing depth

- Air temperature below 65°F (18 °C)

DISINFECTION

Chlorination

- Sludge buildup in contact chamber
- Gas bubbles
- Inadequate retention time (typically 30 minutes at peak flow conditions)
- Floating scum and/or solids
- Evidence of short circuiting (poor tank baffling)
- Inadequate ventilation of chlorine feeding room and storage area
- High temperatures in chlorination rooms
- Improper operation of automatic feed or feedback control
- Excessive foaming downstream
- Evidence of toxicity downstream (dead fish, other dead organisms)
- Improper chlorine feed, storage, and reserve supply
- Leak detection equipment is tied into the plant alarm system
- Self-Contained Breathing Apparatus (SCBA) available on-site
- Proper training in use of SCBA
- Lack emergency SOP and/or RMP (Risk Management Plan)
- No chlorine repair kit available

Dechlorination

- Improper storage of sulfur dioxide cylinders.
- Inadequate ventilation of sulfur dioxide feeding room.
- Automatic sulfur dioxide feed or feedback control not operating properly.
- Depressed DO after dechlorination.
- Improper storage and mixture of sodium metabisulfite containers.
- Reduced efficiency of activated carbon dechlorination units because of organic and inorganic compound interference.
- No SCBAs available on-site.
- Improper training in use of SCBA.
- No emergency SOP and/or RMP.

Ultraviolet (UV)

- Quartz sleeves not kept clean
- Bulbs are not all operational
- Effluent has high turbidity
- Fecal coliform tests show inadequate bacterial kill

SLUDGE HANDLING

General Indicators

- The facility does not waste sludge.
- Inadequate sludge removal from clarifiers or thickeners.
- Poor dewatering characteristics of thermal treated sludge.
- Thickened sludge too thin.
- Fouling of overflow weirs on gravity thickeners.
- Air flotation skimmer blade binding on beaching plate.
- Unordinary down time of sludge treatment units.
- Sludge disposal inadequate to keep treatment system in balance - storing excess sludge inventory within other treatment units such as activated sludge basin, or clarifiers due to inadequate sludge wasting capabilities.
- Mass balance inappropriate (ratio of sludge wasted should be 0.65-0.85 lbs. of sludge per lb. of Biochemical Oxygen Demand (BOD) removed).
- Sludge decant or return flows high in solids.
- Odors.
- Improper loading rates.
- Lack of adequate process control (unit removal efficiencies, DO, sludge age, F:M ratio, etc.).

Sludge Anaerobic Digestion

- Inoperative mechanical or gas mixers
- Inoperative sludge heater or low temperature
- Inadequate gas production
- Unexpected gas composition
- Floating cover of digester tilting
- Inoperative gas burner
- Supernatant emitting a sour odor from either primary or secondary digester
- Excessive suspended solids in supernatant
- Supernatant recycle overloading the Wastewater Treatment Plant (WWTP)
- pH problems

Sludge Aerobic Digestion

- Excessive foaming in tank
- Objectionable odor in aerobically digested sludge
- Insufficient dissolved oxygen in digester
- Digester overloaded
- Clogging of diffusers in digester
- Mechanical aerator failure in digester

- Inadequate supernatant removal from sludge lagoons
- Solids accumulation in tank

Sludge Dewatering

- Drying beds
  - Poor sludge distribution on drying beds
  - Vegetation in drying beds (unless reed design)
  - Dry sludge remaining in drying beds (storage)
  - Inadequate drying time on drying beds
  - Some unused drying beds
  - Dry sludge stacked around drying beds where runoff may enter navigable waters
  - Filtrate from sludge drying beds returned to front of plant
  - Inadequate sludge wasting capabilities as indicated by all beds being full, and high solids inventory within the treatment units

- Centrifuge
  - Excessive solids in fluid phase of sample after centrifugation
  - Inadequate dryness of centrifugal sludge cake
  - Excessive vibration or other mechanical problems

- Filter press
  - High level of solids in filtrate from filter presses or vacuum filters
  - Thin filter cake caused by poor dewatering
  - Vacuum filter cloth binding
  - Low vacuum on filter
  - Improperly cleaned vacuum filter media
  - Sludge buildup on belts and/or rollers of filter press
  - Excessive moisture in belt filter press sludge cake
  - Difficult cake discharge from filter presses
  - Filter cake sticks to solids-conveying equipment of filter press
  - Frequent media binding of plate filter press
  - Sludge blowing out of filter press
  - Insufficient run time of sludge dewatering equipment

Sludge Stabilization

- Lagoon
  - Objectionable odor from sludge lagoon
  - Damage to dikes around sludge drying lagoons
  - Unlined sludge lagoons

  - Sludge lagoons full, overflowing sludge back to plant or to natural drainage
  - Deep rooted vegetation on dikes or berms

- Composting
  - Piles that give off foul odor
  - Inoperable blower
  - Temperature does not reach 122–140°F (50–60°C)
  - Uncontrolled stormwater runoff

- Heat drying/pelletizing
  - Excess moisture in sludge feed
  - Insufficient air flow or drying temperature achieved
  - Inadequate drying of final product (excess moisture in final product)
  - Excess odors associated with treatment area
  - Excess odors associated with treated product

- Alkaline stabilization
  - Insufficient amount of lime (or other alkaline additive) used to ensure pH is raised sufficiently.
  - Inadequate mixing provided to ensure good contact of lime (or other alkaline additive) with sludge solids.
  - pH problems.
  - Excess odors associated with treatment area.
  - Excess odors associated with treated product.
  - Excessive lime dust around treatment equipment.

- Incineration
  - Objectionable odors associated with treatment area
  - Evidence of excessive ash around unit
  - Visible smoke or dust exhaust from unit
  - Noncompliance with air permit parameters
  - Spilling or leaking sludge from dewatered sludge transfer equipment

- Sludge disposal
  - Sludge constituents not analyzed before disposal
  - Sludge not transported in appropriate and approved vehicle
  - Surface runoff of sludge at land application site
  - Liquid sludge (i.e., less than 10 percent solids) applied to landfill site
  - Sludge fails paint filter test
  - Inadequate coverage of sludge in subsurface plow injection system

- Objectionable odors generated at land application site
- Slow drying of soil-sludge mixture in subsurface injection system
- Sludge pooling at land application sites
- Breeding flies, vectors, and/or odors at landfill site
- Inadequate burial of sludge at landfill site
- Excessive erosion at sludge sites
- Sludge disposed of in unpermitted sites
- Disposal not in accordance with federal, state, or local regulations
- Sludge lagoons full and overflowing
- Inadequate runoff control at landfill or land application sites

POLISHING PONDS OR TANKS

- Objectionable odor, excessive foam, floating solids, or oil sheens in polishing ponds or tanks.
- Solids or scum accumulations in tank or at side of pond.
- Evidence of bypassed polishing ponds or tanks.

PLANT EFFLUENT

- Excessive suspended solids, turbidity, foam, grease, scum, color, and other macroscopic particulate matter present.
- Potential toxicity (dead fish, dead plants at discharge).
- Stained sediments in receiving waters.
- Sludge in the receiving water, anaerobic sediments, and blood worms.
- Low dissolved oxygen content.
- Eutrophication.

FLOW MEASUREMENT

- Improper placement of flow measurement device.
- Flow totalizer not calibrated.
- Buildup of solids in flume or weir.
- Broken or cracked flume or weir.
- Improperly functioning magnetic flowmeter.
- Clogged or broken stilling wells.
- Weir plate edge corroded or damaged; i.e., not sharp edged (< 1/8"), or not level.
- System not capable of measuring maximum flow.
- Sizing of system adequate to handle flow range.
- Flow measurement error greater than ± 10 percent.
- Flow measurement that includes all wastewater discharged and does not include wastestreams that are recirculated back to the treatment plant.

CHEMICAL TREATMENT UNITS

- Evidence of heavy corrosion
- No portion-measuring device at feed unit
- pH measuring not evident at pH adjustment tank
- Chemicals left open when they should be closed
- Chemicals outdated
- Chemical containers stored improperly or hazardously
- Inappropriately stored, moved, or handled chemical tank cars (trucks or train)
- Spilled dry chemicals on floor between storage area and feed units
- Improperly disposed of empty chemical containers
- Large containers handled improperly, container transfer equipment not maintained
- No appropriate sized berms or dikes at liquid chemical feed units
- Inadequate supply of chemicals
- Chemical dust covering feed unit area or, storage and transfer areas
- Use of an inappropriate coagulant
- Improperly stored or handled glass carboys (acid storage)

STANDBY POWER AND ALARMS

- Emergency generator with no automatic switch-over.
- Generator not regularly checked and exercised.
- No separate electrical substation feed line.
- Portable generators with quick connects.
- Portion of plant operated by the standby power.
- Treatment units and headworks equipped with alarms to notify operations staff of unit failure or loss of power.
- System for Supervisory Control and Data Available (SCADA):
  - Only large facilities tend to have this equipment.
  - SCADA to monitor and operate lift station in the collection system.

GENERAL HOUSEKEEPING

- Facility control panel in disrepair or not in use
- Wastewater pipelines not clearly distinguished from product pipelines
- Spills or leaks in dry areas not remediated in a timely manner

PRODUCTION CHANGES

- For a POTW, change in service area.
- For a POTW, increase or decrease in intake flows from industrial, commercial, or domestic sectors.

- For an IU, change in production volume.
- For an IU, large alteration of processes (inputs, temperature, etc.).

C. PERMIT COMPLIANCE AND OPERATION AND MAINTENANCE EVALUATION

In addition to the physical inspection of the plant, inspectors should also evaluate the operation and maintenance of the plant equipment and the facility's compliance with their permit requirements. When the physical inspection findings indicate that specific practices of the facility contribute to or cause problems, the inspector should detail the problems and use that information to evaluate the operation and maintenance procedures.

Inspectors should interview various staff to provide a better idea of what is happening on-site. If conflicting information is received during staff interviews, make sure to clarify this information before leaving the site. If the staff does not clearly answer a question, rephrase the question and ask it later during the inspection. The inspector should interview facility staff to:

- Gather background information.
- Determine normal operation and maintenance procedures.
- Evaluate knowledge and ability.
- Determine the number of operation, maintenance, laboratory, and other essential staff.

The inspector should also review the following records as needed:

- Operator logs
- Operations and maintenance records
- Operations and maintenance manual
- Sampling and laboratory records
- Monitoring reports

COMPLIANCE EVALUATION

The inspector should bring to the inspection a few submitted Discharge Monitoring Reports (DMRs) to compare with the monitoring reports kept on-site. To evaluate compliance with permit requirements, the inspector should:

- Compare monitoring report data to the permit requirements and verify that all non-compliance has been reported, monitoring requirements have been met, and analysis is in accordance with permit requirements.
- Compare the laboratory data to reported data to ensure transcription errors have not occurred and ensure all data on the DMR is accurate.
- Evaluate laboratory analytical procedures and methods to ensure the accuracy of the effluent discharge data.
- Randomly check calculations to evaluate accuracy of reported data.

OPERATION EVALUATION

Operating factors affecting plant performance range from qualitative factors such as the skills and aptitudes of operators (e.g., process knowledge and general aptitude), to physical deficiencies in laboratory equipment or a lack of flexibility in process equipment. The evaluation of operation functions must focus on wastewater treatment, sludge treatment/disposal, and laboratory analysis. The evaluation should be based on the following topics:

- Policies and procedures
- Organization
- Staffing and training
- Planning
- Management controls

Although each of the preceding evaluation topics should be covered in the review of operation functions, the four areas discussed in the following paragraphs should particularly concern the inspector:

Policies and Procedures

Written operating procedures and standard reference texts enable the operator to achieve efficient plant operation. The operations manual prepared for the facility is the most important reference that an inspector should review when evaluating plant policies and procedures. Other reference materials relating to operations that should be available to the operator include manufacturers' literature, publications by professional organizations (e.g., the Water Environment Federation), and EPA publications.

Staffing and Training

Even the best engineered facility cannot perform to its potential without enough capable and qualified staff. The inspector must consider the abilities and limitations of the operating staff. Most states have some type of certification program for operators. The inspector may inquire about how many of the staff has been trained and to what degree staff is certified. Staff interviews may include the individual in charge of the overall operation, the chief operator, specific unit process operators, and laboratory staff. The inspector should ascertain the hours the facility is manned and unmanned. If the facility is regularly unmanned, the inspector should inquire about unit alarms, in the event of equipment failure or loss of power, alarm telemetry or autodialers, facility response procedures and whether there have been any unit bypasses as a result of the plant being unmanned.

Health and Safety

At all times, the facility should follow safe operating procedures. Employees must be trained in emergency shut-down, fire control, and spill response procedures, as well as in the use of safety equipment, safe sampling techniques, and safe handling of chemicals and wastes. Employees should not enter confined spaces unless properly trained and equipped. Managers must be aware of the Occupational Safety and Health Administration (OSHA) Right-to-Know

laws regarding potentially dangerous chemicals in the workplace. This law specifically requires a written hazard communication program, labeling of chemicals, and the availability of material safety data sheets to employees upon request. Safety practices specified in the NPDES permit should be verified by the inspector, however, if safety concerns unrelated to the permit are observed, the facility should be referred to OSHA to address the concern.

Management Controls

Monitoring practices are a good indicator of both the emphasis placed on operations and the operator's understanding of process controls. Factors affecting a facility's monitoring capabilities include the following:

- The sampling program
- Performance testing
- Analytical capabilities
- Recordkeeping practices

An effective process control program is essential to a treatment facility's optimal performance. In most cases, the inspector will rely on discussions with the plant superintendent and/or operators to supplement available records and the technical evaluation. The key considerations for effective process controls include the following:

- Process control data
- Process knowledge of the operators
- The basis for the control practices
- Implementation of the control practices
- Past performance
- Operator emphasis on controls
- Recordkeeping

Table 4-1 presents the basic review questions that an inspector should ask in evaluating operation functions.

Table 4-1. Operation and Maintenance Function Evaluation Questions

Policies and Procedures
• Is there a formal or informal set of policies for facility operations? • Do policies address: — Compliance with permit? — Maintaining process controls? — Quality control? — Preventive maintenance? • Is there a set of standard procedures to implement these policies? • Are the procedures written or informal?

Table 4-1. Operation and Maintenance Function Evaluation Questions

- Do the procedures consider the following areas?
  - Collection system
  - Emergency
  - Energy conservation
  - Equipment record system
  - Inventory management
  - Labor relations scheduling
  - Laboratory
  - Maintenance planning
  - Monitoring
  - Operating procedures
  - Process control
  - Pumping stations
  - Safety
  - Sludge disposal
  - Treatment chemical supply
  - Treatment process
  - Work orders
- Are the procedures followed?

Organization

- Is there an organizational plan (or chart) for operations?
- Does the plan include:
  - Delegation of responsibility and authority?
  - Job descriptions?
  - Interaction with other functions (such as maintenance)?
- Is the plan formal or informal?
- Does staff have access to and understand the plan?
- Does the facility follow the plan?
- Is the plan consistent with policies and procedures?
  - Is the plan flexible?
  - Can it handle emergency situations?
  - Does the plan clearly define lines of authority and responsibility in the following subfunctional areas?
    - Laboratory
    - Monitoring practices
    - Process control
    - Mechanical
    - Instruments
    - Electrical
    - Sludge disposal
    - Buildings and grounds
    - Collection system
    - Automotive
    - Pumping stations
    - Supplies and spare parts

Staffing

- Is there an adequate number of staff to achieve policies and procedures?
- Have you considered long-term, strategic workforce planning and recruitment?
- Are staff members adequately qualified for their duties and responsibilities by demonstrating the following:
  - Certification
  - Qualifications
  - Ability

Table 4-1. Operation and Maintenance Function Evaluation Questions

- Job performance
- Understanding of treatment processes

- Is staff used effectively to support plant activities?
- Has the potential for borrowing personnel from other plants been considered?
- Are training procedures followed for:
  - Orientation of new staff?
  - Training new operators?
  - Training new supervisors?
  - Continuing training of existing staff?
  - Cross training staff between plant jobs needing more staff/support?
- Which of the following training procedures are used?
  - Formal classroom
  - Home study
  - On-the-job training
  - Participation in professional organization
- Does the training program provide specific instruction for the following operations and maintenance activities?
  - Automotive
  - Building maintenance
  - Electrical
  - Emergency procedures
  - Equipment troubleshooting
  - Handling personnel problems
  - Instrumentation
  - Inventory control
  - Laboratory procedures
  - Mechanical
  - Monitoring practices
  - Safety
  - Treatment processes
- Does management encourage staff motivation?
- Does management support its first-line supervisors?
- Is staff motivation maintained through any of the following tools?
  - Encouragement for training
  - Job recognition
  - Job security
  - Promotional opportunities
  - Salary incentives
  - Working environment

Operations

- How does the facility establish operating schedules?
- Do schedules attempt to attain optimum staff utilization?
- Are line supervisors included in manpower scheduling?
- Are staff involved in and/or informed of manpower planning?
- Is there sufficient long-term planning for staff replacement and system changes?

Table 4-1. Operation and Maintenance Function Evaluation Questions

- Are there procedures in manpower staffing for emergency situations?
- How are process control changes initiated?
- How do process control changes interact with management controls?
- How are laboratory results used in process control?
- Are there emergency plans for treatment control?
- Is there an effective energy management plan? Is the plan used?
- To what extent are operations personnel involved in the budget process?
- Do budgets adequately identify and justify the cost components of operations?
- Are future budgets based on current and anticipated operating conditions?
- Do operating and capital budget limits constrain operations?
- Can budget line items be adjusted to reflect actual operating conditions?

Maintenance

- Are maintenance activities planned? Is the planning formal or informal?
- Does the facility have sufficient management controls to affect realistic planning and scheduling? If the controls exist, are they used?
- Are operating variables exploited to simplify maintenance efforts?
- To what extent are the supply and spare part inventories planned in conjunction with maintenance activities?
- Have minimum and maximum levels been established for all inventory items?
- Does the facility have a maintenance emergency plan?
- Is the maintenance emergency plan current? Is the staff knowledgeable about emergency procedures?
- Does a plan exist for returning to the preventive maintenance mode following an emergency?
- Are preventive maintenance tasks scheduled in accordance with manufacturer's recommendations?
- Is adequate time allowed for corrective maintenance?
- Are basic maintenance practices (preventive and corrective) and frequencies reviewed for cost-effectiveness?
- Do the management controls provide sufficient information for accurate budget preparation?
- Does the maintenance department receive feedback on cost performance to facilitate future budget preparation?
- To what extent are maintenance personnel involved in the budget process?
- Do budgets adequately identify and justify the cost components of maintenance?
- Are future budgets based on current and anticipated operating and maintenance conditions?
- Do maintenance and capital budget limits constrain preventive maintenance (equipment replacement and improvements)?
- Does the maintenance department receive adequate feedback on cost performance?
- Can budget line items be adjusted to reflect actual maintenance conditions?

Management Controls

- Are current versions of the following documents maintained?
  - Operating reports
  - Work schedules

Table 4-1. Operation and Maintenance Function Evaluation Questions

- Activity reports
- Performance reports (labor, supplies, energy)
- Expenditure reports (labor, supplies, energy)
- Cost analysis reports
- Emergency and complaint calls
- Process control data, including effluent quality

- Do the reports contain sufficient information to support their intended purpose?
- Are the reports usable and accepted by the staff?
- Are the reports being completed as required?
- Are the reports consistent among themselves?
- Are the reports used directly in process control?
- Are the reports reviewed and discussed with operating staff?
- What types of summary reports are required?
- To whom are reports distributed and when?

Management Controls (Maintenance)

- Does a maintenance record system exist? Does it include the following?
  - As-built drawings
  - Shop drawings
  - Construction specifications
  - Capital and equipment inventory
  - Maintenance history (preventive and corrective)
  - Maintenance costs
  - Equipment manuals
- Does the facility keep a current base record system as part of daily maintenance practices?
- Does the facility have a work order system for scheduling maintenance? Is it explicit or implicit?
- Which of the following do work orders contain?
  - Date
  - Location
  - Work requirements
  - Assigned personnel
  - Work order number
  - Nature of problem
  - Time requirements
  - Space for reporting work performed, required parts and supplies, time required, and cost summary
  - Responsible staff member and supervisory signature requirements
- When emergency work must be performed without a work order, is one completed afterward?
- Are work orders usable and acceptable by staff as essential to the maintenance program? Are they completed?

Table 4-1. Operation and Maintenance Function Evaluation Questions

- Is work order information transferred to a maintenance record system?
- Does a catalog or index system exist for controlling items in inventory?
- Are withdrawal tickets used for obtaining supplies from inventory?
- Do the tickets contain cost information and interact well with inventory controls and the work order system?
- Is the cost and activity information from work orders aggregated to provide management reports? Is this information also used for budget preparation?
- Is the maintenance performance discussed regularly with staff?
- How is the cost of contract maintenance or the use of specialized assistance recorded?
- Are safeguards and penalties adequate to prevent maintenance cards from being returned without the work being done?
- Is the preventive maintenance record checked after an emergency equipment failure?

MAINTENANCE EVALUATION

Facility maintenance directly affects the ability of the facility to run efficiently and to comply with its NPDES permit. The two types of facility maintenance are preventive maintenance and corrective maintenance:

- Preventive maintenance:
  - Reduces facility operating costs by eliminating breakdowns and the need for corrective maintenance.
  - Improves the facility's reliability by minimizing the time equipment is out of service.
  - Increases the useful life of equipment, thus avoiding costly premature replacement.
  - Avoids possible compliance violations.
- Corrective maintenance:
  - Returns malfunctioning equipment to operation
  - Avoids or minimizes possible violations

Evaluation of the maintenance function should focus on the ability to maintain process equipment, supply of treatment chemicals, vehicles, and building and grounds. Although each of the five evaluation topics (policies and procedures, organization, staffing, planning, and management controls) should be covered for each facility inspected, the principal areas of concern in the maintenance evaluation are:

- Staffing and training
- Planning and scheduling
- Management controls, including records systems and inventory control

Only well-trained, competent plant staff can be expected to perform adequate physical inspections, repairs, and preventive maintenance. Wastewater facility maintenance is complex and requires a variety of skills. An ongoing training program is essential because many of these skills are not readily available.

Maintenance planning and scheduling are essential to effective corrective and preventive maintenance. The maintenance supervisor should prepare work schedules listing job priorities, work assignments, available personnel, and timing.

A detailed records system is the basis of any maintenance program. Records are used to establish maintenance histories on equipment, diagnose problems, and anticipate—and thereby avoid—equipment failure, making records an effective tool for preventive maintenance.

A central inventory of spare parts, equipment, and supplies should be maintained and controlled. The basis for the inventory should be the equipment manufacturer's recommendations, supplemented by specific, historical experience with maintenance problems and requirements. Inventoried supplies should be kept at levels sufficient to avoid process interruptions.

A maintenance cost control system should be an integral part of every wastewater facility. Budgets must be developed from past cost records and usually are categorized according to preventive maintenance, corrective maintenance, and projected and actual major repair requirements. Annual costs must be compared to the budget periodically to control maintenance expenditures. Evaluating costs this way serves to control expenditures and provides a baseline for future budgets.

The basic concerns that need to be addressed and evaluated during the inspector's maintenance program review are presented in Table 4-1. These questions may help identify the causes of a facility's operation and maintenance problems.

D. REFERENCES

The following is a list of resources providing more information on wastewater treatment facilities and their processes.

U.S. Environmental Protection Agency. (1973). *Maintenance Management Systems for Municipal Wastewater Facilities.* EPA 430/9-74-004.

U.S. Environmental Protection Agency. (1978). *Field Manual for Performance Evaluation and Troubleshooting at Municipal Wastewater Treatment Facilities.* MO No. 16, EPA 430/9-78-001.

U.S. Environmental Protection Agency. (1979). *Inspector's Guide for Evaluation of Municipal Wastewater Treatment Plants*. EPA 430/9-79-010.

U.S. Environmental Protection Agency. (1982). *Comprehensive Diagnostic Evaluation and Selected Management Issues*. EPA 430/9-82-003.

U.S. Environmental Protection Agency. (1999a). *Wastewater Technology Fact Sheet Ozone Disinfection*. EPA 832-F-99-063.

U.S. Environmental Protection Agency. (1999b). *Wastewater Technology Fact Sheet Ultraviolet Disinfection*. EPA 832-F-99-064.

U.S. Environmental Protection Agency. (2000a). *Biosolids Technology Fact Sheet Centrifuge Thickening and Dewatering*. EPA 832-F-00-053.

U.S. Environmental Protection Agency. (2000b). *Biosolids Technology Fact Sheet Belt Filter Press*. EPA 832-F-00-057.

U.S. Environmental Protection Agency. (2000c). *Decentralized Systems Technology Fact Sheet Aerobic Treatment*. EPA 832-F-00-031.

U.S. Environmental Protection Agency. (2000d). *Decentralized Systems Technology Fact Sheet Evapotranspiration*. EPA 832-F-00-033.

U.S. Environmental Protection Agency. (2000e). *Guide for Evaluating Capacity, Management, Operation, and Maintenance Programs at Wastewater Treatment Plants*. EPA 300-B-00-015.

U.S. Environmental Protection Agency. (2000f). *Wastewater Technology Fact Sheet Ammonia Stripping*. EPA 832-F-00-019.

U.S. Environmental Protection Agency. (2000g). *Wastewater Technology Fact Sheet Chemical Precipitation*. EPA 832-F-00-018.

U.S. Environmental Protection Agency. (2000h). *Wastewater Technology Fact Sheet Dechlorination*. EPA 832-F-00-022.

U.S. Environmental Protection Agency. (2000i). *Wastewater Technology Fact Sheet Force Main Sewers*. EPA 832-F-00-071.

U.S. Environmental Protection Agency. (2000j). *Wastewater Technology Fact Sheet Granular Activated Carbon Adsorption and Regeneration*. EPA 832-F-00-017.

Water Environment Federation (WEF). (1992). *Wastewater Treatment Plant Design*. MOP No. 8.
Water Pollution Control Federation (WPCF). (1990). *Operation of Wastewater Treatment Plants*. MOP No. 11.

E. FACILITY SITE REVIEW CHECKLIST

The following is an example of a checklist that may be used by inspectors at a facility site review.

A. Operation and Maintenance Evaluation			
Yes	No	N/A	1. Facility properly operates and maintains treatment units
Yes	No	N/A	2. Facility has standby power or other equivalent provision.
Yes	No	N/A	3. Adequate alarm system for power or equipment failures is available.
			4. Sludge disposal procedures are appropriate:
Yes	No	N/A	a. Disposal of sludge according to regulations
Yes	No	N/A	b. State approval for sludge disposal received.
Yes	No	N/A	5. All treatment units, other than backup units, are in service.
Yes	No	N/A	6. Facility follows procedures for facility operation and maintenance.
Yes	No	N/A	7. Sufficient sludge is disposed of to maintain treatment process equilibrium.
Yes	No	N/A	8. Organizational Plan (chart) for operation and maintenance is provided.
Yes	No	N/A	9. Plan establishes operating schedules.
Yes	No	N/A	10. Facility has written emergency plan for treatment control.
			11. Maintenance record system exists and includes:
Yes	No	N/A	a. As-built drawings
Yes	No	N/A	b. Shop drawings
Yes	No	N/A	c. Construction specifications
Yes	No	N/A	d. Maintenance history
Yes	No	N/A	e. Maintenance costs
Yes	No	N/A	f. Repair history
Yes	No	N/A	g. Records of equipment repair and timely return to service.
Yes	No	N/A	12. Adequate number of qualified operator's on-hand.
Yes	No	N/A	13. Facility has established procedures for training new operators.
Yes	No	N/A	14. Facility maintains adequate spare parts and supplies inventory.
Yes	No	N/A	15. Facility keeps instruction files for operation and maintenance of each item of major equipment.
Yes	No	N/A	16. Operation and maintenance manual is available.
Yes	No	N/A	17. Regulatory agency is notified of any bypassing. (Dates: _____)
			18.
Yes	No	N/A	a. Hydraulic overflows and/or organic overloads are experienced.
Yes	No	N/A	b. Untreated bypass discharge occurs during power failure.
Yes	No	N/A	c. Untreated overflows occurred since last inspection. Reason:
Yes	No	N/A	d. Flows were observed in overflow or bypass channels.
Yes	No	N/A	e. Checking for overflows is performed routinely.
Yes	No	N/A	f. Overflows are reported to EPA or to the appropriate state agency as specified in the permit.

B. Safety Evaluation			
Yes	No	N/A	1. Facility uses undiked/unbermed oil/chemical storage tanks.
Yes	No	N/A	2. Facility maintains up-to-date equipment repair records.
Yes	No	N/A	3. Dated tags show out-of-service equipment. a. Proper facility/unit lock-out and tag-out procedures are being followed.
Yes	No	N/A	4. Facility schedules/performs routine and preventive maintenance on time.
Yes	No	N/A	5. Facility provides personal protective clothing (e.g., safety helmets, ear protectors, goggles, gloves, rubber boots with steel toes, eyewashes in labs).
			6. Safety devices are readily available:
Yes	No	N/A	a. Fire extinguishers.
Yes	No	N/A	b. Oxygen deficiency/explosive gas indicator.
Yes	No	N/A	c. Self-contained breathing apparatus near entrance to chlorine room.
Yes	No	N/A	d. Safety harness.
Yes	No	N/A	e. First aid kits.
Yes	No	N/A	f. Ladders to enter manholes or wet-wells (fiberglass or wooden for electrical work).
Yes	No	N/A	g. Traffic control cones.
Yes	No	N/A	h. Safety buoy at activated sludge plants.
Yes	No	N/A	i. Life preservers for lagoons.
Yes	No	N/A	j. Fiberglass or wooden ladder for electrical work.
Yes	No	N/A	k. Portable crane/hoist.
Yes	No	N/A	7. Plant has general safety structures such as rails around or covers over tanks, pits, or wells.
Yes	No	N/A	8. Emergency phone numbers are listed, including EPA and state.
Yes	No	N/A	9. Plant is generally clean, free from open trash areas.
Yes	No	N/A	10. Facility has available portable hoists, for equipment removal.
Yes	No	N/A	11. All plant personnel are immunized for typhoid, tetanus, and hepatitis B.
Yes	No	N/A	12. No cross connections exist between a potable water supply and non-potable source.
Yes	No	N/A	13. Gas/explosion controls such as pressure-vacuum relief values, no smoking signs, explosimeters, and drip traps are present near anaerobic digesters, enclosed screening or degritting chambers, and sludge-piping or gas-piping structures.
Yes	No	N/A	14. Facility has enclosed and identified all electrical circuitry.
Yes	No	N/A	15. Personnel are trained in electrical work to be performed as well as safety procedures.

			16. Chlorine safety precautions are followed:
Yes	No	N/A	a. NIOSH-approved 30-minute air pack?
Yes	No	N/A	b. All standing chlorine cylinders chained in place?
Yes	No	N/A	c. All personnel trained in the use of chlorine?
Yes	No	N/A	d. Chlorine repair kit available?
Yes	No	N/A	e. Chlorine leak detector tied into plant alarm system?
Yes	No	N/A	f. Chlorine cylinders stored in adequately ventilated areas?
Yes	No	N/A	g. Ventilation fan with an outside switch?
Yes	No	N/A	h. Posted safety precautions?
Yes	No	N/A	i. Existing emergency SOP and/or RMP or SPCC?
Yes	No	N/A	17. Facility has complied with the six employer responsibilities for the Worker Right-to-Know Law (P.A. 83-240)
Yes	No	N/A	18. Emergency Action Plan on file with local fire department and appropriate emergency agency.
Yes	No	N/A	19. Laboratory safety devices (eyewash and shower, fume hood, proper labeling and storage, pipette suction bulbs) available.
Yes	No	N/A	20. Facility post warning signs (no smoking, high voltage, non-potable water, chlorine hazard, watch-your-step, and exit).

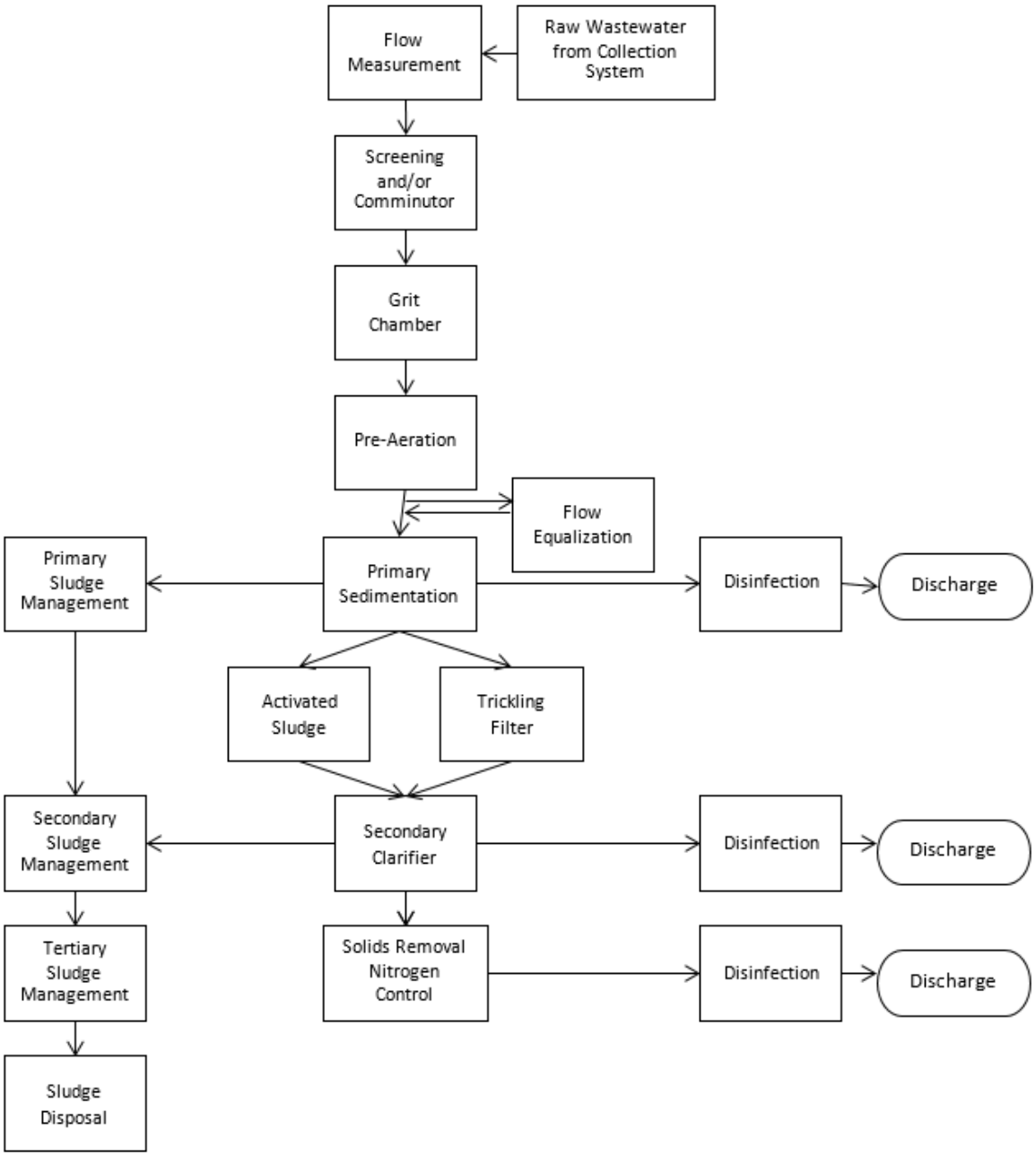


Exhibit 4-1. General Wastewater Treatment Flow Diagram

CHAPTER 5 – SAMPLING

Contents

List of Tables

Associated Appendices

M. Example Chain-of-Custody Form
N. Updated Fact Sheet: Department of Transportation Hazardous Materials Training

Related Websites

Agency-wide Quality System Documents: https://www.epa.gov/quality/agency-wide-quality-system-documents

A. EVALUATION OF PERMITTEE SAMPLING PROGRAM AND COMPLIANCE SAMPLING

Wastewater sampling/analysis is an integral part of the National Pollutant Discharge Elimination System (NPDES) Compliance Monitoring Program. NPDES permits contain specific and legally enforceable effluent limitations and monitoring requirements.

OBJECTIVES AND REQUIREMENTS

When evaluating the permittee sampling program, the inspector should:

- Verify that the permittee's sampling program complies with the permit.
- Verify that the permittee's sampling program complies with:
  - Title 40 of the *Code of Federal Regulations* (CFR), sections 136.1 to 136.6 and Appendices A, B, and C (Guidelines for Establishing Test Procedures for the Analysis of Pollutants) for wastewater samples; and 40 CFR Part 503.
- Document potential violations to support enforcement action.

In addition, specific objectives of the sampling conducted by inspectors include the following:

- Verify compliance with effluent limitations.
- Verify accuracy of reports and program self-monitoring.
- Support enforcement action.
- Support permit development reissuance and/or revision.
- Determine the quantity and quality of effluent.

Sampling, analysis, preservation technique, sample holding time, and sample container requirements are provided under 40 CFR Part 136 as authorized by section 304(h) of the Clean Water Act (CWA). Chapter 7 contains more information on required analytical procedures "Laboratory Analyses Techniques Evaluation." See the checklist for use in evaluating the permittee's sampling program at the end of this chapter.

For all NPDES permittees the inspector should perform a review of sampling procedures and quality control measures the facility uses to ensure the integrity of sample data.

To evaluate sampling procedures, assess the following eight areas:

- Sample site locations
- Sample collection techniques
- Field measurements
- Sample labeling (including locations) and documentation
- Sample preservation and holding time
- Transfer of custody and shipment of samples
- Quality control

- Data handling and reporting

SIGNIFICANT INDUSTRIAL USER MONITORING PROGRAM

It is the responsibility of the permitted Publicly Owned Treatment Works (POTW) with a pretreatment program to oversee sampling procedures of industrial users and to conduct compliance monitoring of its own. Therefore, during a Pretreatment Compliance Inspection (PCI) or audit, the inspector may also need to evaluate POTW sampling procedures for significant industrial users who discharge to the POTW in addition to evaluating the sampling procedures of any permitted POTW. According to the General Pretreatment Regulations, 40 CFR 403.12(o), industrial users and POTWs subject to 40 CFR 403.12 reporting requirements must maintain the following monitoring records:

- Date, exact place, method and time of sampling, and name of sampler
- Date of analysis
- Name of analyst
- Analytical techniques/methods used
- Analytical results

During a PCI or an audit, the inspector evaluates the POTW industrial user monitoring program with respect to the criteria specified in the POTW pretreatment program. Elements of the sampling scheme will include the eight areas addressed above and any other areas specifically addressed in the pretreatment program. Chapter 9 discusses the focus of this evaluation in greater detail.

BIOSOLIDS MONITORING PROGRAM

Chapter 10 discusses evaluation of a permittee's biosolids monitoring program. Lists of approved biosolids analytical methods, sample containers, preservation techniques, and holding times for biosolids samples can be found on EPA's website at: https://www.epa.gov/biosolids/additional-information-biosolids-managers#analytical.

TOXICITY TESTING PROGRAM

Chapter 8 discusses evaluation of a permittee's Whole Effluent Toxicity testing program. In addition, for methods manuals for Whole Effluent Toxicity testing go to https://www.epa.gov/cwa-methods/whole-effluent-toxicity-methods.

STORMWATER PROGRAM

Chapter 11 provides considerations for performing stormwater monitoring.

B. SAMPLING PROCEDURES AND TECHNIQUES

Whether an inspector is evaluating a permittee's sampling program or conducting compliance sampling on the permittee's effluent, that inspector must be familiar with the procedures and techniques necessary for accurate sampling of wastewaters. The following discussion details

the procedures for sample collection, preservation, sample transfer including chain-of-custody, quality control, and data handling.

WASTEWATER SAMPLE COLLECTION TECHNIQUES

Sample collection is an important part of the compliance monitoring program. Without proper sample collection procedures, the results of such monitoring programs are neither useful nor valid, even with the most precise and accurate analytical measurements.

Selection of Representative Sampling Sites

Normally, samples should be collected at the location specified in the permit. In some instances, the sampling location specified in the permit may not be adequate for the collection of a representative sample. In that case, the inspector should determine the most representative sampling point available and collect a sample at that location as well as the location specified by the permit (or chosen by the permittee). If the facility disagrees, the reason for the conflict must be documented for later resolution by the permitting authority.

Sample Types

Two types of sample techniques are used: grab and composite. For many monitoring procedures, the regulations at 40 CFR Part 136 do not specify sampling type. For these procedures, the NPDES permit writer determines the appropriate sample type based on the data objective, and/or the required analytical method and specifies the sampling technique in the NPDES permit.

Grab Samples. Grab samples are individual samples collected at a specific time not exceeding 15 minutes and are representative of the conditions at the time the sample is collected. The sample volume depends on the type and number of analyses to be performed. The collection of a grab sample is appropriate when a sample is needed to:

- Represent an effluent that does not discharge on a continuous basis.
- Provide information about instantaneous concentrations of pollutants at a specific time.
- Allow collection of a variable sample volume.
- Corroborate composite samples.
- Monitor parameters not amenable to compositing (e.g., pH, temperature, dissolved oxygen, chlorine, purgeable organics, oil and grease, coliform bacteria, and others specified by the NPDES permit, which may include phenols, sulfites, and hexavalent chromium).

Composite Samples. Composite samples are samples collected over time, either by continuous sampling or by mixing discrete samples. Composite samples represent the average characteristics of the wastestream during the compositing period. Composite samples are collected when:

- Average pollutant concentration during the compositing period is desired.
- Mass per unit time loadings are calculated.

- Wastewater characteristics are highly variable.

The four primary methods of composite sample collection are time compositing, flow proportion compositing, sequential compositing, and continuous compositing. Table 5-1 lists the advantages and disadvantages of these methods. The permit may specify which type of composite sample to use. Composite samples are collected either manually by combining multiple grab samples or by using automatic sampling equipment. Inspectors should consider variability in wastestream flow rate, parameter concentrations and the approved EPA methods when choosing compositing methods, sampling equipment (tubing and containers), and quality assurance procedures. The compositing methods are as follows:

- Time Composite Sample: This method requires discrete sample aliquots collected in one container at constant time intervals. This method is appropriate when the flow of the sampled stream is constant (flow rate does not vary more than ±10 percent of the average flow rate) or when flow monitoring equipment is not available.

Table 5-1. Compositing Methods

Method	Advantages	Disadvantages	Comments
Time Composite			
Constant sample volume, constant time interval between samples.	Minimal manual effort; requires no flow measurement.	May lack representativeness for highly variable flows.	Widely used in both automatic and manual sampling.
Flow-Proportional Composite			
Constant sample volume, time interval between samples proportional to stream flow.	Minimal manual effort.	Requires accurate flow measurement reading equipment; manual compositing from flowchart.	Widely used in automatic as well as manual sampling.
Constant time interval between samples, sample volume proportional to total stream flow at time of sampling.	Minimal instrumentation.	Manual compositing from flowchart in absence of prior information on the ratio of minimum to maximum flow; chance of collecting too small or too large individual discrete samples for a given composite volume.	Used in automatic samplers and widely used as manual method.
Constant time interval between samples, sample volume proportional to total stream flow since last sample.	Minimal instrumentation.	Manual compositing from flow chart in absence of prior information on the ratio of minimum to maximum flow; chance of collecting too small or too large individual discrete samples for a given composite volume.	Not widely used in automatic samplers but may be done manually.

Table 5-1. Compositing Methods

Method	Advantages	Disadvantages	Comments
Sequential Composite			
Series of short period composites, constant time intervals between samples.	Useful if fluctuations occur and the time history is desired.	Requires manual compositing of aliquots based on flow.	Commonly used; however, manual compositing is labor intensive.
Series of short period composites, aliquots taken at constant discharge increments.	Useful if fluctuations occur and the time history is desired.	Requires flow totalizer; requires manual compositing of aliquots based on flow.	Manual compositing is labor intensive.
Continuous Composite			
Constant sample volume.	Minimal manual effort, requires no flow measurement highly variable flows.	Requires large sample capacity; may lack representativeness for highly variable flows.	Practical but not widely used.
Sample volume proportional to stream flow.	Minimal manual effort, most representative especially for highly variable sample volume, variable pumping capacity and power.	Requires accurate flow measurement equipment, large sample volume, variable pumping capacity, and power.	Not widely used.

- Flow-Proportional Composite Sample—in one method, a constant sample volume is collected at varying time intervals proportional to stream flow (e.g., 200 milliliters sample collected for every 5,000 gallons of flow). In the other method (which has two variations, see Table 5-1), the sample is collected by increasing the volume of each aliquot as the flow increases, while maintaining a constant time interval between the aliquots.
- Sequential Composite Sample—this method requires discrete samples collected in individual containers at constant time intervals or discharge increments; for example, samples collected every 15 minutes, composited into separate containers each hour. The discrete samples can then be manually flow-proportioned to form the composite sample. Alternatively, a constant sample volume is collected at constant discharge volume increments measured with a flow totalizer.
- Continuous Composite Sample—collect this sample continuously from the wastestream. The sample may be constant volume, or the volume may vary in proportion to the flow rate of the wastestream.

Influent Sample Collection. Document and take influent samples at points of high turbulence flow to ensure good mixing. In some instances, the most desirable location may not be accessible. Ensure sampling points are located prior to any internal facility return lines, and sampling equipment should be placed so that it does not interfere with flow measuring devices. The preferred sampling points for raw wastewater are at the most downstream location from the collection lines, but prior to preliminary treatment:

- Waste flowing from the last process in a manufacturing operation, for an industrial user.
- Pump wet well (if turbulent).
- Upstream collection lines, tank, or distribution box following pumping from the wet well or sump.
- Flume throat.
- Aerated grit chamber.
- Upstream siphon following the comminutor (in absence of grit chamber).

If it is not possible to sample at a preferred point, choose an alternative location and document the basis for choosing that location.

Effluent Sample Collection. Collect effluent samples at the location specified in the NPDES permit. Occasionally, municipal plant permits may specify sampling prior to chlorination. For these plants, monitor all parameters at the upstream location except fecal coliforms, pH, and total residual chlorine. Collect wastewater for use in bioassays at the location specified in the facility's NPDES permit.

Collect samples either manually (grab or composite) or with automatic samplers (continuous or composite). The following general guidelines apply when taking samples:

- Take samples at a location specified in the NPDES permit and/or at a location selected to yield a representative sample.
- Use the sampling method (grab, composite, continuous) specified in the permit. Some parameters that must be collected as an individual grab sample are dissolved oxygen, total residual chlorine, oil and grease, coliform bacteria, purgeable organics, sulfides, cyanide, and total phenols.
- Avoid collecting large nonhomogeneous particles and objects.
- Collect the sample facing upstream to avoid contamination.
- Do not rinse sample container with sample when collecting oil and grease and microbiological samples, but fill the container directly to within 2.5 to 5 cm from the top.
- Fill the container completely if the sample is to be analyzed for purgeable organics, oxygen, ammonia, hydrogen sulfide, free chlorine, pH, hardness, sulfite, ammonium, ferrous iron, acidity, or alkalinity.
- Collect sufficient volume to allow for quality assurance testing. (see EPA's website https://www.epa.gov/cwa-methods for a listing of all approved sampling methods. Each sampling method will indicate the required sampling equipment, sampling containers and sampling volume, but additional volumes may be necessary for quality assurance testing.)

The following general guidelines apply when using automatic samplers:

- Collect samples where the wastewater is well mixed. Collect the sample near the center of the flow channel at 0.4 to 0.6 depth (mid-depth).
- Obtain a sufficient volume of sample to perform all required analyses plus any additional amount for quality control. Individual portions of a composite sample should be at least 100 milliliters to minimize sampler solids bias.
- For automatic samplers that use a peristaltic pump, obtain adequate flow rates in the sampler tubing to effectively transport the suspended solids. To avoid solids bias, the velocity of the wastewater in sample tubing should be at least 2 feet per second (fps) and the tubing diameter should be at least 0.25 inch.
- Time of sample collection begins when the last aliquot is dispensed into the composite sample container.

Sample Volume

The volume of sample collected depends on the type and number of analyses needed, as reflected in the parameters to be measured. Obtain the volume of the sample sufficient for all the required analyses plus an additional amount to provide for any split samples or repeat analyses. EPA approved sampling methods provide a guide to sample volumes required for determining the constituents in wastewater (available at https://www.epa.gov/cwa-methods). Consult the laboratory receiving the sample for any specific volume required. EPA's *Methods for Chemical Analysis of Water and Wastes* (EPA, 1979a) and *Handbook for Sampling and Sample Preservation of Water and Wastewater* (EPA, 1982), and the current EPA-approved edition of *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), 2013) contain specific recommended minimum sample volumes for different pollutant parameters.

Sample Containers

The regulations at 40 CFR Part 136 describe required sample containers, sample preservation, and sample holding time. EPA approved sampling methods indicate appropriate sample containers for each analysis It is essential that the sample containers be made of chemically resistant material unaffected by the concentrations of the pollutants measured. In addition, sample containers must have a closure that will protect the sample from contamination. Collect wastewater samples for chemical analysis in plastic (polyethylene) containers. Exceptions to this general rule are oil and grease samples, pesticides, phenols, polychlorinated biphenyls (PCBs), and other organic pollutant samples. Collect these in properly cleaned glass jars or bottles and seal. Collect bacteriological samples in properly sterilized plastic or glass containers. Collect samples that contain constituents that will oxidize when exposed to sunlight (such as iron cyanide complexes) in dark containers.

Ensure sample containers are clean and uncontaminated. Check analytical procedures to determine if they specify container cleaning procedures. Use precleaned and sterilized disposable containers (e.g., polyethylene cubitainers). If these are not used or if the analytical

method does not specify procedures, use the following procedures for cleaning sample containers:

- Wash with hot water and detergent.
- Rinse with acid (e.g., nitric for metals).
- Rinse with tap water, then rinse three or more times with organic-free water.
- Rinse glass containers with an interference-free, redistilled solvent (such as acetone or methylene chloride for extractable organics.
- Dry in contaminant-free area.

EPA SAMPLE IDENTIFICATION METHODS

Identify each sample accurately and completely. Use labels or tags to identify the samples that are moisture-resistant and able to withstand field conditions. If moisture-resistant labels are not available, place a piece of tape over each label to prevent water damage. Use a waterproof pen to complete the labels or tags. A numbered label or tag associated with a field sample data sheet containing detailed information on the sample is preferable to using only a label or tag for information[2]. The information for each sample should include the following:

- Facility name/location
- Sample site location
- Sample number
- Name of sample collector
- Date and time of collection
- Indication of grab or composite sample with appropriate time and volume information
- Identification of parameter to be analyzed
- If the sample is preserved and, if so, the preservative used

WASTEWATER SAMPLE PRESERVATION AND HOLDING TIME

In most cases, wastewater samples contain one or more unstable pollutants that require immediate (e.g., within 15 minutes) preservation and/or analysis. Provide appropriate chemical preservation before transferring samples to the laboratory. EPA approved sampling methods indicate appropriate sample preservation for each analysis (sampling methods are available at https://www.epa.gov/cwa-methods). Procedures used to preserve samples include cooling, pH adjustment, and chemical treatment. For some parameters, such as cyanide and phenols, add preservatives to sample bottles prior to or immediately following sample collection. For many samples, if preservatives are not appropriately used, bacteria can quickly degrade certain constituents (such as phenols and phosphorus). Other constituents may volatilize (such as volatile organics and sulfides) or may react to form different chemical species (hexavalent

[2] Note: Preprinted labels, data sheets, chain-of-custody forms, etc., can be done in the field using software developed by the Superfund Program.

chromium, for example). Proper preservation and holding times are essential to ensure sample integrity (see 40 CFR Part 136).

Analysis of samples within one day ensures against error from sample deterioration. However, such prompt analysis is not feasible for composite samples in which portions may be stored for as long as 24 hours. Where possible, provide sample preservation during compositing, usually by refrigeration to 6°C (or icing). If using an automatic sampler with ice, replace the ice as necessary to maintain low temperatures. This is a limitation of automatic samplers used during the summer when ice must be frequently replaced.

Table II of 40 CFR 136.3(e) indicates maximum sample holding times. Times listed are the maximum holding times between sample collection and analysis that are allowed for the sample to be considered valid. Unless otherwise specified in the method, holding time limitations begin upon combination of the last aliquot in a sample. When use of an automatic sampler makes it impossible to preserve each aliquot, the chemical samples may be preserved by maintaining at 6°C until compositing and sample splitting is completed (40 CFR 136.3(e)).

TRANSFER OF CUSTODY AND SHIPMENT OF SAMPLES

To ensure the validity of the permit compliance sampling data in court, written records must accurately trace the custody of each sample through all phases of the monitoring program (EPA Order 5360.1). The primary objective of this chain-of-custody is to create an accurate written record (see an example chain-of-custody form in Appendix M) that can be used to trace the possession and handling of the sample from the moment of its collection through its analysis and introduction as evidence. The following procedures are appropriate for the transfer of custody and shipment of samples:

- Use sample seals to protect the sample's integrity from the time of collection to the time it is opened in the laboratory, including the time the sample is within an automatic sampling apparatus, thus the automatic sampler should be sealed on the outside. The seal should indicate the collector's name, the date and time of sample collection, and sample identification number. For automatic samplers, seals should indicate the sample time at which the apparatus began sampling, as the sample container is subsequently sealed in the apparatus.
- Pack samples properly to prevent breakage. Seal or lock the shipping container to readily detect any evidence of tampering. Use of tamper-proof evidence tape is recommended.
- Place samples on ice or synthetic ice substitute that will maintain sample temperature at 6°C throughout shipment.
- The responsibility for proper packaging, labeling, and transferring of possession of the sample lies with the inspector. Accompany every sample with a sample tag and a chain-of-custody record that has been completed, signed, and dated. The chain-of-custody record should include the names of sample collectors, sample identification numbers, date and time of sample collection, location of sample collection, and names and signatures of all persons handling the sample in the field and in the laboratory.

- The originator retains a copy of the chain of custody forms. Also, the originator must retain all receipts associated with the shipment.
- EPA Inspectors with the responsibility of working with hazardous materials that are placed in commerce (transporting/shipping) must have hazardous materials training as required by the Department of Transportation (see Appendix N).
- When transferring possession of samples, the transferee must sign and record the date and time on the chain-of-custody record (use the currently approved record). In general, custody transfers are made for each sample, although samples may be transferred as a group, if desired. For each sample being transferred, the transferee should list the sample and their name on the custody record. Each person who takes custody must fill in the appropriate section of the chain-of-custody record. Both the transferee and person who takes custody of the sample(s) must sign the custody record.
- Pack and ship samples in accordance with applicable International Air Transportation Association (IATA) and/or DOT regulations.

QUALITY CONTROL

Conduct control checks during the actual sample collection to determine the performance of sample collection techniques. In general, the most common monitoring errors usually are improper sampling methodology, improper preservation, inadequate mixing during compositing and splitting, and excessive sample holding time. In addition, collect and analyze the following samples to check sample collection techniques:

Blanks

- Trip blank. Trip blanks are vial(s) filled at the laboratory with deionized water. The blank(s) follows the same handling and transport procedures as the samples collected during the event. The blank(s) functions as a check on sample contamination originating from sample transport, shipping and from site conditions.

  Note: Expose the trip blank vial(s), to the same environmental conditions (light, temperature, etc.) of the sample vial(s) but do not open until it is time for analysis.

- Field blank/field reagent blank. Field blanks are similar to trip blanks except they are prepared in the field with deionized water exactly as the sample(s) that are collected. Field blanks are used to check for analytical artifacts and/or background introduced by sampling and analytical procedures.
- Temperature blank. A temperature blank is a small sample bottle filled with distilled water that is placed in each cooler prior to shipment. Upon arrival at the laboratory the temperature of the sample bottle is measured to evaluate if samples were adequately cooled during sample shipment.
- Equipment/rinsate blank. Collect an equipment/rinsate blank when using an automatic sampler or other non-dedicated equipment during the sampling process. The blank is a check of the equipment cleanliness. For automatic samplers, prepare blanks prior to collecting samples, by pumping deionized organic free water (rinsate) through the

sampler and collecting the discharge purge water in a sample container for analysis for the constituents of concern.

Field Duplicate. Collect a field duplicate sample simultaneously from the same source at selected stations on a random timeframe by grab samples or from two sets of field equipment installed at the site. Duplicate samples check analytical precision as well as evaluate the "representativeness" of the sample aliquot.

Split Samples. Split samples are samples that have been divided into two containers for analysis by separate laboratories. These samples provide an excellent means of identifying discrepancies in the permittee's analytical techniques and procedures. When filling split samples from a single composite jug, shake the composited sample well and half fill the EPA sample container, then shake the composite again and fill half of the permittee's container. Repeat the procedure for each parameter collected.

The laboratories performing the sample analyses should also use the following control measures:

Prep/Reagent Blank. A prep/reagent blank is a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and to aid in identifying errors in the observed value that may result from the analytical steps.

Quality Control Sample. A quality control sample is an uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. Use this sample to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurements' system.

Matrix Spike/Matrix Spike Duplicate (MS/MSD). A matrix spike/matrix spike duplicate sample is three times the normal volume required for a specific chemical analysis to which a known quantity of analyte has been added prior to all sample preparation. The laboratory utilizes the MS/MSD samples as part of their Quality Assurance/Quality Control Program.

- Use a matrix spike to verify accuracy of the analytical procedures.
- A matrix spike duplicate is a duplicate of a matrix spike sample. It measures the precision of the analysis in terms of relative percent difference.

Table 5-2 indicates quality control procedures for field analyses and equipment. Quality control is discussed in greater detail in Chapter 7 of this manual and EPA's *NPDES Compliance Inspector Training module: Laboratory Analyses* (EPA, 1990).

Table 5-2. Quality Control Procedures for Field Analysis and Equipment

Parameter	General	Daily	Other Frequency
Dissolved Oxygen			
Membrane Electrode	• Enter the make, model, and serial and/or ID number for each meter in a logbook. • Report data to nearest 0.1 mg/L.	• Calibrate meter using manufacturer's instructions or Winkler-Azide method. • Check membrane for air bubbles and holes. Change membrane and Potassium chloride (KCl) solution if necessary. • Check leads, switch contacts, etc., for corrosion and shorts if meter pointer remains off-scale.	• Annually, check instrument calibration and linearity using a series of at least three dissolved oxygen standards. • Annually, take all meters to the laboratory for maintenance, calibration, and quality control checks.
Winkler-Azide Method	Record data to nearest 0.1 mg/L.	Duplicate analysis should be run as a precision check. Duplicate values should agree within ±0.2 mg/l.	
pH			
Electrode Method	Enter the make, model, and serial and/or ID number for each meter in a logbook.	• Calibrate the system against traceable standard buffer solutions of known pH value that closely brackets the actual sample pH (e.g., 4, 7, and 10 at the start of a sampling run). • Periodically check the buffers during the sample run and record the data in the logbook. • Be on the alert for erratic meter response arising from weak batteries, cracked electrodes, fouling, etc. • Check response and linearity following highly acidic or alkaline samples. Allow additional time for equilibration. • Check against the closest reference solution each time a violation is found. • Rinse electrodes thoroughly between samples and after calibration. Blot dry. • Store the probe in approved storage solution (e.g., KCl)	

Table 5-2. Quality Control Procedures for Field Analysis and Equipment

Parameter	General	Daily	Other Frequency
Conductivity			
	Enter the make, model, and serial and/or ID number for each meter in a logbook.	• Standardize with KCl standard solutions having similar specific conductance values to those anticipated in the samples. Calculate the cell constant using two different standards. • Rinse cell after each sample to prevent carryover.	• Quarterly, take all meters to lab for maintenance, calibration, and quality control checks. • Quarterly, check temperature compensation. • Quarterly, check date of last platinizing, if necessary. • Quarterly, analyze NIST or EPA reference standard solutions, and record actual vs. observed readings in the logbook.
Residual Chlorine			
Amperometric Titration	Enter the make, model, and ID and/or serial number of each titration apparatus in a logbook. Report results to nearest 0.01 mg/l.	Refer to instrument manufacturer's instructions for proper operation and calibration procedures.	Biweekly, return instrument to lab for maintenance and addition of fresh, standardized reagents.
Temperature			
Manual Thermometer	• Enter the make, model, and serial and/or ID number and temper-ature range. • All standardization should be against a traceable NIST or NIST calibrated thermometer. Reading should agree within ±1°C. If enforcement action is anticipated, calibrate the thermometer before and after analysis. All data should be read to the nearest 1°C. Report data between 10° and 99°C to two significant figures.	Check for air spaces of bubbles in the column, cracks, etc. Compare with a known source if available.	• Initially and annually, determine accuracy throughout the expected working range of 0°C to 50°C. A minimum of three temperatures within the range should be used to verify accuracy. Preferably, the 3 temperature readings should be taken within the following ranges: 5–10°C, 15–25°C, and 35–45°C.
Thermistors, Thermographs	Enter the make, model, and serial and/or ID number of the instrument in a log-book. All standardization shall be against a NIST or NIST calibrated thermometer. Reading	Check thermistor and sensing device for response and operation according to the manufacturer's instruction. Record actual versus standard temperature in logbook.	Initially and annually, determine accuracy throughout the expected working range of 0°C to 50°C. A minimum of three temperatures within the range should be used to verify

Table 5-2. Quality Control Procedures for Field Analysis and Equipment

Parameter	General	Daily	Other Frequency
	should agree within ±1°C. If enforcement action is anticipated, refer to the procedure listed above.		accuracy. Preferably, the 3 temperature readings should be taken within the following ranges: 5–10°C, 15–25°C, and 35–45°C.
Flow Measurement			
	Enter the make, model, and serial and/or ID number of each flow measurement instrument in a logbook.	Install the device in accordance with the manufacturer's instructions and with the procedures given in owner's manual.	Annually affix record of calibration (as per NIST standard or manufacturer's suggested standard) to the instrument log.
Automatic Samplers			
	Enter the make, model, and serial and/or ID number of each sampler in a logbook.		For each sampling event, check intake velocity vs. head (using a minimum of three samples), and clock time setting vs. actual time interval. Calibrate annually and record results in a logbook.

QUALITY ASSURANCE PROJECT PLAN

The EPA has developed the Quality Assurance Project Plan (QAPP) as a tool for project managers and planners to document the type and quality of data needed for the agency to make environmental decisions and to describe the methods for collecting and assessing those data. The QAPP is required for all EPA projects resulting in the generation, collection, and use of environmental data. The development, review, approval and implementation of the QAPP is an integral part of an Agency-wide Quality System, which is required per the authority of EPA Order 5360.1 A2.

If the EPA is to have confidence in the quality of data used to support environmental decisions, there must be a systematic planning process in place. A product of the systematic planning process is the QAPP. An example of the systematic planning process endorsed by the EPA is the Data Quality Objectives (DQO) Process. The QAPP ensures that the needed management and technical practices are in place so that environmental data used to support agency decisions are of adequate quality and usability for their intended purpose.

Prior to the start of data collection, a QAPP defining the goals and scope of the project, the need for sample collection, a description of the data quality objectives and QA/QC activities to ensure data validity and usability must be developed by the project officer. Thereafter, a review by all parties to the sampling effort, such as a Quality Assurance (QA) Officer, must be conducted. Also, EPA laboratories will require a copy of an approved QAPP prior to conducting any sample analysis. This QAPP requirement applies to both EPA staff and outside contractors. The process for approval of the QAPP and other documents related to the data collection activity should be outlined in the lead organization's Quality Management Plan (QMP).

For further information on QAPP's please visit the Office of Environmental Information (OEI) web page at: https://www.epa.gov/quality/agency-wide-quality-system-documents.

DATA HANDLING AND REPORTING

Verified analytical results are normally entered into a laboratory data management system of some type. The system should contain the sampling data, including time and exact location, analysis dates and times, names of analysts, analytical methods/techniques used, and analytical results. Data are then reported to the inspector for inclusion into the compliance report. The quality assurance manual by EPA (EPA, 1979b) and the article by J.J. Delfino (Delfino, 1977) provide useful information to the inspector on many data management techniques.

C. REFERENCES

The following is a list of resources providing additional information on sampling.

American Public Health Association (APHA), American Water Works Association (AWWA), and World Economic Forum (WEF). (2013). *Standard Methods for the Examination of Water and Wastewater*.

Associated Water and Air Resources Engineers, Inc. (1973). *Handbook for Industrial Wastewater Monitoring*. USEPA Technology Transfer.

Delfino, J.J. (1977). "Quality Assurance in Water and Wastewater Analysis Laboratories." *Water and Sewage Works*, 124(7), 79-84.

Federal Register. (1984). G*uidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Final Rule and Interim Final Rule and Proposed Rule*. Vol. 49, No. 209.

Harris, D.J., and Keffer, W.J. (1974). *Wastewater Sampling Methodologies and Flow Measurement Techniques*. U.S. Environmental Protection Agency Region VII. EPA-907/9-74-005.

Lauch, R.P. (1975). *Performance of ISCO Model 1391 Water and Wastewater Sampler*. U.S. Environmental Protection Agency. EPA-670/4-75-003.

Lauch, R.P. (1976). *A Survey of Commercially Available Automatic Wastewater Samplers*. U.S. Environmental Protection Agency. EPA-600/4-76-051.

Shelley, P.E. (1975). *Design and Testing of a Prototype Automatic Sewer Sampling System*. Office of Research and Development, U.S. Environmental Protection Agency. EPA 600/2-76-006.

Shelley, P.E., and Kirkpatrick, G.A. (1975). *An Assessment of Automatic Sewer Flow Samplers*. Office of Research and Development, U.S. Environmental Protection Agency. EPA-600/2-75-065.

U.S. Environmental Protection Agency. (1978). *Methods for Benzidine, Chlorinated Organic Compounds, Pentachlorophenol and Pesticides in Water and Wastewater*. Environmental Monitoring and Support Laboratory, Cincinnati, Ohio.

U.S. Environmental Protection Agency. (1979a). *Methods for Chemical Analysis of Water and Wastes*. EPA-600/4-79-020.

U.S. Environmental Protection Agency. (1979b). *Handbook for Analytical Quality Control in Water and Wastewater Laboratories*. EPA-600/4-79-019.

U.S. Environmental Protection Agency. (1979c). *NPDES Compliance Sampling Inspection Manual*. MCD-51.

U.S. Environmental Protection Agency. (1981). *Methods for Organic Chemical Analysis of Water and Wastes by GC, HPLC and GC/MS*. Environmental Monitoring Support Laboratory, Cincinnati, Ohio.

U.S. Environmental Protection Agency. (1982). *Handbook for Sampling and Sample Preservation of Water and Wastewater*. EPA-600/4-82-029.

U.S. Environmental Protection Agency. (1990). *NPDES Compliance Monitoring Inspector Training Module: Laboratory Analysis*. EPA 833-R-90-103.

U.S. Environmental Protection Agency. (2000a). *Manual for the Evaluation of Laboratories Performing Aquatic Toxicity Tests*. EPA-600/4-90/031.

U.S. Environmental Protection Agency. (2000b). *Guidance for the Data Quality Objectives Process (G-4).* EPA-600/R-96/055.

U.S. Environmental Protection Agency. (2002a). *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*. EPA 821-R-02-012.

U.S. Environmental Protection Agency. (2002b). *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. EPA 821-R-02-013.

U.S. Environmental Protection Agency. (2002c). *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms Organisms*. EPA 821-R-02-014.

U.S. Environmental Protection Agency. (2002d). *Guidelines Establishing Test Procedures for the Analysis of Pollutants; Whole Effluent Toxicity Test Methods; Final Rule.* 40 CFR Part 136.

U.S. Environmental Protection Agency. (2001- Reissued May 21, 2006). *EPA Requirements for QA Project Plans (QA/R-5)*. EPA-240/B-01/003.

Wood, L.B., and Stanbridge, H.H. (1968). "Automatic Samplers," Water Pollution Control, 67(5): 495-520.

D. PERMITTEE SAMPLING INSPECTION CHECKLIST

A. PERMITTEE SAMPLING EVALUATION			
Yes	No	N/A	1. Take samples at sites specified in permit.
Yes	No	N/A	2. Locations adequate for representative samples.
Yes	No	N/A	3. Flow proportioned samples obtained when required by permit.
Yes	No	N/A	4. Complete sampling and analysis on parameters specified by permit.
Yes	No	N/A	5. Conduct sampling and analysis in frequency specified by permit.
Yes	No	N/A	6. Permittee uses method of sample collection required by permit. Required method: _____ If not, method being used is: ( ) Grab ( ) Manual Composite ( ) Automatic Composite
			7. Sample collection procedures adequate:
Yes	No	N/A	a. Samples refrigerated during compositing.
Yes	No	N/A	b. Proper preservation techniques used.
Yes	No	N/A	c. Containers and sample holding times before analyses conform to 40 CFR 136.3.
Yes	No	N/A	d. Samples analyzed in timeframe needed.
Yes	No	N/A	8. Facility performs monitoring and analyses more often than required by permit; if so, results reported in permittee's self-monitoring report.
Yes	No	N/A	9. Samples contain chlorine.
Yes	No	N/A	10. Use contract laboratory for sample analysis.
Yes	No	N/A	11. POTW collects samples from industrial users in pretreatment program.
B. SAMPLING INSPECTION PROCEDURES AND OBSERVATIONS			
Yes	No	N/A	1. Obtain grab samples.
Yes	No	N/A	2. Obtain composite sample. Compositing Frequency: _____ Preservation: _____
Yes	No	N/A	3. Refrigerate sample during compositing.
Yes	No	N/A	4. Obtain flow-proportioned sample.
Yes	No	N/A	5. Obtain sample from facility sampling device.
Yes	No	N/A	6. Sample representative of volume and nature of discharge.
Yes	No	N/A	7. Sample split with permittee.
Yes	No	N/A	8. Employ chain-of-custody procedures.
Yes	No	N/A	9. Samples collected in accordance with permit.
Yes	No	N/A	10. Observe excessive foam, grease, floating solids at the outfall.

C. AUTOMATIC SAMPLER PROCEDURES AND OBSERVATIONS			
Yes	No	N/A	1. Sample intake tubing place in a well-mixed, representative location (0.4 to 0.6 depth).
Yes	No	N/A	2. Individual aliquot volume checked and at least 100ml.
Yes	No	N/A	3. Proper sample tubing (Teflon™ for organics, otherwise Tygon®) and tubing at ID at least 0.25 inch.
Yes	No	N/A	4. Proper composite sample container (glass for organics, otherwise plastic.
Yes	No	N/A	5. Proper refrigeration (6^{o}C or ice), with required documentation.
Yes	No	N/A	6. Proper wastewater velocity in the sample tubing (at least 2 fps).

CHAPTER 6 – FLOW MEASUREMENT

Contents

Associated Appendices

O. Supplemental Flow Measurement Information

A. EVALUATION OF PERMITTEE'S FLOW MEASUREMENT

OBJECTIVE AND REQUIREMENTS

To comply with the permit requirements established under the National Pollutant Discharge Elimination System (NPDES), the permittee must accurately determine the quantity of wastewater being discharged. Discharge flow measurement is an integral part of the NPDES program, it is important that the inspector evaluate the accuracy of the measurement.

In addition to providing usable information for enforcement purposes, flow measurement serves to:

- Provide data for pollutant mass loading calculations.
- Provide operating and performance data on the wastewater treatment plant.
- Compute treatment costs, based on wastewater volume.
- Obtain data for long-term planning of plant capacity, versus capacity used.
- Provide information on Infiltration and Inflow (I/I) conditions, and the need for cost-effective I/I correction.

A Flow Measurement Inspection Checklist for the inspector's use appears at the end of this chapter.

EVALUATION OF FACILITY INSTALLED FLOW DEVICES AND DATA

There are two types of wastewater flow: closed-channel flow and open-channel flow. Closed-channel flow occurs under pressure in a liquid-full conduit (usually a pipe). The facility will usually have a metering device inserted into the conduit that measures flow. Examples of closed-channel flow measuring devices are the Venturi meter, the Pitot tube, the paddle wheel, the electromagnetic flowmeter, Doppler, and the transit-time flowmeter. In practice, closed-channel flow is normally encountered between treatment units in a wastewater treatment plant, where liquids and/or sludges are pumped under pressure.

Open-channel flow occurs in conduits that are not liquid-full. Open-channel flow is partially full pipes not under pressure. Open-channel flow is the most prevalent type of flow at NPDES-regulated discharge points. Open-channel flows are typically measured using primary and secondary devices. Primary devices are standard hydraulic structures, such as flumes and weirs that are inserted in the open channel. Inspectors can obtain accurate flow measurements merely by measuring the depth of liquid (head) at the specific point in the primary device. In a weir application, for example, the flow rate is a function of the head of liquid above the weir crest.

Facilities use secondary devices in conjunction with primary devices to automate the flow measuring process. Typically, secondary devices measure the liquid depth in the primary device and convert the depth measurement to a corresponding flow, using established mathematical relationships. Examples of secondary devices are gauges, floats, ultrasonic transducers, bubblers, and transit-time flowmeters. A recorder generally measures the output of the

secondary device transmitted to a recorder and/or totalizer to provide instantaneous and historical flow data to the operator. Outputs may also be transmitted to sampling systems to facilitate flow proportioning. Appendix O, "Supplemental Flow Measurement Information," contains further information on flow measurement devices.

The inspector must assure that the permittee obtains accurate wastewater flow data to calculate mass loading (quantity) from measured concentrations of pollutants discharged as required by many NPDES permits. The permittee must produce data that meet requirements in terms of precision and accuracy. Precision refers to data reproducibility or the ability to obtain consistent data from repeated measurements of the same quantity. Accuracy refers to the agreement between the amount of a component measured by the test and the amount present.

The accuracy of flow measurement (including both primary and secondary devices) varies widely with the device, its location, environmental conditions, and other factors such as maintenance and calibration. Faulty fabrication, construction, and installation of primary devices are common sources of errors. Improper calibration, misreading, and variation in the speed of totalizer drive motors are major errors related to secondary devices (see Appendix O, "Supplemental Flow Measurement Information"). When evaluating facility installed devices, the inspector should do the following:

- Verify that the facility has installed primary and/or secondary devices according to the manufacturer's manual instructions.
- Inspect the primary device for evidence of corrosion, scale formation, or solids accumulation that may bias the flow measurement.
- Verify that weirs are level, plumb, and perpendicular to the flow direction.
- Verify that flumes are level and smooth-finished, the throat walls (narrowed section of flume) are plumb, and the throat width is the standard size intended.
- Inspect historical records (i.e., strip charts and logs) for evidence of continuous flow measurements and for routine and maintenance operations schedules. Compare periods of missing data with maintenance logs for explanations of measuring system problems.
- Observe the flow patterns near the primary device for excessive turbulence, velocity, or accumulating foam. The flow lines should be straight.
- Ensure that the flow measurement system or technique being used measures the entire wastewater discharge as required by the NPDES permit. Inspect carefully the piping to determine whether there are any wastewater diversions, return lines, or bypasses around the system. Make sure the system meets the permit requirement, such as instantaneous or continuous, daily, or other time interval measures. Note anomalies in the inspection report.
- Verify that the site chosen for flow measurement by the facility is appropriate and is in accordance with permit requirements.

- Verify that the site chosen by the facility for flow measurement is suitable for the type of discharge, flow range, suspended solids concentration, and other relevant factors.
- Determine if the facility has closed-channel flow measuring devices where the pipe is always full. If these devices are used, then there must also be a means for the permittee and regulatory agencies/inspector to verify the accuracy of these meters. Primary open-channeled flow measuring devices such as weirs and flumes should be used in an open-channel segment above or below the closed-channel segment to verify the flow measured by the closed-channel flow measuring devices.
- Verify that the facility uses appropriate tables, curves, and formulas to calculate flow rates.
- Review and evaluate calibration and maintenance programs for the discharger's flow measurement system. The permit normally requires the facility to check the calibration regularly by the permittee. The facility must ensure that their flow measurement systems are calibrated by a qualified source at least once a year to ensure their accuracy. Lack of such a program is considered unacceptable for NPDES compliance purposes.
- Verify that the facility calibrates secondary flowmeter systems to be within 10 percent of the primary flow measurement system.
- Verify that primary and secondary devices are adequate for normal flow as well as maximum expected flows. Note whether the flow measurement system can measure the expected range of flows.
- Collect accurate flow data during inspection to validate self-monitoring data collected by the permittee.
- The facility must install a flow measuring system that has the capability of routine flow verification by the permittee or appropriate regulatory personnel.

EVALUATION OF PERMITTEE DATA HANDLING AND REPORTING

The permittee or facility must keep flow measurement records for a minimum period of three years. Many flow-measuring devices produce a continuous flowchart for plant records. Flow records should contain date, flow, time of reading, and operator's name. The facility should record maintenance, inspection dates, and calibration data.

The inspector should review the permittee's records and note the presence or absence of data such as:

- Frequency of routine operational inspections.
- Frequency of maintenance inspections.
- Frequency of flowmeter calibration (should be as specified in permit, generally at least once per year).
- Irregularity or uniformity of flow.

EVALUATION OF PERMITTEE QUALITY CONTROL

The inspection should evaluate the following quality control issues during a compliance inspection to ensure:

- Proper operation and maintenance of equipment
- Accurate records
- Sufficient inventory of spare parts
- Valid flow measurement techniques
- Precise flow data
- Adequate frequency of calibration checks

Evaluate precision of float driven flow meters when flows are stable. Push the float gently downward, hold for 30 seconds, then allowed to return normally. The recorded flow rate should be the same before and after the float was moved. Evaluate accuracy by measuring the instantaneous flow rate at the primary device used at the facility and comparing the value against the value on the meter, graph, integrator, or company record. The difference between two stable totalizer readings (flow is steady for 10 minutes or more) should not exceed ±10 percent of the instantaneous flow measured at the primary device. Note that most flow measurement systems have both an instantaneous meter readout and a totalizer. Both devices should agree, but that is not always the case due to electrical and other various malfunctions in the flow measuring system. In most cases, the totalizer reading will be what is reported by the permittee. If this is the case, then that device should be checked for accuracy and the permittee's flow measuring system rated accordingly.

In addition, the inspector can evaluate accuracy by installing a second flow measurement system, sometimes referred to as a reference system. Agreement in measured flow rates between the two systems should be within ±10 percent of the reference rate if all conditions are as recommended for the systems.

B. FLOW MEASUREMENT COMPLIANCE

OBJECTIVES

The current NPDES program depends heavily on the permittee's submittal of self-monitoring data. The flow discharge measured during the NPDES compliance inspection should verify the flow measurement data collected by the permittee, support any enforcement action that may be necessary, and provide a basis for reissuing or revising the NPDES permit.

FLOW MEASUREMENT SYSTEM EVALUATION

The responsibility of the inspector includes collecting accurate flow data during the inspection and validating data collected during the permittee's self-monitoring.

The NPDES inspector must check both the permittee's flow data and the flow measurement system to verify the permittee's compliance with NPDES permit requirements. If a flow-measuring device is located below ground or in confined space, inspectors are not to enter

confined spaces unless trained and permitted to do so. When evaluating a flow measurement system, the inspector should consider and record findings on the following:

- Whether the system measures the entire discharge flow.
- The system's accuracy and good working order. This will include a thorough physical inspection of the system and comparison of system readings to actual flow or those obtained with calibrated portable instruments.
- The need for new system equipment.
- The existence or absence of a routine calibration and maintenance program for flow measurement equipment.

If the permittee's flow measurement system is accurate within ±10 percent, the inspector should use the installed system. If the flow sensor or recorder is found to be inaccurate, the inspector should determine whether the equipment can be corrected in time for use during the inspection. If the equipment cannot be repaired in a timely manner, use the portable flow sensor and recorder used to assess the accuracy of the permittee's system for the duration of the inspection. If nonstandard primary flow devices are being used, request the permittee to supply data on the accuracy and precision of the method being employed.

For flow measurement in pipelines, the inspector may use a portable flowmeter. The inspector should select a flowmeter with an operating range wide enough to cover the anticipated flow to be measured. The inspector should test and calibrate the selected flowmeter before use. The inspector should select the site for flow measurement according to permit requirements and install the selected flowmeter according to the manufacturer's specifications. The inspector should use the proper tables, charts, and formulas as specified by the manufacturer to calculate flow rates.

Four basic steps are involved in evaluating the permittee's flow measurement system:

- Physical inspection of the primary device
- Physical inspection of the secondary device and ancillary equipment
- Flow measurement using the primary/secondary device combination of the permittee
- Certification of the system using a calibrated, portable instrument

Facilities with a closed pipe flow measurement system present a challenge to the inspector. Have the facility personnel explain the operation of the system and how they calibrate the flow measurement system. Check if it is calibrated yearly at a minimum. It is suggested that the facility conduct periodic monthly checks of the flow measurement system. The inspector can do a calibration of the closed pipe flow measurement systems in the following ways:

1. If an open-channel primary device is maintained at the facility the inspector can obtain an instantaneous head reading to verify the accuracy of the closed channel flow measuring system. Flow should be within ±10 percent of the closed channel system.

2. The inspector can use a portable flow meter (usually consists of two strap-on sensors that mount on the pipe and utilize the Doppler principle) to verify the accuracy of the facility's flow measurement system by conducting side-by-side comparisons. Flow should be within ±10 percent.
3. Confirm that the calibration procedure demonstrated by the facility's calibration personnel is adequate.

The following sections present procedures for inspecting the more common types of primary and secondary devices, for measuring flow using common permanent and portable systems, and for evaluating flow data. Please note that the number of primary/secondary device combinations is limitless; therefore, it is not feasible to provide procedures for all systems. When encountering systems other than those discussed here the inspector should consult the manufacturer's manual or facility personnel for advice on how the flow-measurement system operates before preparing a written inspection procedure.

CLOSED CONDUIT EVALUATION PROCEDURES

For closed-channel flow, the inspector performs the following checks on the system:

- Check for straight pipe runs of sufficient length both upstream (8–10 inches) and downstream (4–6 inches) of the measuring device.
- Determine if the meter size is appropriate for pipe diameter and flow ranges based on equipment manufacturer literature.
- Determine frequency of cleaning of pressure taps.

PRIMARY DEVICE INSPECTION PROCEDURES

The two most common open-channel primary devices are sharp-crested weirs and Parshall flumes. Common sources of error when using them include the following:

- Faulty fabrication—weirs may be too narrow or not "sharp" enough. Flume surfaces may be rough, critical dimensions may exceed tolerances, or throat walls may not be vertical.
- Improper installation—the facility may install weirs and flumes too near pipe elbows, valves, or other sources of turbulence. The devices may be out of level or plumb.
- Sizing errors—the primary device's recommended applications may not include the actual flow range.
- Poor maintenance—primary devices corrode and deteriorate. Debris and solids may accumulate in them Specific inspection procedures for the sharp-crested weir, the Parshall flume, and the Palmer-Bowlus flume devices follow.

Sharp-Crested Weir Inspection Procedures

- Inspect the upstream approach to the weir.
  - Verify that the weir is perpendicular to the flow direction.

  - Verify that the approach is a straight section of conduit with a length at least 20 times the maximum expected head of liquid above the weir crest.
  - Observe the flow pattern in the approach channel. The flow should occur in smooth stream lines without velocity gradients and turbulence.
  - Check the approach, particularly near the weir, for accumulated solids, debris, or oil and grease. The approach must have no accumulated matter.

- Inspect the sharp-crested weir.
  - Verify that the crest of the weir is level across the entire conduit traverse.
  - Measure the width of the weir crest. The edge of the weir crest should be no more than 1/8-inch thick.
  - Make certain the weir crest corresponds to zero-gauge elevation (zero output on the secondary device).
  - Measure the angle formed by the top of the crest and the upstream face of the weir. This angle must be 90 degrees.
  - Measure the chamfer (beveled edge) on the downstream side of the crest. The chamfer should be approximately 45 degrees.
  - Visually survey the weir-bulkhead connection for evidence of leaks or cracks that permit bypass.
  - Measure the height of the weir crests above the channel floor. The height should be at least twice the maximum expected head (2H) of liquid above the crest.
  - Measure the width of the end contraction. The width should be at least twice the maximum expected head (2H) of the liquid above the crest.
  - Confirm the location of the head-measuring device. The device should be located upstream of the weir at a point at least four times the maximum head.
  - Inspect the weir for evidence of corrosion, scale formation, or clinging matter. The weir must be clean and smooth.
  - Observe flow patterns on the downstream side of the weir. Check for the existence of an air gap (ventilation) immediately adjacent to the downstream face of the weir. Ventilation is necessary to prevent a vacuum that can induce errors in head measurements. Also, ensure that the crest is higher than the maximum downstream level of water in the conduit.
  - Verify that the nappe is not submerged and that it springs free of the weir plate.
  - If the weir contains a V-notch, measure the apex angle. The apex should range from 22.5 degrees to 90 degrees. Verify that the head is between 0.2 and 2.0 feet. The weir should not be operated with a head of less than 0.2 feet since the nappe may not spring clear of the crest.

King's *Handbook of Hydraulics* (King, 1963) frequently referenced throughout this chapter, provides a detailed discussion on weirs.

Parshall Flume Inspection Procedures

- Inspect the overall flume design.
  - Check that the flume is in a straight section of the conduit.
  - Check that the flume design is symmetrical and level in the transverse and translational directions.
  - Check that the flume is smooth-finished and constructed using a corrosion resistant material.
  - Measure the dimensions of the flume. Dimensions are strictly prescribed as a function of throat width (see Figure O-5 in Appendix O for critical dimensions).
  - Measure the head of liquid in the flume at two-thirds upstream of the throat in the convergence section and compare with the acceptable ranges in Table O-4 in Appendix O.
  - Check that the flow at the entrance is free of turbulence or "white" water. Flows should be laminar through the flume with uniform velocities across the width of the flume. Smaller flumes should have velocities less than 0.5 meters per second. Larger flumes should have velocities less than 2 meters per second.

- Inspect the flume approach (convergent section).
  - Confirm that the upstream channel is straight, horizontal, and of a uniform cross-section for a distance that is at least ten times the flume throat width.
  - Verify that the mouth of the convergent section is as wide as the channel and that the convergent section is merged flushed against the channel wall with rounded transitions (smooth transition between convergent section and channel wall—i.e., no sharp edges) to avoid turbulence in the flow.
  - Check that the upstream channel is free of accumulated matter. Accumulated matter may be indicative of oversizing of the flume or an incorrect setting of the flume in the channel.
  - Confirm that the location of the liquid measuring device is two-thirds upstream of the throat in the convergence section.

- Inspect the flume discharge (divergent section).
  - Check that the design of the downstream channel is low enough to allow free discharge conditions in the divergent section of the flume.
  - Check that the downstream channel is also free of accumulated matter.
  - Verify that the head of water in the discharge is not restricting flow through the flume. There should not be any obstruction, constriction, or channel turns in the divergent section that may cause the flow to back up in the flume. The existence of a "standard wave" is good evidence of free flow and verifies that there is no submergence present. This must be accounted for in the calculation of flow rate through the flume as described in the next section.

  - Determine whether submergence occurs at or near maximum flow (e.g., look for water marks on the wall).

Palmer-Bowlus Flume Inspection Procedures

- Inspect the overall flume design as outlined above. These flumes are seldom used for effluent flow measurement.
- Inspect the flume.
  - The flume should be in a straight section of the conduit.
  - Flow at the entrance should be free of "white" water.
  - Observe the flow in the flume. The profile should approximate that depicted in Figure O-8 in Appendix O.
  - The flume should be level in the transverse direction and should not exceed the translational slope in Table O-6 in Appendix O.
  - Measure the head of water in the flume. Head should be within the ranges specified in Table O-6 in Appendix O.
- Inspect the flume discharge.
  - Verify that free flow exists. Look for the characteristic "standing wave" in the divergent section of the flume.

Venturi Meter Inspection Procedures

- Verify that the facility installed the Venturi meter according to manufacturer's instructions.
- Verify that the facility installed the Venturi meter downstream from a straight and uniform section of pipe, at least 5 to 20 diameters, depending on the ratio of pipe to throat diameter and whether straightening vanes are installed upstream. (Installation of straightening vanes upstream will reduce the upstream piping requirements.)
- Verify that the pressure measuring taps are free of debris and are not plugged.
- Verify the facility calibrated the Venturi meter in place by either the volumetric method or the comparative dye dilution method to check the manufacturer's calibration curve or to develop a new calibration curve.

SECONDARY DEVICE INSPECTION PROCEDURES

The following are common sources of error in the use of secondary devices:

- Improper location—gauge is in the wrong position relative to the primary device.
- Inadequate maintenance—gauge is not serviced regularly.
- Incorrect zero setting—zero setting of gauge is not the zero point of the primary device.
- Operator error—human error exists in the reading.

Flow Measurement Procedures in Weir Applications

- Determine that the head measurement device is positioned 3 to 4 head lengths upstream of a weir.
- Verify that the zero or other point of the gauge is equal to that of the primary device.

The inspector should use an independent method of measuring head, such as with a yardstick or carpenter's rule (be sure to take your measurement at least four times the maximum head upstream and from the weir and convert to nearest hundredth of a foot). To determine flow rate, use the appropriate head discharge relationship formula (see Table O-1 in Appendix O).

Flow Measurement Procedures in Parshall Flume Applications

Flow Measurement—Free-Flow Conditions.

- Determine upstream head (H_a) using staff gauge.
  - Verify that staff gauge is set to zero head. Use either a yardstick or carpenter's rule.
  - Verify that staff gauge is at proper location (two-thirds the length of the converging section back from the beginning of the throat).
  - Read to nearest division the gauge division at which liquid surface intersects gauge.
  - Read H_a in feet from staff gauge.
- To determine flow rate, use Figure N-6 in Appendix O in the unit desired, use tables published in flow measurement standard references, or calculate using the coefficients in Table O-5 in Appendix O.

Flow Measurement—Submerged-Flow Condition.

Generally, it is difficult to make field measurements with submerged-flow conditions. In cases when measurements can be obtained (using a staff or float gauge), the procedures listed below should be followed:

- Determine upstream head using staff or float gauge.
  - Read to nearest division and, at the same time as for H_b, the gauge division at which liquid surface intersects gauge.
  - Calculate H_a from gauge reading.
- Determine downstream head (H_b) using staff or float gauge.
  - H_b refers to a measurement at the crest.
  - Read to nearest division, and at the same time as for H_a, the gauge division at which liquid surface intersects gauge.
  - Calculate H_b from staff reading.
- Determine flow rate.
  - Calculate percent submergence:

$$\left[\frac{H_b}{H_a}\right] \times 100$$

- Consult Table O-6 in Appendix O.
- When a correction factor is obtained, use H_a and find free-flow from Figure I-6.
- Multiply this free-flow value by the correction factor to obtain the submerged flow.

The inspector may use an independent method of measuring head, such as a yardstick or carpenter's rule at the proper head measurement point. Because of the sloping water surface in the converging section of a flume, it is essential that the proper head measurement point be used.

Flow Measurement in Palmer-Bowlus Flume Applications

- Obtain head measurements as in the Parshall Flume application, using the secondary device. The head is the height of water above the step. The total depth upstream of the step is not the head.
- Refer to manufacturer-supplied discharge tables to convert head measurements to flow data. Palmer-Bowlus flumes, unlike Parshall flumes, are not constructed to standard dimensional standards. The inspector must not use discharge tables supplied by other manufacturers.

Verification

Most flow measurement errors result from inadequate calibration of the flow totalizer, and recorder. If the inspector has determined that the primary device has been installed properly, verification of the permittee's system is relatively simple. Compare the flow determined from the inspector's independent measurement to the flow of the permittee's totalizer or recorder. The permittee's flow measurements should be within 10 percent of the inspector's measurements to certify accurate flow measurement. Optimally, flow comparisons should be made at various flow rates to check system accuracy.

When the permit requires that the daily average flow be measured by a totalizing meter, the inspector should verify that the totalizer is accurate (i.e., properly calibrated). This can be done during a period of steady flow by reading the totalizer and at the same time starting a stopwatch. Start the stopwatch just as a new digit starts to appear on the totalizer. After 10 to 30 minutes, the totalizer should be read again; just as a new digit begins to appear, the stop watch is read. Subtract the two totalizer readings to determine, the total flow over the measured time period. Calculate the flow rate in gallons per minute by using the time from the stopwatch. Compare this flow rate to the flow determined by actual measurement of the head made at the primary device at the time interval. Consider the calibration of the totalizer satisfactory if the two flows are within 10 percent of each other, when the actual measured flow is used as the known value, or divisor, in the percent calculation.

C. REFERENCES

The following is a list of resources providing additional information on flow measurement.

Associated Water and Air Resource Engineers, Inc. (1973). *Handbook for Industrial Wastewater Monitoring*. USEPA, Technology Transfer.

Blasso, L. (1975). "Flow Measurement Under Any Conditions," *Instruments and Control Systems*, 48(2): 45-50.

Bos, M.G. (1976). *Discharge Measurement Structures*, Working Group on Small Hydraulic Structures International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands.

Eli, R., and Pederson, H. (1979). *Calibration of a 90° V-Notch Weir Using Parameters Other than Upstream Head.* EPA-600/4-80-035.

ISCO. (2006). *Open Channel Flow Measurement Handbook*, Lincoln, Nebraska.

King, H.W., and Brater, E.F. (1963). *Handbook of Hydraulics*. 5th ed. New York: McGraw-Hill Book Co.

Mauis, F.T. (1949). "How to Calculate Flow Over Submerged Thin-Plate Weirs." *Eng. News-Record*. p. 65.

Metcalf and Eddy Inc. (2013). *Wastewater Engineering.* New York: McGraw-Hill Book Company.

Robinson, A.R. (1965). *Simplified Flow Corrections for Parshall Flumes Under Submerged Conditions*. Civil Engineering, ASCE.

Shelley, P.E., and Kirkpatrick, G.A. (1975). *Sewer Flow Measurement; A State of the Art Assessment*. U.S. Environmental Protection Agency, EPA-600/2-75-027.

Simon, A. (1976). *Practical Hydraulics*. New York: John Wiley & Sons.

Smoot, G.F. (1974). *A Review of Velocity-Measuring Devices*. U.S. Department of the Interior (USDI), United States Geological Survey (USGS). Open File Report, Reston, Virginia.

Stevens. (1978). *Water Resources Data Book*, Beaverton, Oregon: Leupold & Stevens.

Thorsen, T., and Oden, R. (1975). "How to Measure Industrial Wastewater Flow," *Chemical Engineering*, 82(4): 95-100.

U.S. Department of Commerce, National Bureau of Standards. (1975). *A Guide to Methods and Standards for the Measurement of Water Flow*. COM-75-10683.

U.S. Department of the Interior (USDI), Bureau of Reclamation. (2001). *Water Measurement Manual*, 2nd Ed.

U.S. Environmental Protection Agency. (1981). *NPDES Compliance Flow Measurement Manual*. Office of Water Enforcement and Permits Enforcement Division.

U.S. Environmental Protection Agency. (1991). Video: *National Pollutant Discharge Elimination System (NPDES) Parshall Flume inspection*. EPA 832-V91-001. Available at: http://www.youtube.com/watch?v=y6hiOLgTo6g

D. FLOW MEASUREMENT INSPECTION CHECKLIST

A. GENERAL				
Yes	No	N/A	1.	a. Primary flow measuring device properly installed and maintained.
Yes	No	N/A		b. Flow measured at each outfall? _____ Number of outfalls? _____
Yes	No	N/A		c. Is there a straight length of pipe or channel before and after the flowmeter of at least 5 to 20 diameter lengths?
Yes	No	N/A		d. If a magnetic flowmeter is used, are there sources of electric noise in the near vicinity?
Yes	No	N/A		e. Is the magnetic flowmeter properly grounded?
Yes	No	N/A		f. Is the full pipe requirement met?
Yes	No	N/A	2.	a. Flow records properly kept.
Yes	No	N/A		b. All charts maintained in a file.
Yes	No	N/A		c. All calibration data entered into a logbook.
Yes	No	N/A	3.	Actual discharged flow measured.
Yes	No	N/A	4.	Effluent flow measured after all return lines.
Yes	No	N/A	5.	Secondary instruments (totalizers, recorders, etc.) properly operated and maintained.
Yes	No	N/A	6.	Spare parts stocked.
Yes	No	N/A	7.	Effluent loadings calculated using effluent flow.
B. FLUMES				
Yes	No	N/A	1.	Flow entering flume reasonably well-distributed across the channel and free of turbulence, boils, or other disturbances.
Yes	No	N/A	2.	Cross-sectional velocities at entrance relatively uniform.
Yes	No	N/A	3.	Flume clean and free of debris and deposits.
Yes	No	N/A	4.	All dimensions of flume accurate and level.
Yes	No	N/A	5.	Side walls of flume vertical and smooth.
Yes	No	N/A	6.	Sides of flume throat vertical and parallel.
Yes	No	N/A	7.	Flume head being measured at proper location.
Yes	No	N/A	8.	Measurement of flume head zeroed to flume crest.
Yes	No	N/A	9.	Flume properly sized to measure range of existing flow.
Yes	No	N/A	10.	Flume operating under free-flow conditions over existing range of flows.
Yes	No	N/A	11.	Flume submerged under certain flow conditions.
Yes	No	N/A	12.	Flume operation invariably free-flow.

C. WEIRS			
Yes	No	N/A	1. What type of weir does the facility use?
Yes	No	N/A	2. Weir exactly level.
Yes	No	N/A	3. Weir plate plumb and its top and edges sharp and clean.
Yes	No	N/A	4. Downstream edge of weir is chamfered at 45°.
Yes	No	N/A	5. Free access for air below the nappe of the weir.
Yes	No	N/A	6. Upstream channel of weir straight for at least four times the depth of water level and free from disturbances.
Yes	No	N/A	7. Distance from sides of weir to side of channel at least 2H.
Yes	No	N/A	8. Area of approach channel at least (8 × nappe area) for upstream distance of 15H.
Yes	No	N/A	9. If not, is velocity of approach too high?
Yes	No	N/A	10. Head measurements properly made by facility personnel.
Yes	No	N/A	11. Leakage does not occur around weir.
Yes	No	N/A	12. Use of proper flow tables by facility personnel.
D. OTHER FLOW DEVICES			
			1. Type of flowmeter used:
			2. What are the most common problems that the operator has had with the flowmeter?
			3. Measured wastewater flow: _____ MGD; Recorded flow: _____; Error _____%
E. CALIBRATION AND MAINTENANCE			
Yes	No	N/A	1. Flow totalizer properly calibrated.
			2. Frequency of routine inspection by proper operator: _____/day.
			3. Frequency of maintenance inspections by plant personnel: _____/year.
Yes	No	N/A	4. Flowmeter calibration records kept. Frequency of flowmeter calibration: _____/month.
Yes	No	N/A	5. Flow measurement equipment adequate to handle expected ranges of flow rates.
Yes	No	N/A	6. Calibration frequency adequate.

CHAPTER 7 – LABORATORY PROCEDURES AND QUALITY ASSURANCE

Contents

A. OBJECTIVES AND REQUIREMENTS

The analytical laboratory provides both qualitative and quantitative information for determining the extent of permittee compliance with permit discharge requirements. To be valuable or useful, the data must be representative and accurately describe the characteristics and concentrations of constituents in the samples submitted to the laboratory. The objectives of laboratory Quality Assurance (QA) are to monitor and document the accuracy and precision of the results reported and to meet reliability requirements.

QA refers to a total program for ensuring the reliability of data by utilizing administrative and technical procedures and policies regarding personnel, resources, and facilities. QA is required for all functions bearing on environmental measurements and includes activities such as project/study definition; sample collection and tracking; laboratory analysis; data validation, analysis, reduction, and reporting; documentation; and data storage systems. Thus, the QA program is designed to evaluate and maintain the desired quality of data. Quality Control (QC), a function of QA, is the routine application of procedures for controlling the accuracy and precision of the measurement process and includes the proper calibration of instruments and the use of the appropriate analytical procedures.

The regulations at Title 40 of the *Code of Federal Regulations* (CFR), section 122.41(e) (conditions applicable to all permits), requires adequate laboratory and process controls, including appropriate QA/QC procedures. Each permittee's laboratory must have a QA/QC program. The laboratory must document the QA/QC program in a written QA/QC manual and the laboratory should make it available to all personnel responsible for sample analyses. The manual must clearly identify the individuals involved in the QA program and document their responsibilities. The laboratory's standard operating procedures must meet user requirements in terms of specificity, completeness, precision, accuracy, representativeness, and comparability of the required testing procedures. The laboratory should devote approximately 10 to 20 percent of their resources to their QA/QC program.

Guidance in this chapter is broad-based and may not be applicable to every laboratory. This chapter includes a Laboratory Quality Assurance Checklist for the inspector's use at the end of the chapter. For detailed information concerning laboratory QA/QC, refer to Environmental Protection Agency's (EPA's) *Handbook for Analytical Quality Control in Water and Wastewater Laboratories* (EPA, 1979) and EPA's *National Pollutant Discharge Elimination System (NPDES) Compliance Monitoring Inspector Training Module: Laboratory Analysis* (EPA, 1990). If a more detailed assessment of a laboratory is required, personnel with more extensive knowledge of the methodologies should perform the inspection.

B. SAMPLE HANDLING PROCEDURES

EVALUATION OF PERMITTEE SAMPLE HANDLING PROCEDURES

Proper sample handling procedures are necessary in the laboratory from the sample's receipt to its discard. Sample handling procedures for small permittees may differ from procedures for larger permittees because staff organizational structures and treatment facility designs vary

from one facility to the next. However, proper sample handling procedures should be standardized, utilized and documented by all permittees. In evaluating laboratory sample handling procedures, the inspector should verify the following:

- The laboratory area is secure and restricts entry to authorized personnel only.
- The laboratory has a sample security area that is dry, clean, and isolated; has sufficient refrigerated space; and can be locked securely.
- The laboratory has a sample custodian and a back-up custodian.
- The custodian receives all incoming samples, signs the chain-of-custody record sheet accompanying the samples, and locks the samples in the sample security area refrigerator.
- The custodian ensures that samples are properly stored.
- The custodian performs or analyzes checks of proper preservation, container type, and holding times and documents the results.
- The custodian distributes and retrieves samples to and from personnel who perform the analyses (i.e., analysts) and documents the transfer of the samples in the chain-of-custody record, which is retained as a permanent record. The chain-of-custody record typically identifies the sample identification number, sample collection date and time, sample type, sample location, sample volume, and preservatives.
- The custodian and analysts ensure the minimum possible number of people handle the samples.
- The custodian only disposes of samples and records upon direction from the laboratory director, in consultation with previously designated enforcement officials, when it is certain that the information is no longer required or that the samples have deteriorated.

C. LABORATORY ANALYSES TECHNIQUES EVALUATION

EVALUATION OF PERMITTEE LABORATORY ANALYTICAL PROCEDURES

The permittee's laboratories or its contract laboratories must use uniform methods, thus, eliminating methodology as a variable when data are compared or shared among laboratories. The permittee's laboratory must consult 40 CFR Part 136 for the alternative methods approval process. A permittee may only use alternative test procedures if the procedures have EPA approval, as specified by 40 CFR 136.4 and 136.5, and promulgated under Public Law (PL) 92-500.

Many standardized test procedures promulgated under 40 CFR Part 136 are covered in EPA's *Methods for Chemical Analysis of Water and Wastes* (EPA, 1983) and the latest accepted edition of *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), 2013). Revisions and new additions to this manual are made whenever new analytical techniques or instruments are developed. These are considered

accepted after final publication in the Federal Register.[3] Other approved methods from United States Geological Survey (USGS), American Society for Testing and Materials (ASTM), and several commercial vendor methods are also referenced in 40 CFR Part 136.

In evaluating laboratory analytical procedures, the inspector should verify the following:

- The laboratory personnel follow analytical methods specified in the most current 40 CFR Part 136.
- The laboratory personnel properly perform any deviations allowed by 40 CFR Part 136 and maintain documentation of any EPA-approved deviation from specified procedures.
- The laboratory personnel follow QA/QC procedures that conform to the procedures specified in the permit, analytical method, or methods compendium for approved 40 CFR Part 136 methods from a consensus organization. For example, the Standard Methods for the Examination of Water and Wastewater (APHA, AWWA, and WEF) contains QA/QC procedures.
- The laboratory personnel maintain a QA/QC record on reagent preparation, instrument calibration and maintenance, incubator temperature, and purchase of supplies.
- The laboratory personnel conduct QA/QC checks on materials, supplies, equipment, instrument calibration and maintenance, facilities, analyses, and standard solutions.

EVALUATION OF PERMITTEE LABORATORY FACILITIES AND EQUIPMENT

To verify that the proper analytical procedures are being followed, the inspector should have the responsible analyst describe each of the procedures. The inspector should be alert to any deviation from the specified analytical method. Any questions regarding the proper procedures can be resolved by referring to the cited methodology. Even simple analyses can yield invalid results if the methodology cited in 40 CFR Part 136 is not exactly followed. Certain required deviations from the approved methods are cited in 40 CFR Part 136, notes.

Laboratory Services

The availability of laboratory services affects data reliability. In evaluating laboratory services, the inspector should verify that the laboratory provides the following:

- Adequate supply of laboratory pure water, free from chemical interferences and other undesirable contaminants. The laboratory personnel should check water quality routinely and document it.
- Adequate bench, instrumentation, storage, and recordkeeping space.
- Clean and orderly work area to help avoid contamination.
- Adequate circulation and egress.
- Adequate humidity and temperature control.
- Adequate lighting and ventilation.

[3] The most current 40 CFR Part 136 may supersede any method or technique cited in this manual.

- Dry, uncontaminated compressed air when required.
- Efficient fume hood systems.
- Necessary equipment such as a hot plate, incubator, water bath, refrigerator for samples, glassware, pH meter, thermometer, balance, etc.
- Electrical power for routine laboratory use and, if appropriate, voltage-regulated sources for delicate electronic instruments.
- Vibration-free area for accurate weighing.

The inspector should also check that the laboratory personnel use proper safety equipment (e.g., lab coats, gloves, safety glasses, goggles, and fume hoods) where necessary. The inspector should document any problems and refer to the proper authority (e.g., Occupational Safety and Health Administration (OSHA)).

Instruments and Equipment

Instrumentation is extremely important in the analytical laboratory. To a certain extent, analytical instrumentation is always developmental; manufacturers are continually redesigning and upgrading their products, striving for miniaturization, enhanced durability and sensitivity, and improved automation. In evaluating laboratory instruments and equipment, the inspector should verify the following:

- The laboratory personnel follow standard and specific procedures for selecting and cleaning glassware and containers. Chapter 2 of EPA's *NPDES Compliance Monitoring Inspector Training Module: Laboratory Analysis* (EPA, 1990) contains detailed information on glassware cleaning.
- The laboratory personnel follow written requirements (e.g., standard operating procedures) for daily operation of instruments and equipment.
- The laboratory contains emergency equipment such as a fire extinguisher, eye wash station, shower, first aid kit, lab coats, gloves, and goggles.
- Standards and appropriate blanks are available from suppliers to perform standard calibration procedures. The laboratory personnel should use standard concentrations that closely bracket actual sample concentrations. Sources of standards are documented and where possible, traceable to a national standard (e.g., National Institute of Standards and Technology (NIST).
- The laboratory personnel maintain records of each set of analyses performed including the order in which calibration, QA/QC, and samples were analyzed (i.e., analysis run logs or instrument run logs).
- The laboratory personnel follow written troubleshooting procedures to identify common equipment malfunctions.
- The laboratory personnel follow written schedules for replacement, cleaning, checking, and/or adjustment by service personnel.
- The laboratory personnel maintain documentation on equipment maintenance and service checks.

Commonly used analytical instruments include analytical balances, pH meters, dissolved oxygen meters, conductivity meters, turbidity meters, spectrophotometers, atomic absorption spectrophotometers, organic carbon analyzers, selective ion analyzers, gas-liquid chromatographs, titrimetric analyses, and temperature controls. Chapter 2 of EPA's *NPDES Compliance Monitoring Inspector Training Module: Laboratory Analysis* (EPA 1990) includes a detailed discussion on these instruments.

Supplies

Chemical reagents, solvents, and gases are available in many grades of purity, ranging from technical grade to various ultrapure grades. The purity of the materials required in analytical chemistry varies with the type of analysis. The parameter being measured, the analytical method, and the sensitivity and specificity of the detection system determine the purity of the reagents required. Do not use reagents of lesser purity than that specified by the method. In evaluating laboratory supplies, the inspector should verify that the laboratory personnel:

- Check the accuracy of purchased solutions as per method requirements.
- Prepare stock solutions and standards using volumetric glassware.
- Prepare and standardize reagents against reliable primary standards.
- Use the required reagent purity for the specific analytical method.
- Check working standards frequently to determine changes in concentration or composition.
- Verify concentrations of stock solutions before being used to prepare new working standards.
- Label standards and reagents properly including the preparation date, concentration, the analyst's identification, storage requirements, and discard date.
- Store standards, reagents, and solvents in appropriate containers and under required method conditions and manufacturer’s directions. If conditions are not specified, store standards and reagents according to 40 CFR Part 136, Table II.
- Store standards, reagents and solvents using clean containers of suitable composition with tight-fitting stoppers.
- Discard standards and reagents after recommended shelf-life has expired or when signs of discoloration, formation of precipitates, or significant changes in concentrations are observed.

D. QUALITY ASSURANCE AND QUALITY CONTROL

EVALUATION OF THE PRECISION AND ACCURACY OF THE PERMITTEE LABORATORY

The purpose of laboratory control procedures is to ensure high-quality analyses using control samples, control charts, reference materials, and instrument calibration. The laboratory must initiate and maintain controls throughout the analysis of samples. Specifically, each testing batch must contain at least one blank, standard, duplicate, and spiked (as applicable) sample analysis. When a batch contains more than 10 samples, every tenth sample should be followed by a duplicate and a spike (as applicable). Consult each method for specific QC requirements.

The precision of laboratory findings refers to the reproducibility or degree of agreement among replicate measurements of the same quantity. The closer the numerical values of the measurements come to each other, the more precise the measurements are. In a laboratory QC program, precision is determined by the analysis of actual samples in duplicate. These may represent a range of concentrations and a variety of interfering materials usually encountered during the analysis. Accuracy refers to the degree of difference between observed values and known or actual values. The closer the value of the measurement comes to the actual value, the more accurate the measurement is. The accuracy of a method can be determined by analyses of samples to which known amounts of reference standards have been added (spiked samples).

In evaluating the precision of the measurement process, the inspector should verify that the laboratory personnel:

- Introduce duplicate samples into the train of actual samples at least 10 percent of the time to monitor the performance of the analytical system.
- Prepare and use precision control charts or other statistical techniques for each analytical procedure. Develop precision control charts by collecting data from a minimum of 15 to 20 duplicate samples (run in controlled conditions) over an extended period (e.g., 10 to 20 days). Statistical methods include calculation of mean, standard deviation, and variance to define the range and variability of the data.
- Take corrective actions when data fall outside the warning and control limits.
- Document out-of-control data, the situation, and the corrective action taken.

In evaluating accuracy of the measurement process, the inspector should verify that the laboratory personnel:

- Introduce spiked samples into the train of actual samples at least 10 percent of the time to monitor the performance of the analytical system. In the spiked samples, the amount of additive is appropriate to the detection limit and sample concentration.
- Prepare and use accuracy control charts for each analytical procedure. Develop accuracy control charts by collecting data from a minimum of 15 to 20 spiked samples (run in controlled conditions) over an extended period.
  - Establish accuracy limits (as percent recovery) based on standard deviations whose upper and lower control limits are three times the standard deviation above and below the central line.
  - Establish the upper and lower warning limits at twice the standard deviation above and below the central line. Note: Some parameters have a defined warning limit required by 40 CFR Part 136.
- Take corrective actions when data fall outside the warning and control limits.
- Document out-of-control data, the situation, and the corrective action taken.

EXAMPLE OF LABORATORY QA/QC MEASURES FOR MICROBIAL ANALYSES

As an example of the laboratory quality measures an inspector might evaluate, the following discussion applies to microbial analysis. Microbial contamination is a common concern related to animal feeding operations and sanitary treatment systems covered by the NPDES standards. Common microbial contaminants of concern in wastewater and sewage sludge include total coliform, fecal coliform, and enterococci. Appropriate microbial laboratory control measures the inspector should verify include the use by laboratory personnel of:

- Positive and negative controls—controls are known cultures that are analyzed exactly like a field sample and will produce an expected positive or negative result for a given type of medium.
- Media sterility checks—media are incubated at the appropriate temperature without the field sample and observed for growth to verify the media is not contaminated with the evaluated microorganisms prior to use in the laboratory.
- Dilution sterility checks—dilution water is analyzed exactly like a field sample and observed for growth to verify the water is not contaminated with the evaluated microorganisms prior to use in the laboratory.
- Sample bottle blanks—a blank is analyzed for each bottle lot used during the sampling episode to verify the sample bottles had not been contaminated with the evaluated microorganisms prior to the field sampling.
- Membrane filter preparation blanks—membrane filter blanks are analyzed at the beginning of each set of filtered samples to verify the membrane filtration equipment is not contaminated with the evaluated microorganisms prior to use in the laboratory.
- Incubator temperature monitoring—incubator temperatures are monitored in the laboratory to verify that prepared microbial samples are being incubated at the correct temperatures.

The analytical methods for microbial analyses are specified in 40 CFR Part 136, Table IA.

EVALUATION OF PERMITTEE DATA HANDLING AND REPORTING

An analytical laboratory must have a system for uniformly recording, correcting, processing, and reporting data. The inspector should verify that the laboratory personnel:

- Use correct formulas to calculate the final results.
- Apply round-off rules uniformly.
- Establish significant figures for each analysis.
- Provide data in the form/units required for reporting.
- Ensure cross-checking calculations provisions are available.
- Determine control chart approaches and statistical calculations for the purposes of QA/QC and reporting.

- Maintain laboratory report forms that provide complete data documentation and facilitate data processing.
- Keep permanently bound laboratory notebooks or pre-printed data forms to document the procedures performed and the details of the analysis, such as the original value recorded, correction factors applied, blanks used, data values reported, personnel that performed the tests, and any abnormalities that occurred during the testing procedure.
- Define procedures for correction of data entry errors. Original data entries can be read and the individual(s) making the corrections are clearly identified.
- Back up computer data with duplicate copies (i.e., electronic and hardcopy).
- Maintain data records that allow the recalculation of all results reported by the laboratory(ies) from the original unprocessed results (i.e., raw data) to the final results sent to EPA and the regulatory authority for a minimum of three years.

EVALUATION OF PERMITTEE LABORATORY PERSONNEL

Analytical operations in the laboratory vary in complexity. Consequently, the laboratory should clearly define work assignments. All analysts should be thoroughly instructed in basic laboratory operations. Those persons performing complex analytical tasks should be qualified and properly trained. All analysts must follow specified laboratory procedures and be skilled in using the laboratory equipment and techniques required for the analyses assigned to them. In evaluating laboratory personnel, the inspector should consider the following factors:

- Adequacy of training.
- Skill and diligence in following procedures.
- Skill and knowledge in using equipment and analytical methods (particularly for complex equipment such as gas chromatography).
- Precision and accuracy in performing analytical tasks.
- Assignment of clearly defined tasks and responsibilities.

EVALUATION OF CONTRACT LABORATORIES

When the permittee contracts with the laboratory to analyze samples, the inspector may need to evaluate the laboratory practices at the contracted laboratory. The practices can also be evaluated by other designated EPA inspectors. If a deficiency is identified at a contract laboratory, the permittee is responsible for the deficiency and will be notified.

OVERVIEW OF THE DISCHARGE MONITORING REPORT QUALITY ASSURANCE PROGRAM AND HOW IT RELATES TO THE INSPECTION PROGRAM

The validity of the NPDES program depends on the quality of the self-monitoring program. The Discharge Monitoring Report Quality Assurance (DMR QA) program is an important tool used to ensure the quality of NPDES self-monitoring data. The program is designed to evaluate and improve the ability of laboratories serving NPDES permittees to analyze and report accurate self-monitoring data.

Major and selected minor permittees under the NPDES program are required to participate in the annual DMR-QA study program. DMR-QA evaluates the analytical ability of the laboratories that routinely perform self-monitoring analyses required by their NPDES permit. EPA also approves certain state laboratory certification programs to be used as either a full or a partial substitute for DMR-QA. Under the program, permittees must purchase NPDES performance evaluation samples containing constituents normally found in industrial and municipal wastewaters from accredited providers. The permittee analyzes these samples using the analytical methods and laboratory normally employed for their reporting of NPDES self-monitoring data. The supplier of the performance evaluation sample will evaluate the results and respond to the permittee.

Highlights

- The DMR-QA Program has been an excellent means of focusing on and improving the quality of laboratory results used in developing DMR data. Improvements in the DMR-QA data have been significant.
- This program has helped major permittees identify and correct both analytical and data handling problems in their laboratories.
- In general, permittees are receptive to the program and recognize its value, including some who challenged EPA's authority to require participation.
- Regions and states are generally supportive and have made good use of the results of this program for targeting inspections and directing other follow-up activities. This ability to concentrate corrective actions on problem permittees results in an increased efficiency in improving the self-monitoring data of all NPDES permittees.
- The program is one of the least resource-intensive methods for maintaining direct and regular technical contact with NPDES permittees. It has been recognized as a cost-effective effort.
- Utilizing computer technology, the following ways of managing and analyzing DMR QA data were started in fiscal year 1985: compiling tracking summaries, comparing performance of the major industries, tracking multiple permittees, and regenerating past performance evaluation reports.

The results of the DMR-QA are provided to and tracked by EPA and the state DMR-QA coordinator. The DMR-QA Program and the NPDES inspection programs are interdependent in several areas. First, EPA can use DMR-QA evaluations of permittee performance to target the inspections since the evaluations identify potential problems in the laboratory analysis or data handling and reporting. This targeting helps to direct limited resources to permittees who need them most. Non-reporting of DMR-QA results is also an important trigger for on-site inspections. Secondly, EPA can identify instances when the QA results do not comply with the parameters specified in the permit to check during the inspection.

E. REFERENCES

The following is a list of resources providing additional information on laboratory procedures.

ASTM. (1982). *Annual Book of Standards: Part 31, Water*. Philadelphia, PA: ASTM.

American Public Health Association (APHA), American Water Works Association (AWWA), and World Economic Forum (WEF). (2013). *Standard Methods for the Examination of Water and Wastewater*.

Brown, E., Skougstad, M.W. and Fishman, M.J. (1970). *Methods for Collection and Analysis of Water Samples for Dissolved Minerals and Gases*. U.S. Geological Survey Techniques of Water Resources Inv., Book 5.

Delfino, J.J. (1977). "Quality Assurance in Water and Wastewater Analysis Laboratories." *Water and Sewage Works*, 124(7): 79-84.

Federal Register. (1986). *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act* (also see October 26, 1986). Vol 51. No. 125.

Plumb, R.H., Jr. (1981). "Procedure for Handling and Chemical Analysis of Sediment and Water Samples." U.S. Environmental Protection Agency Technical Report, EPA/CE-81-1.

U.S. Geological Survey (USGS), United States Department of the Interior (USDI). (1985). “"Methods for determination of inorganic substances in water and fluvial sediments." Open File Report 85-495.

U.S. Environmental Protection Agency. (1979). *Handbook for Analytical Quality Control in Water and Wastewater Laboratories*. EPA-600/4-79-019.

U.S. Environmental Protection Agency. (1983). *Methods for Chemical Analysis of Water and Wastes*. EPA-600/4-79-020.

U.S. Environmental Protection Agency. (1990). *NPDES Compliance Monitoring Inspector Training Module: Laboratory Analysis*. EPA 833-R-90-103.

U.S. Environmental Protection Agency. (1999a). *Methods and Guidance for Analysis of Water, Version 2.0.* EPA 821-C-99-004.

U.S. Environmental Protection Agency. (2004). *National Environmental Laboratory Accreditation Conference (NELAC): Constitution, Bylaws, and Standards*. EPA-600/R-04/003.

U.S. Environmental Protection Agency. (2005). *EPA Quality Manual for Environmental Programs.* CIO 2105-P-01-0.

U.S. Environmental Protection Agency. (2013). *EPA Microbiology Resources.* Available online at: https://www.epa.gov/water-research/microbiological-methods-and-online-publications

F. LABORATORY QUALITY ASSURANCE CHECKLIST

A. GENERAL			
Yes	No	N/A	1. Laboratory maintains a written QA/QC manual.
B. SAMPLE HANDLING PROCEDURES			
Yes	No	N/A	1. Access to laboratory area restricted to authorized personnel only.
Yes	No	N/A	2. Sample security area available within laboratory that is dry, clean, and isolated; has sufficient refrigerated space; and can be locked securely.
Yes	No	N/A	3. Laboratory refrigerator utilizes a thermometer with NIST certification or that is annually calibrated against another NIST-certified thermometer and documented using certification tags.
Yes	No	N/A	4. Laboratory has a sample custodian and a back-up custodian.
Yes	No	N/A	5. Custodian receives and logs in all incoming samples.
Yes	No	N/A	6. Custodian properly stores samples.
Yes	No	N/A	7. Custodian performs checks of proper preservation, container type, and holding times performed and documents the results.
Yes	No	N/A	8. Custodian distributes and retrieves samples to and from the analysts.
Yes	No	N/A	9. Custodian maintains chain-of-custody documentation.
Yes	No	N/A	10. Custodian and analysts ensure the minimum possible number of people handles the samples.
Yes	No	N/A	11. Custodian disposes of the samples and records upon direction of the laboratory director.
C. LABORATORY PROCEDURES			
Yes	No	N/A	1. EPA-approved written analytical testing procedures used and protocols are easily accessible by laboratory personnel.
Yes	No	N/A	2. If alternate analytical procedures used, proper written approval obtained.
Yes	No	N/A	3. Calibration and maintenance of instruments and equipment satisfactory.
Yes	No	N/A	4. QA procedures used.
Yes	No	N/A	5. QC procedures adequate.
			6. Duplicate samples are analyzed _____ % of time.
			7. Spiked samples are used _____ % of time.
Yes	No	N/A	8. Whole Effluent Toxicity (WET) testing is required by the permit and conducted by the laboratory. Culturing procedures are adequately documented for each organism tested.
Yes	No	N/A	9. WET testing protocols are clearly described.
Yes	No	N/A	10. Commercial laboratory used. Name: _____
			Address: _____
			Contact: _____
			Phone: _____

			Certification #: _____
D. LABORATORY FACILITIES AND EQUIPMENT			
Yes	No	N/A	1. Adequate supply of laboratory pure water available for specific analysis.
Yes	No	N/A	2. Adequate bench, instrumentation, storage, and recordkeeping space available.
Yes	No	N/A	3. Clean and orderly work area available to help avoid contamination.
Yes	No	N/A	4. Adequate circulation and egress.
Yes	No	N/A	5. Adequate humidity and temperature control.
Yes	No	N/A	6. Adequate lighting and ventilation.
Yes	No	N/A	7. Dry, uncontaminated compressed air available.
Yes	No	N/A	8. Efficient fume hood systems available.
Yes	No	N/A	9. Adequate electrical sources available.
Yes	No	N/A	10. Instruments/equipment available and in good condition.
Yes	No	N/A	11. Vibration-free area for accurate weighing available.
Yes	No	N/A	12. Proper safety equipment (lab coats, gloves, safety glasses, goggles, and fume hoods) used when necessary.
Yes	No	N/A	13. Proper volumetric glassware used.
Yes	No	N/A	14. Glassware properly cleaned.
Yes	No	N/A	15. Written requirements for daily operation of instruments/equipment available.
Yes	No	N/A	16. Standards and appropriate blanks available to perform daily check procedures.
Yes	No	N/A	17. Sources of standards documented and where possible traceable to a national standard (e.g., NIST).
Yes	No	N/A	18. Records of each set of analysis including order in which calibration, QA/QC, and samples were analyzed are available.
Yes	No	N/A	19. Written troubleshooting procedures for instruments/equipment are available.
Yes	No	N/A	20. Written schedules for required maintenance are available.
Yes	No	N/A	21. Check the accuracy of purchased solutions as per method requirements.
Yes	No	N/A	22. Prepare stock solutions and standards using volumetric glassware.
Yes	No	N/A	23. Prepare and standardize reagents against reliable primary standards.
Yes	No	N/A	24. Use the required reagent purity for the specific analytical method.
Yes	No	N/A	25. Frequently checked working standards to determine changes in concentration or composition.
Yes	No	N/A	26. Verify concentrations of stock solutions before being used to prepare new working standards.
Yes	No	N/A	27. Background reagents and solvents run with every series of samples.
Yes	No	N/A	28. Label standards and reagents properly, including the preparation date, concentration, the analyst's identification, storage requirements, and discard date.
Yes	No	N/A	29. Store standards, reagents, and solvents in appropriate containers and under required method conditions and manufacturer's directions.
Yes	No	N/A	30. Store standards, reagents, and solvents using clean containers.

Yes	No	N/A	31. Replace gas cylinders at 100-200 psi.
Yes	No	N/A	32. Written procedures exist for cleanup, hazard response methods, and applications of correction methods for reagents and solvents.
Yes	No	N/A	33. Discard standards after recommended shelf-life has expired or when signs of discoloration, formation of precipitates, or significant changes in concentrations are observed.
E. LABORATORY PRECISION, ACCURACY, AND CONTROL PROCEDURES			
Yes	No	N/A	1. Analyzed multiple control samples (i.e., blanks, standards, duplicates, and spikes) for each type of QA/QC check and recorded information. Every tenth sample should have been followed by a duplicate and a spike.
Yes	No	N/A	2. Plotted precision and accuracy control methods used to determine whether valid, questionable, or invalid data are being generated throughout the analysis.
Yes	No	N/A	3. Taken corrective actions when data fall outside the warning and control limits.
Yes	No	N/A	4. Recorded out-of-control data, the situation, and the corrective action taken.
F. DATA HANDLING AND REPORTING			
Yes	No	N/A	1. Used correct formulas to calculate final results.
Yes	No	N/A	2. Applied round-off rules uniformly.
Yes	No	N/A	3. Established significant figures for each analysis.
Yes	No	N/A	4. Recorded data in the proper form and units for reporting.
Yes	No	N/A	5. Ensured cross-checking calculations provisions are available.
Yes	No	N/A	6. Developed and followed control chart approaches and statistical calculations for QA/QC.
Yes	No	N/A	7. Laboratory report forms developed to provide complete data documentation and to facilitate data processing.
Yes	No	N/A	8. Laboratory notebooks or pre-printed data forms bound permanently utilized to provide good documentation.
Yes	No	N/A	9. Procedures for correction of data entry errors are defined.
Yes	No	N/A	10. Backed up computer data with duplicate copies (i.e., electronic and hardcopy).
Yes	No	N/A	11. Efficient filing system exists, enabling prompt retrieval of information and channeling of report copies.
Yes	No	N/A	12. Data records allow recalculation of all results reported by the laboratory(ies) from the original unprocessed results (raw data) to the final results sent to EPA and the regulatory authority for a minimum of three years.
G. LABORATORY PERSONNEL			
Yes	No	N/A	1. Enough analysts present to perform the analyses necessary.
Yes	No	N/A	2. Analysts have on hand the necessary references for EPA procedures being used.
Yes	No	N/A	3. Analysts trained in procedures performed through formal or informal training or certification programs.

CHAPTER 8 – TOXICITY

Contents

List of Tables

Related Websites

Office of Science and Technology/Engineering and Analysis Division Methods home page (including Whole Effluent Toxicity): https://www.epa.gov/cwa-methods/whole-effluent-toxicity-methods

Office of Wastewater Management/Water Permits Division National Pollutant Discharge Elimination System Permits Program—Whole Effluent Toxicity home page: https://www.epa.gov/npdes/npdes-permit-limits#wet

Office of Wastewater Management/Water Permits Division – Recorded Webinars and Training – Whole Effluent Toxicity (WET) Training: https://www.epa.gov/npdes/npdes-training#wettraining (Note: Module 8, *NPDES WET Compliance and Enforcement*)

A. OBJECTIVES

Toxicity is a characteristic of a substance (or group of substances) that causes adverse effects in organisms. Adverse effects include an increased rate of morbidity (the rate of occurrence of disease) and mortality (the rate of occurrence of death), as well as those effects that limit an organism's ability to survive in nature, such as impaired reproductive ability, mobility or growth. Toxicity of a substance is measured by observing the responses of organisms to increasing concentrations of that substance. One substance is more toxic than another when it causes the same adverse effects at a lower concentration.

Whole Effluent Toxicity (WET) is a National Pollutant Discharge Elimination System (NPDES) permits program parameter designed to evaluate the toxicity of the entire wastestream as opposed to its individual components. WET testing may be performed or evaluated as part of one of five NPDES inspections:

- Compliance Evaluation Inspection (CEI)
- Compliance Sampling Inspection (CSI)
- Performance Audit Inspection (PAI)
- Toxics Sampling Inspection (XSI)
- Compliance Biomonitoring Inspection

In addition, an inspector should consider the toxicity of a municipal treatment plant's effluent as part of Pretreatment Compliance Inspections (PCIs), since the effluent toxicity may originate from industrial or commercial discharges to the municipal treatment plant.

EPA test methods manuals for Whole Effluent Toxicity testing can be accessed at: https://www.epa.gov/cwa-methods/whole-effluent-toxicity-methods.

The inspector should understand the permittee's WET testing requirements so that the appropriate objectives can be met. These objectives may include:

- Assess compliance with NPDES permit conditions.
- Assess NPDES permit conditions for clear and inclusive language.
- Consider overall laboratory WET test performance (reference toxicants and other WET quality assurance/quality control (QA/QC) requirements) especially EPA's minimum WET test methods' Test Acceptability Criteria (TAC).
- Evaluate quality of self-monitoring data.
- Assess adequacy of self-monitoring procedures.
- Document presence or absence of toxic conditions.
- Identify need to perform Toxicity Reduction Evaluation (TRE) and/or a Toxicity Identification Evaluation (TIE).
- Identify permit terms and conditions that may not be strong enough to ensure state WET water quality standards are met.

B. REQUIREMENTS OF WET TESTING

WET tests are techniques to determine the toxicity of a permittee's discharge or effluent by measuring the responses of organisms to varying concentrations of the facility's effluent and test dilution water. The EPA WET test methods, as revised November 2002, are specified in 40 CFR Part 136 and described in the EPA WET test methods manuals (accessible at https://www.epa.gov/cwa-methods/whole-effluent-toxicity-methods). This section provides general background on WET tests and guidance for inspectors to consider when performing various types of inspections concerning WET tests (laboratory performance, effluent sampling, shipping, records, etc.).

TYPES OF WET TESTING

Depending on the EPA WET test required under a NPDES permit, the WET test designs may vary according to nationally standardized testing and where applicable, regional specific protocols. They vary in the number of test organisms used, duration of the test (acute or chronic), or in the way in which the effluent contacts the organism (flow-through, static, static renewal). The permitting authority will select the appropriate WET test design depending on the suspected toxicants present and the intended use of the WET test results. For example, a preliminary Range screening or T-test WET uses comparatively fewer organisms than the full scale WET test (five test concentrations plus a control treatment) because the results are derived from the comparison of a single effluent test concentration to the control treatment. This initial screening WET test is usually conducted to assess if toxicity is present and should be followed up with a multiple concentration WET test to generate a dose-response curve unless the statistical analysis used was designed for a two concentration WET test and is sufficiently robust for interpreting WET data generated from a T-test. WET data interpretation and analysis is discussed in more detail in Section C of this chapter. The more common EPA WET tests have requirements that include a multi-concentration dilution series consisting of a control treatment (no effluent) and five effluent test concentrations (serial dilutions of effluent sample plus dilution water, except for the 100-percent effluent test concentration). EPA WET test methods have minimum mandatory test acceptability criteria (TAC) that must be met for the WET test and its results to be considered a valid WET test.

EPA WET tests have method specific requirements that include: the number of test organisms per test chamber, the number of test replicates per test dilution, a test design of a control treatment plus five effluent dilution test concentrations, and specified test durations for acute and chronic testing. See the EPA WET test methods for more details. The response of each organism in each test concentration is observed and recorded. The toxicity of the effluent sample is determined by analyzing the response of the test organisms in relation to the effluent test concentration to which the organisms were exposed.

WET testing may be performed as either acute or chronic tests in accordance with standardized EPA WET test methods. The terms acute and chronic refer to the length of time that the organisms are exposed to the toxicant, and the respective WET test endpoints (i.e., acute-lethal, chronic-lethal and sub-lethal). The duration of the tests is prescribed in the WET test

method specified in the NPDES permit. Generally, acute tests measure short-term extreme negative effect responses, such as death or a debilitating physiological disorder. A test organism response to toxicity observed within 96 hours or less is typically considered an acute measurement. Chronic tests involve a causative agent that lingers or continues for a relatively longer period, often one-tenth of an organism's lifespan or more. "Chronic" should be considered a relative term depending on the lifespan of an organism. WET chronic tests typically run for seven days. A chronic effect may result in negative responses such as death (lethal endpoint), as well as stunted growth and reduced mobility or reproductive rates (sub-lethal endpoints).

Common test responses indicating the presence of toxic conditions include:

- Death—increase in number of organisms killed by a test solution when compared to the control treatment.
- Inhibited growth—measurement of reduction in growth (including mean weight of an organism) compared to the control treatment.
- Reduced reproduction or mobility—measurement of reduction in reproductive rates or mobility compared to the control treatment.
- Terata—increase in number of gross abnormalities shown in early life stages compared to the control treatment.

Other WET test design terms describe the way that test organisms are physically exposed to WET test concentrations such as: flow-through, static renewal, and static. In a flow-through test, effluent and dilution water are mechanically renewed continuously. This test setup requires specialized equipment (a serial or proportional dilutor or syringe pumps) and has higher operating costs than a static test. In a static renewal test, the test solutions are replaced periodically (usually daily) with fresh effluent and dilution water. In a static test, the solutions used at the start of the test are not replaced for the test's duration. Both static renewal and static tests require less sophisticated equipment. The decision of which WET test design type is required should be specified in the NPDES permit for both acute and/or chronic tests according to the respective EPA's WET test methods (40 CFR Part 136 and EPA Pacific West Coast methods (EPA, 1995)), which can be incorporated by reference.

WET TEST COMPONENTS

The following discussions pertain primarily to issues in a laboratory audit.

WET tests, as defined in EPA WET test methods (40 CFR Part 136 or EPA's Pacific West Coast WET methods), consist of the following components:

- Sampling, including a chain-of-custody form.
- Effluent.
- Receiving water.
- Dilution water (preferably the receiving water but in some instances a synthetic water approved by the regulatory agency).

- Testing system.
- Test organisms (in house mass cultures or externally purchased).
- QA/QC requirements, including EPA WET test method TACs.
- Reference toxicants.
- WET test data evaluation and analysis.

As described in the EPA approved WET test methods, organisms in the testing system are exposed to a combination of effluent and dilution water to produce WET test results. Each component of the test, including food items, must be of a specific quality for successful toxicity testing. The inspector should determine if the test components adhere to the requirements specified in the NPDES permit and the NPDES EPA WET test method referenced or incorporated into the NPDES permit's general conditions section (e.g., EPA's WET test methods at 40 CFR Part 136). The inspector should review the permittee's sampling logbook, chain-of-custody forms, source of WET test organisms used and the testing laboratory reports for the information necessary to assess the quality of the test components.

Each component has specific requirements (e.g., sample location for the effluent, maximum sample holding time, dilution water constituents, health of the test organisms, appropriate choice of test apparatus materials). Accurate and reproducible test results can only be expected when the critical test components are handled properly. It is, therefore, very important to understand the relationships between these test components and the critical factors that determine the acceptability (e.g., to be considered a valid WET test) of each based on quality assurance requirements and to ensure the validity of the generated WET test results. During a NPDES inspection, the inspector is likely to encounter the critical factors described in the following sections.

EFFLUENT

The effluent sampling strategy should be specified in the NPDES permit. Effluent samples must be representative of the entire final effluent discharge and free of contamination from other sources. The monitoring frequency selected by the permitting authority should be specified in the NPDES permit and should be representative of the permitted effluent discharge including accounting for the variability of the effluent due to several possible factors including but not limited to seasonal changes, facility process variations, available receiving water dilution (if allowed by state water quality standards or permitting regulations for mixing zones), etc. Samples collected to be shipped to an off-site laboratory must be maintained at a temperature ranging from 0° to 6°C by chilling the sample(s) to 6°C during or immediately after collection, shipped in ice to the designated testing laboratory accompanied by a chain-of-custody form, and refrigerated (0° to 6°C) upon receipt by the testing laboratory.

The type and frequency of samples taken (e.g., grab, composite) must be consistent with those required in the NPDES permit. For flow-through tests that are not done by pumping effluent directly into dilutors, daily sample sizes must be sufficient to supply the dilutor for periods ranging from 24 to 36 hours. This volume will depend on the type of WET test being conducted and the number of dilutions being run. For static renewal tests, daily sample volumes should be

sufficient to replenish all dilutions in the test series and provide separate containers of the dilutions to allow for dissolved oxygen (DO), pH, salinity, temperature and other chemical analyses without contaminating the test dilutions. This volume will depend on the type of WET test being conducted and dilutions being run. For static-renewal toxicity tests, composite and grab samples for 7-day chronic testing requires the use of an original sample and two renewal samples over the duration of the test. Preferably, and after using the original sample, renewal samples should be put into use on days 3 and 5 of testing. Table 8-1 provides guidance as to representative sampling strategies for various situations. For some volatile toxicants that are acutely toxic (e.g., chlorine), standard composite sampling does not yield an effluent sample that is representative of the actual permitted effluent discharge due to volatilization of chlorine during sampling, shipping and holding. On-site flow-through testing would yield more appropriate WET test results where, considering available dilution, the effluent contains measurable amounts of chlorine.

Samples for on-site laboratory testing should be used immediately when practical, but must be used within 36 hours of collection. It is usually not possible to refrigerate the large-volume samples (200 liters or more) that are required for flow-through fish tests, but all other samples should be either iced or refrigerated if they are not to be used immediately. Note: hand-delivered samples used on the same day of collection do not need to be cooled at 0° to 6°C prior to WET test initiation.

As a minimum requirement in all cases, tests should be initiated within 36 hours of collection. In the case of short-term chronic tests, samples taken on days one, three, and five may be held for a longer period of time to complete the test. In no case should preservatives be added to or chemical disinfection performed on the effluent sample(s) prior to being tested for toxicity, nor should the effluent samples be dechlorinated unless the permit specifically allows for sample dechlorination.

DILUTION WATER

The choice of dilution water to use in WET tests should be specified in the NPDES permit and depends on the purpose of the toxicity test. Synthetic dilution water is used to evaluate the inherent toxicity of the effluent. Dilution water from the receiving stream or a nontoxic equivalent is used to test for interactions after an effluent discharge thoroughly mixes with the receiving water (where state laws allow for a mixing zone). Receiving waters, synthetic waters, or synthetic waters adjusted to approximate receiving water characteristics may be used for dilution water, if the water meets the qualifications for an acceptable dilution water. EPA WET test methods manuals describe various techniques for the preparation of synthetic dilution water that may be necessary to use if the natural receiving water exhibits unacceptable levels of toxicity. Under no circumstances should the dilution water cause toxic responses in the WET test organisms. A lack of toxic responses or observed impacts to the control treatment organisms is one indicator of the possible suitability of the dilution water. EPA WET test methods specify mandatory TACs for test organisms in control treatments for each test species for both acute and chronic tests for both lethal and sub-lethal endpoints. TAC is further discussed in Section C of this chapter.

Dilution water obtained from receiving waters should be collected following all sampling procedures including the use of a chain-of-custody form, and should be used immediately for testing. If the dilution water will not be used within 24 hours, it should be refrigerated (0° to 6°C) as soon as it is collected. In any case, to ensure that no appreciable change in toxic characteristics occurs before testing, the holding time from the time the receiving water sample is collected to the first use of the receiving water sample in the WET test initiation must not exceed 36 hours unless a variance has been granted. If a delay in the WET test initiation of up to 36 hours is necessary, the receiving water samples must be stored under strict conditions (i.e., temperatures of 0° to 6°C). The location of the receiving water sample should be noted in the permittee's sampling log and the chain-of-custody form. It should be upstream and out of the influence of the permitted outfall. The location should be free of other sources of contamination (e.g., other facility outfalls).

Table 8-1. Recommended Effluent Sampling Strategies for Continuous and Intermittent Discharges for Flow-Through, Static Renewal, and Static Toxicity Tests[a]

Continuous Discharge			
TEST TYPE	**CHRONIC**	**ACUTE Retention Time < 14 Days**	**ACUTE Retention Time >14 Days**
Flow-through**	-	Two Grab samples daily; early a.m. and late p.m.	One grab sample daily.
Static Renewal	3x 24-hour composite samples, every other day.	Four separate grab samples each day for four concurrent tests.	One grab sample on first day.
Static	Single 24-hour composite sample on first day.	Four separate grab samples on first day for four concurrent tests.	One grab sample on first day.

Intermittent Discharge				
TEST TYPE	**CHRONIC**	**ACUTE Continuous Discharge During 1 or 2 Adjacent 8-Hour Shifts**	**ACUTE Discharge from Batch Treatment**	**ACUTE Discharge to Estuary on Outgoing Tide**
Flow-Through[b]	-	One grab sample midway through shifts daily.	One grab sample of discharge daily.	One grab sample of discharge daily.
Static Renewal	3x 24-hour composite samples collected for duration of discharge unless discharge ceases.	One grab sample midway through shifts on first day.	One grab sample of discharge daily.	One grab sample of discharge daily.
Static	Composite sample collected for duration of discharge, first day.	One grab sample midway through shifts on first day.	One grab sample of discharge on first day.	One grab sample of discharge on first day.

[a] Sampling requirements should be clearly specified in the permit.

[b] For flow-through tests, it is always preferable to pump directly to the dilutor.

TEST SYSTEM

WET tests may be performed in a fixed or mobile laboratory. Depending on the scope of the program, facilities may include equipment for rearing, holding, and acclimating test organisms. Temperature control is achieved using circulating water baths, heat exchangers, or environmental chambers. Holding, acclimation, and dilution water should be temperature controlled and aerated whenever possible. Air used for aeration must be free of oil and fumes; filters to remove oil in the air are desirable. Test facilities must be well-ventilated and free of fumes. During holding, acclimating, and testing, conditions should remain as constant as possible and test organisms should be shielded from external disturbances (held under the same conditions as those used for testing). Reference toxicants should be properly stored in a closed area separate from the WET testing areas.

Any materials that contact either the effluent or dilution water must not release, absorb, or adsorb toxicants. Many choices for test equipment are available. Properly prepared (see discussion at end of this section) glassware and stainless steel are generally acceptable for effluent freshwater holding, mixing, and transfer to WET test chambers. Stainless steel, however, is not acceptable for saltwater systems. Square-sided glass aquaria should be held together with small beads of silicone adhesive, with any unnecessary adhesive removed from inside the aquaria. If stainless steel containers are used, they must be welded, not soldered. Other specialized containers of Nitex or Teflon™ are also acceptable. Tanks for storing effluents and dilution water may also be made of fiberglass. All containers or tubes made from these materials are reusable with appropriate cleaning (see below).

Polyethylene, polypropylene, polyvinyl chloride, polystyrene, and Tygon® may also be used for containers or tubing, but should be checked for toxicity before being used in a WET test. Because these materials may absorb toxicants during a test, their reuse is discouraged to prevent absorbed toxicants from leaching into new effluent or dilution water.

Copper, galvanized metal, brass, lead, and rubber must not contact the testing solutions at any time.

New plastic ware (from a known nontoxic source) can be used after rinsing with dilution water. New glassware should be soaked overnight in dilute (20 percent) nitric or hydrochloric acid, rinsed in tap water, and then rinsed with dilution water before use.

Glassware and stainless steel components that must be reused should be soaked in an appropriate detergent used for toxicity testing and scrubbed (or washed in a laboratory dishwasher), rinsed twice with tap water, rinsed with dilute acid, rinsed twice with tap water, rinsed with full strength acetone, rinsed twice with tap water, and then rinsed with dilution water before use. Glassware for algae tests should be neutralized in sodium bicarbonate before use.

TEST ORGANISMS

Organisms used for toxicity testing are limited to certain species for which there are established EPA WET testing protocols (40 CFR Part 136 and EPA Pacific West Coast WET Test methods

(EPA, 1995)). Some examples of freshwater and saltwater test species commonly used in WET tests include: a) freshwater—daphnids (water flea, invertebrate) and fathead minnows (fish vertebrate); b) saltwater—algae (plant), mysids (shrimp, invertebrate) and silversides (fish vertebrate). The life stage, source, acclimation and feeding procedures, presence of disease, and the number of organisms placed in test chambers all affect the degree to which test organisms respond to toxicants. Therefore, it is important that these factors comply with EPA's required WET test method procedures. Test conditions for various types of tests and organisms are summarized in the test acceptability criteria tables that can be accessed at https://www.epa.gov/cwa-methods/whole-effluent-toxicity-methods.

The inspector should ascertain, as closely as possible, that the following procedures are being observed:

- The correct test organisms (including the choice of test organisms to account for *species sensitivity* for the tested effluent, the most sensitive species must be used under the NPDES permit regulations for reasonable potential determinations (40 CFR 122.44(d)(1)(ii)) must be utilized in the test (most often as specified in the NPDES permit). "Wild" (e.g., collected from the receiving stream) organisms are rarely appropriate in WET testing.
- The laboratory should record the source of test organisms (hatchery, in-house, or elsewhere). Also, test organisms used in toxicity testing must be of known history, free of disease, and acclimated to test conditions. Culture information should be recorded. Test organisms must be of the appropriate age and the appropriate number of organisms must be used in each WET test chamber before initiating a WET test.
- A daily log (that is a daily bench sheet for each WET test being performed) should be kept by the laboratory concerning the WET test organisms including: feeding, mortality, reproduction, growth, mobility, and any abnormal behavioral observations. Measurements for each test chamber should be recorded such as pH, temperature, dissolved oxygen, conductivity, etc. to ensure optimal testing conditions are maintained.
- The testing laboratory must adhere to the following procedures for holding test organisms:
  - Test organisms purchased may be used to start mass cultures. However, if the organisms are to be used for WET chronic testing, then at the start of the test they must be no more than 48 hours old (if fish, purchased and shipped) or no more than 24 hours old (if fish, not shipped, or if freshwater invertebrates such as *Ceriodaphnia dubia*). Freshwater invertebrates used in a test must have been released within an 8-hour period, to avoid impacts on reproductive performance.
  - Maintain DO levels above 4 mg/L for warm water species and above 6 mg/L for cold water species.
- Test organisms should not be subjected to changes of more than 2 units of pH in any 24-hour period or 3 degrees of temperature in any 12-hour period.

- Test organisms should be fed according to the EPA WET test method requirements for the WET test. When feeding is necessary for mysid or fish tests, excess food should be removed daily during renewal by aspirating with a pipette, to avoid problems such as food buildup leading to excessive oxygen demand.
- Test organisms should be handled as little as possible to minimize stress:
  - Dip nets should be used for large organisms (e.g., salmonids).
  - Pipettes should be used for transferring small organisms such as juvenile fathead minnow, fry minnows, silverside fry, and, daphnid or midge larvae.

REFERENCE TOXICANTS

Reference toxicants are used to evaluate the health and sensitivity of WET test organisms over time and for documenting initial and ongoing laboratory performance. A laboratory performs a definitive toxicity test with a reference toxicant at least once per month for each toxicity test method conducted in that month. The monthly WET test results are plotted on a control chart to track trends in organism health or sensitivity.

Although EPA does not require the use of specific reference toxicants or set required acceptance ranges for reference toxicants for reference toxicant testing, EPA does recommend that laboratories conduct frequent reference toxicant tests. EPA recommends that the results of these reference toxicant tests be used to evaluate the health and sensitivity of the test organisms over time and for documenting initial and ongoing laboratory performance. Testing laboratories must perform at least one acceptable reference toxicant test per month for each type of toxicity test method conducted in that month regardless of the source of test organisms. If a test method is conducted only monthly, or less frequently, a reference toxicant test must be performed concurrently with each effluent toxicity test to document ongoing laboratory performance and to assess organism sensitivity and consistency when organisms are cultured in-house. When organisms are obtained from external suppliers, concurrent reference toxicant tests must be performed with each effluent sample tested, unless the test organism supplier provides control chart data from at least the past five months of reference toxicant testing, which will assess organism sensitivity and health. The EPA WET test method manuals require a laboratory to obtain consistent, precise results with reference toxicant toxicity tests with effluents under the NPDES permits. It is important that the reference toxicants should be securely stored in an area separate and away from the laboratory's mass cultures or purchased test organisms to prevent unintended exposure or contamination of test organisms by the reference toxicants. This should be one of the inspector's checklist items when inspecting a WET laboratory.

An attempt should be made to match the type of reference toxicant used (e.g., metal or chlorinated organic) to the major pollutant in the wastewater tested. Reference toxicant data must be included with the testing laboratory report.

Reference toxicant test results should not be used as *de facto* criteria for rejection of individual effluent or receiving water tests. The EPA WET test methods manuals provide guidance for what to do when more than 1 reference test in 20 reference toxicant tests falls outside of

control chart limits, or when a reference toxicant test result falls "well" outside of the control treatment limits. However, when reference toxicity tests indicate possible anomalies, the laboratory should investigate sources of variability, take corrective actions to reduce identified sources of variability, and perform an additional reference toxicant test during the same month.

CONDUCT OF THE TEST(S)

EPA WET test methods should be carried out by analysts who are experienced in the use or conduct of aquatic tests and the interpretation of data from aquatic toxicity testing. Test conditions should match those specified in the summary of test condition tables provided for each EPA WET test method. Physical and chemical measurements taken during the test (e.g., temperature, pH, and DO) must be conducted at the minimum frequency specified in the EPA WET test method manuals. The appropriate procedures are described in each EPA WET test method section of the manuals, by following the table of specified test conditions and required TACs.

RECORDKEEPING AND DATA REPORTING

Proper recordkeeping is essential to an effective NPDES WET test monitoring program. Entities collecting samples for WET testing should consistently use chain-of-custody (COC) procedures to document effluent or receiving water sample transfer. Hand-written entries on bench sheets and COC tags must generally be clear and legible. The analyst should maintain a sample log containing information as to the date, time, and type of sample taken as well as the sampler's name. Unusual conditions should be noted. When evaluating the contract lab's WET test data reporting, the inspector should verify that the following are included:

- Summary of test results, description of test conditions, material tested, test dilution water and other data for quality assurance.
- Methods used for all analyses. The method title, method number, and method source should be provided in the laboratory standard operating procedure (SOP) and test report. Tests must be conducted as stated in the SOP, and the laboratory should verify the test was conducted according to the SOP.
- Date and time test started, date and time test terminated, type and volume of test chambers, volume of solution used per chamber, number of organisms per test chamber, number of replicate test chambers per treatment.
- The test temperature (mean and range), details of whether test was aerated or not, feeding frequency, amount and type of food, and any pH control measures taken.
- The test endpoint(s), and any deviation(s) from EPA's WET test methods (40 CFR Part 136 or EPA Pacific West Coast WET test methods (EPA, 1995)) must be clearly noted.
- The reference toxicity results for WET tests conducted for the test period with specific test details to verify species, temperature, and dilution water used in reference toxicant test.
- Any acclimation of test organisms (temperature mean and range) and the reason(s) for acclimation.

- Any other relevant information.

Any deviations from specifications, as contained in EPA's WET test methods, should be documented and described in the data report by the testing laboratory. Data results for each WET test should include the raw toxicity data in tabular form, including daily records of affected test organisms in each concentration (including control treatments and effluent test concentration replicates); data in graphical form (plots of toxicity data); and a table of LC_{50}s, NOECs, IC_{25}, IC_{50}, etc. (as required in the respective NPDES permit). Records should indicate the statistical approach used to calculate endpoints, include a summary table of physical and chemical data, and include laboratory documentation of variability as part of the quality assurance/quality control (QA/QC). For more information on possible contributing factors to WET variability and recommendations for reducing it, see section 7.3 of EPA's *Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination System Program* (EPA, 2000a).

REVIEW CHECKLIST

While WET test reviews are performed as part of a routine NPDES facility inspection and usually are not comprehensive, the inspector and the permittee should carefully prepare in advance for the inspection. Laboratory inspection reviews can quickly ascertain if the facility is following their NPDES permit requirements and, secondarily, identify any obvious problems with reporting or laboratory performance. Inspectors should refer to the following checklist of possible issues that can be identified during a NPDES facility inspection.

Yes	No	N/A	Does the facility have a copy of its NPDES permit readily available? (Recommended: The inspector should bring a copy of the NPDES permit in the event the permittee does not have a complete copy at the time of inspection)
Yes	No	N/A	Were the WET tests required by the NPDES permit performed? Check the permit for the WET testing frequency and any special conditions related to WET testing, including whether a testing frequency decrease is authorized and the basis or rationale for decreasing the WET testing frequency (which should be documented in the NPDES permit fact sheet). This can be done prior to arriving on-site including contacting the NPDES state permitting authority or EPA if the state is not NPDES authorized.
Yes	No	N/A	Are all test reports for WET tests performed over the last three years available for review?
Yes	No	N/A	Are the test reports complete (e.g., bench data sheets for chemicals and test organisms, reference toxicant test results, chain of custody forms or tags, statistical analyses)?
Yes	No	N/A	Was the correct type of WET test performed including the choice of an appropriate (*most sensitive species*) WET test species used?

Yes	No	N/A	Did the effluent samples contain any measurable chlorine, or > 10 mg/l ammonia?
Yes	No	N/A	Was the WET test initiated within 36 hours of the first effluent sample being taken? This can be verified by checking the dates and times on the chain-of-custody forms or tags and bench sheets.
Yes	No	N/A	Did the laboratory or permittee make any judgment decisions beyond their authority? If Yes, describe:
Yes	No	N/A	Were there any deviations from the appropriate EPA WET test method? See NPDES permit and EPA WET test methods' test acceptability criteria.
Yes	No	N/A	Were the valid WET test results recorded and did they indicate non-compliance with the NPDES permits? If Yes, what follow-up actions were taken by the permittee and/or the permitting authority?
Yes	No	N/A	Were the WET test results reported correctly by the permittee and on the DMR?
Yes	No	N/A	Was the WET test determined to be invalid due to poor test organism performance in the control treatment?
Yes	No	N/A	If the WET test was declared invalid, was a new effluent sample collected, a new WET test performed and reported?

In the case of a PAI, both the laboratory performing the WET tests and the NPDES permittee are evaluated. This type of inspection requires more extensive information than is presented in this section. The inspector is therefore referred to the EPA's *Manual for the Evaluation of Laboratories Performing Aquatic Toxicity Tests* (EPA, 1991a) for the protocol to perform a PAI.

C. ANALYSIS OF WET DATA

WET test review should be conducted by both the testing laboratory, the permittee, and the NPDES regulatory authority. A review of WET tests includes: checking the WET test conditions; checking WET data or WET test results; and checking EPA WET test methods' TAC for test organisms in the control treatment(s) (and WET test variability for non-lethal endpoints such as the EPA WET test method's required percent minimum significant different (PMSD) determinations). Considerations for each of these WET test reviews are discussed below.

WET test results or WET data need to be interpreted so that compliance with the NPDES permittee's WET permit limits can be determined. For the NPDES permits program, each of EPA WET test methods contain several recommended statistical approaches. In addition, in 2010 EPA HQ (Water Permits Division/Office of Wastewater Management) developed a statistical approach referred to as the Test of Significant Toxicity (TST) as another option for statistically analyzing and interpreting valid WET test data—see EPA's *National Pollutant Discharge Elimination System Test of Significant Toxicity Technical Document* (EPA, 2010a).

The following definitions may help the inspector to interpret the WET test results:

- The LC_{50} (for lethal concentration) is the calculated percentage of effluent (point estimate) at which 50 percent of the organisms die during the test period. Usually, the LC_{50} is calculated statistically by computer programs that fit the dose-response curve to a mathematical function. Computer-based calculation procedures usually print an estimate of the error associated with the LC_{50} estimate.
- The EC_{50} (for effect concentration) is the calculated concentration (point estimate) at which 50 percent of the organisms indicate a particular impaired response or WET test measured effect (not necessarily death) due to exposure to a toxicant. For some species (e.g., *Ceriodaphnia dubia*—freshwater water flea, invertebrate) where the point of death is not certain, immobility is often used as a surrogate for death. Results for responses like the immobility responses in *Daphnia* (water flea, invertebrate) may be reported as an EC_{50} (calculated in the same manner as the LC_{50}). Often, however, no distinction is made between the EC_{50} and the LC_{50} when the response is a surrogate for death.
- The No Observed Effect Concentration (NOEC) is the highest tested concentration at which the organisms' responses are not statistically different from the control treatment organisms' responses. The NOEC (like the Lowest Observed Effect Concentration (LOEC) and Chronic Value (ChV) defined in the following paragraph) is normally determined only for chronic tests.
- The LOEC is the lowest tested effluent test concentration at which the organisms' responses are statistically different from those in the control treatments.
- The ChV is the calculated geometric mean of the NOEC and LOEC (the square root of the product of the NOEC and LOEC).
- The Inhibition Concentration (IC25) is the calculated percentage of effluent (point estimate) at which the organisms exhibit a 25-percent reduction in a non-quantal biological measurement such as fecundity or growth.
- The percent effect response measured at the critical dilution is reported. For example, state water quality standard (WQS) or NPDES permit WET limit may prohibit toxicity at 100 percent effluent or less. In this case, the observed percent effect response at 100 percent effluent would be reported.
- The response may be reported in Toxic Units (TU), either for Acute (TU_a) or Chronic (TU_c) test endpoints.
- A *no significant toxicity* assessment is a recommended statistical analysis alternative type of NPDES permit limit to a NOEC permit limit, as determined by the EPA's recommended TST statistical approach. No significant toxicity applies when the value calculated using a Welch's t-test is *significantly different* (i.e., greater) than a critical value. Thus, for NPDES permits, the assessment for no significant toxicity is based on statistically analyzing the measured effects at the control treatment to an effluent test concentration, which for NPDES permitting is usually the in-stream waste concentration or IWC. The IWC should be one of the effluent test concentrations in the WET test

usually bracketed by the other effluent test concentrations in a multiple test concentration test design.

Overall, there is an inverse relationship between the degree of toxicity and the effluent concentration percentage causing a toxic response. Therefore, the same toxicity test response (e.g., LC_{50}), at lower percentages of an effluent concentration indicates higher toxicity than WET test results at higher percentages of an effluent concentration. So, the magnitude of a TU indicates the degree of toxicity. TUs are defined as $100/LC_{50}$ for acute and 100/NOEC for chronic, with the LC_{50} or NOEC expressed as a percent effluent concentration. An effluent with an LC_{50} of 50 percent has an acute toxicity of 2 acute toxic units ($100/50 = 2\ TU_a$). Similarly, an effluent with a NOEC of 25-percent effluent has a chronic toxicity of 4 chronic toxic units ($100/25= 4\ TU_c$). The major advantage of using toxic units to express toxicity test results is that toxic units increase linearly as the toxicity of the effluent increases and so the higher the numeric TU, the greater the magnitude of measured toxicity. Therefore, an effluent with a TU_a of 4 is twice as toxic as an effluent with a TU_a of 2. Additionally, the NOEC, LC_{50}, and other statistical analyses are entered into the national enforcement database, ICIS, as pass/fail, whereas TUs are entered as a discrete number and can therefore reveal more about toxicity over time. EPA's *Technical Support Document for Water Quality-based Toxics Control* (EPA, 1991b) provides a more extensive discussion of the application of toxic units and the relevance to NPDES permits.

Review of Test Conditions. For WET test data submitted under NPDES permits, all required EPA WET test conditions must be met or the WET test is considered invalid and a new WET test is required using a newly collected effluent sample. Deviations from recommended EPA WET test *mandatory requirements* be evaluated on a case-by-case basis to determine the validity of the WET test results. Deviations from *recommended* test conditions may or may not invalidate a WET test result depending on: the degree of the departure from WET test conditions, the objective of the WET test, and the potential or observed impact of the deviation on the WET test result. Consideration of these factors should be carefully considered before rejecting or accepting a WET test result as valid. For example, if dissolved oxygen is measured below 4.0 mg/L in one WET test chamber, the reviewer should consider whether the observed mortality in that WET test chamber corresponds with the drop in dissolved oxygen. Whereas slight deviations in WET test conditions may not invalidate an individual WET test result, test condition deviations that continue to occur frequently in a laboratory may indicate the need for improved quality control in that laboratory.

Each WET test method has specified acceptable ranges of test conditions that are to be met, such as temperature, dissolved oxygen concentration, salinity, pH, light intensity and duration of photoperiod, organism loading (numbers or weight per volume), feeding, and cleaning procedures. WET tests not meeting the test conditions, Test Acceptability Criteria (TAC), and the non-lethal endpoint percent minimum significant difference (PMSD) for a specific WET test method should be carefully reviewed by the inspector. Also, the WET test and the WET test results should be referred to the EPA or state regional biologist and the NPDES regulatory authority (or permit writer). For each parameter discussed in these tables, the parameter is either *recommended (should do)* or *required (must do)*. For example, the chronic *Ceriodaphnia*

dubia test type is required (must) to be conducted. The inspector should review the EPA WET test methods for a more extensive discussion of each of the *recommended (should)* and *required (must)* WET test specifications. The EPA WET test methods manuals for Whole Effluent Toxicity testing can be accessed at https://www.epa.gov/cwa-methods/whole-effluent-toxicity-methods.

Review of Calculated WET Test Results. Inspectors should review WET test results (from multi-concentration tests) reported under the NPDES permits program according to EPA guidance on the evaluation of concentration-response relationships (EPA, 2000a). This guidance provides review steps for 10 different concentration-response patterns that may be encountered in WET test data. Based on the review, the guidance provides one of three determinations:

1. The calculated effect concentrations are reliable and should be reported.
2. The calculated effect concentrations are anomalous and should be explained.
3. The test was inconclusive and a new WET test should be conducted using a newly collected effluent sample.

It should be noted that the determination of a valid concentration-response relationship is not always clear cut. Data from some WET tests may suggest consultation with professional toxicologists and/or NPDES regulatory officials. Tests that exhibit unexpected concentration-response relationships may indicate a need for further investigation and possibly require a new WET test to be conducted using a newly collected effluent sample.

Questionable results in an acute test include:

- Higher mortalities in lower effluent test concentrations than in higher effluent test concentrations.
- 100-percent mortality in all effluent test concentrations.
- Greater percent mortality in the control treatment than in the lower effluent test concentrations.

Questionable results in a chronic test include:

- Greater growth or reproduction or fewer terata at higher effluent test concentrations than at lower effluent test concentrations.
- No growth or reproduction or 100-percent terata at all effluent test concentrations.
- Less growth or reproduction or more terata in control treatments than in lower effluent test concentrations.

When any of these abnormalities occur (outside of experimental error), the results and test conditions should be reviewed by the EPA and/or state regional biologist or NPDES toxicologist and reported to the NPDES regulatory authority (permit writer). Part of the inspector's review may also include a review of the laboratory's WET test data results and an explanation or interpretation of the WET test results. DMRs are expected to include this information.

In addition to reviewing the concentration-dose response relationship, the inspector should review within-test variability of individual WET tests. For example, when NPDES permits require chronic sub-lethal hypothesis testing endpoints (e.g., reproduction for the *Ceriodaphnia dubia* test), within-test variability should be reviewed and variability criteria applied as described in the chapter "Report Preparation and Test Review" of each WET test method.

Within-test variability is measured as the percent minimum significant difference (PMSD), and is calculated by the test reporting entity, then compared to established upper and lower bounds for test PMSDs. WET tests conducted under NPDES permits that fail to meet these variability criteria and that show "no toxicity" at the permitted receiving water concentration (i.e., not significantly different from the control treatment) are considered invalid WET tests and a new WET test must be conducted using a newly collected effluent sample. Circumstances that indicate that the results of the WET test may be questionable include: pH of the water was less than 6 or greater than 9, feeding schedule used during the test differed from the feeding schedule recommended in the methods manuals, organism culture was contaminated with rotifers, or if the test was repeated due to laboratory error. For additional circumstances that may yield WET test results with questionable variability, the inspector should refer to EPA's *Final Report: Interlaboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods* (EPA, 2001a).

To avoid penalizing laboratories that achieve unusually high precision, lower PMSD bounds are applied when a hypothesis WET test result (e.g., no observed effect concentration NOEC) or lowest observed effect concentration (LOEC) is reported. Lower PMSD bounds are based on the 10th percentiles of national PMSD data. The 10th percentile PMSD represents a practical limit to the sensitivity of the WET test method because few laboratories can achieve such precision on a regular basis and most do not achieve it even occasionally. In determining hypothesis WET test results, an effluent test concentration is not considered toxic if the relative difference from the control treatment is less than the lower PMSD bounds. See EPA's *Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination System Program* (EPA, 2000a), for specific examples of implementing lower PMSD bounds.

Review of Test Acceptability Criteria (TAC) for Controls. Each EPA WET test method also has specific required WET test acceptability criteria or TAC (e.g., minimum control survival) that must be achieved to be considered a valid WET test result. See the summary of test conditions and TAC for each specific EPA WET test method. In general, the valid interpretation of WET test results requires that control treatment organisms must meet minimum TAC for survival, growth, and/or reproduction as required by the respective EPA WET test methods. A summary of TACs per EPA WET test method can be found in Table 8-2.

Mortality in control treatments must not exceed 10 percent for acute toxicity tests and 20 percent for chronic tests (or other values as required by states through their regulations). If organism survival in the control treatments does not meet 90 or 80 percent for an acute or chronic test, respectively, then the WET test results should not be used for calculating summary statistics, and a determination of compliance using the WET test results cannot be made. For

chronic tests, test organism in the control treatments must also meet minimum requirements for growth and reproduction contained in the EPA WET test methods manuals. When using dual controls, the dilution water control treatment should, through statistical analysis, be used to determine the acceptability of the WET test control treatment, and for comparisons against the effluent test concentrations.

Table 8-2. Summary of TAC per EPA Method

EPA Method	Organism with Scientific Name	Endpoint Type	Test Type	Minimum # per Test Chamber	Minimum # of Rep per Conc.	Minimum # Effluent Conc.	Test Duration	Test Acceptance Criteria (TAC)
2000.0	Fathead minnow *(Pimephales promelas)*	Survival	Acute	10	2	5	48–96 hours	> 90% survival in controls
1000.0	Fathead minnow *(Pimephales promelas)*	Survival and growth (larval)	Chronic	10	4	5	7 days	> 80% survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25 mg
1002.0	Water flea *(Ceriodaphnia dubia)*	Survival and reproduction	Chronic	1	10	5	Until 60% of surviving control organisms have 3 broods (6–8 days)	> 80% survival and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control organisms must produce three broods
1007.0	Mysid shrimp *(Americamysis bahia)*	Survival and growth	Chronic	5	8	5	7 days	> 80% survival; average dry weight > 0.20 mg in controls

Table 8-2. Summary of TAC per EPA Method

EPA Method	Organism with Scientific Name	Endpoint Type	Test Type	Minimum # per Test Chamber	Minimum # of Rep per Conc.	Minimum # Effluent Conc.	Test Duration	Test Acceptance Criteria (TAC)
1016.0	Purple urchin *(Strongylocentrotus purpuratus)* or Sand dollar *(Dendraster excentricus)*	Fertilization	Chronic	100	4	4	40 min (20 min plus 20 min)	> 70% egg fertilization in controls; %MSD < 25%; and appropriate sperm counts
1017.0	Giant kelp *(Macrocystis pyrifera)*	Germination and germ-tube length	Chronic	100 for germination 10 for germ-tube length	5	4	48 hours	≥ 70% germination in controls; ≥ 10 µm germ-tube lengths in controls; %MSD of < 20% for both germination and germ-tube length NOEC must be below 35 µg/L in reference toxicant test
1014.0	Red abalone *(Haliotis rufescens)*	Larval development	Chronic	100	5	4	48 hours	≥ 80% normal larval development in controls Statistical significance @ 56 µg/L zinc % MSD < 20%

Table 8-2. Summary of TAC per EPA Method

EPA Method	Organism with Scientific Name	Endpoint Type	Test Type	Minimum # per Test Chamber	Minimum # of Rep per Conc.	Minimum # Effluent Conc.	Test Duration	Test Acceptance Criteria (TAC)
2002.0	Water flea *(Ceriodaphnia dubia)*	Survival	Acute	5	4	5	24, 48, or 96 hours	> 90% survival in controls
1003.0	Green algae *(Selenastrum capricornutum)*	Growth (cell counts, chlorophyll fluorescence, absorbance, or biomass)	Chronic	10,000cells/ mL	4	5	96 hours	Mean cell density of at least 1 X 106 cells/mL in the controls; variability (CV%) among control replicates less than or equal to 20%

D. TOXICITY REDUCTION EVALUTIONS AND TOXICITY IDENTIFICATION EVALUATIONS (TRES/TIES)

Toxicity Reduction Evaluations (TREs) and Toxicity Identification Evaluation (TIEs) are procedures used with the EPA's NPDES permits program to enable permittees to identify and reduce toxicity that is observed using WET tests. EPA's TRE and TIE procedures manuals can be found at the following website: https://www.epa.gov/npdes/npdes-permit-limits#wet.

A TRE is a site-specific study of the effluent or wastewater at a treatment facility. The TRE process is generally a stepwise process that attempts to identify the class of potential toxicants and, if possible, isolate the chemical causing toxicity. A TRE generally consists of six steps, but all six steps may not be required depending on the facility site-specific situation. Once the identification/isolation process has confirmed the potential cause of toxicity, the evaluation step uses techniques to determine what action(s) is needed to reduce or treat the chemical or chemicals causing toxicity in the effluent. If the evaluation step is completed successfully, the TRE should confirm that the actions chosen to reduce toxicity are successful. There are many possible ways to reduce toxicity depending on the cause of toxicity.

The need for a permittee to conduct a TRE may arise when the NPDES WET permit limit is exceeded during WET monitoring in accordance with the NPDES permit. NPDES WET permit limits are established to prevent excursions from state WET water quality standards, so an exceedance of a WET permit limit can sometimes trigger additional permit requirements. These permit triggers are actions the permittee must take to identify and resolve the toxicity to come back into compliance with the permit. Accelerated WET monitoring is a common permit trigger that can vary from state to state, but there's usually a requirement for more frequent WET testing over a short time period, generally a few weeks, to determine if the toxicity is persistent. If the effluent toxicity is not measured at a level that exceeds the permit limit, based on the data generated by the accelerated WET testing, the permit usually allows for a return to the previous WET monitoring frequency schedule. If toxicity continues to measure in exceedance of the WET permit limit, based on the accelerated WET testing data, then the TRE process is initiated. It is extremely important for the permittee and the permitting authority to agree upon an adequate work plan (developed by the permittee) that includes a schedule and reporting requirements throughout the TRE/TIE process, and especially when the TRE is first initiated.

In practice, most of the TRE work completed by the permittee is conducted through the permittee's labs or consultants. Therefore, it is important for the EPA or state NPDES permitting authority to ensure that the TRE process is on track and that the permittee resolves the toxicity problem in an appropriate and timely manner. The NPDES permitting authority can provide key recommendations to the permittee to ensure that all available information and possible strategies are considered in the evaluation. An important recommendation is that the permittee has a TRE work plan that is sufficiently detailed and includes frequent communication with the NPDES permitting authority. TRE work plan requirements vary from

state to state, but commonly include schedule and reporting requirements to ensure effluent toxicity is reduced or eliminated and compliance with the permit is achieved.

A TRE is most likely to be successful if there is a good partnership between the people who know the facility and the experts in engineering, toxicology, and perhaps hydrology, who know how to determine the causes of the effluent toxicity. For example, the toxicologist on the team can help link water quality characteristics to toxicity for different USEPA WET test species.

Regardless of the facility, a TRE almost always starts with a review of available data, such as influent and effluent chemical and physiochemical data, facility treatment data, and WET test data. Often, a thorough review of these data can be very useful in helping to determine what might be causing toxicity in the effluent. Facility treatment information that is often useful in conjunction with the effluent toxicity data include parameters such as effluent carbonaceous oxygen demand (COD), biological oxygen demand (BOD), mixed liquor solids, volatile solids, and removal rates of COD and BOD based on influent and effluent concentrations. The work plan should include the data and other information available for the evaluation, any interim reports or other deliverables to be sent to the NPDES permitting authority, and the roles and responsibilities of the TRE plan's team members.

One optional step in the six-step TRE approach is to identify the *exact cause of effluent toxicity*. This is commonly referred to as a Toxicity Identification Evaluation or TIE. Although not necessary, a TIE can often be very helpful in a TRE because toxicity can be more certainly controlled if the identity of the toxicant(s) is known. In general, the TIE is a three-phase process that characterizes, identifies and confirms the cause or causes of toxicity. Guidance documents for each of the three phases of toxicity identification evaluations and the Phase I TIE for chronically toxic effluents can be found at the EPA website provided at the beginning of this section. A TIE couples effluent chemical analysis and WET test results. Although sometimes it may take additional effort to identify the exact cause of effluent toxicity, particularly in very complex effluent situations, experienced WET testing laboratories and consultants can help ensure that the TIE is not an expensive, time-consuming venture. TIEs are applicable to evaluating toxicity of permitted effluents, ambient waters and sediments including bulk sediment or pore waters.

The role of the NPDES permitting authority in TIEs is to support innovative approaches that are technically feasible and scientifically sound, and to discourage approaches that are costly and/or not results-oriented. In some instances, the discharger may need to use novel approaches to identify the cause of toxicity. The NPDES permitting authority can assist the permittee by providing technical information where appropriate. However, conducting the TIE/TRE is the responsibility the permittee. The role of the NPDES permitting authority is to allow the TIE/TRE process to proceed and to confirm that the permittee is making good progress towards completing the TRE.

In addition to NPDES permit conditions, there are several other mechanisms that the NPDES permitting authority can use to require a permittee to conduct a TRE. The NPDES permitting authority can require a TRE through a CWA section 308 letter, a CWA section 309

administrative order, or as part of the Consent Decree requirements in the settlement of a civil judicial enforcement action. The role of the inspector is to evaluate whether the permittee has met the TRE/TIE milestones and to verify whether the permittee has implemented the selected controls and eliminated toxicity.

E. REFERENCES

The following is a list of resources providing additional information on toxicity and testing.

U.S. Environmental Protection Agency. (1991a). *Manual for the Evaluation of Laboratories Performing Aquatic Toxicity Tests*. EPA 600-4-90-031.

U.S. Environmental Protection Agency. (1991b). *Technical Support Document for Water Quality-based Toxics Control*. EPA 505-2-90-01.

U.S. Environmental Protection Agency. (1995). S*hort-term methods for estimating the chronic toxicity of effluents and receiving waters to West Coast marine and estuarine organisms*. EPA 600-R-95-136.

U.S. Environmental Protection Agency. (1996). *Clarifications Regarding Flexibility in Part 40 CFR Part 136 Whole Effluent Toxicity (WET) Test Methods*. EPA Memorandum.

U.S. Environmental Protection Agency. (1997). *Clarifications Regarding Whole Effluent Toxicity Test Methods Recently Published at Part 40 CFR Part 136 and Guidance on Implementation of Whole Effluent Toxicity in Permits.* EPA Memorandum.

U.S. Environmental Protection Agency. (1999a). *Errata for the Effluent and Receiving Water Toxicity Testing Manuals*. EPA 600-R-98-182.

U.S. Environmental Protection Agency. (1999b). *Whole Effluent Toxicity: Guidelines Establishing Test Procedures for the Analysis of Pollutants, Whole Effluent Toxicity Tests; Final Rule, Technical Corrections*. Office of Science and Technology, Engineering and Analysis Division. 64 FR 4975.

U.S. Environmental Protection Agency. (1999c). *Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants*. Office of Wastewater Management, Water Permits Division. EPA 833-B-99-002.

U.S. Environmental Protection Agency. (2000a). *Understanding and Accounting for Method Variability in Whole Effluent Toxicity Applications Under the National Pollutant Discharge Elimination System Program*. Office of Wastewater Management, Water Permits Division. EPA 833-R-00-003.

U.S. Environmental Protection Agency. (2000b). *Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing (40 CFR Part 136).* Office of Science and Technology, Engineering and Analysis Division. EPA 821-B-00-004.

U.S. Environmental Protection Agency. (2001a). *Final Report: Inter-laboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods, Vol. 1*. Office of Science and Technology, Engineering and Analysis Division. EPA 821-B-01-004.

U.S. Environmental Protection Agency. (2001b). *Final Report: Inter-laboratory Variability Study of EPA Short-term Chronic and Acute Whole Effluent Toxicity Test Methods, Vol. 2: Appendix*. Office of Science and Technology, Engineering and Analysis Division. EPA 821-B-01-005.

U.S. Environmental Protection Agency. (2001c). *Clarifications Regarding Toxicity Reduction and Identification Evaluations in the National Pollutant Discharge Elimination System Program*.

U.S. Environmental Protection Agency. (2002a). *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*. EPA 821-R-02-012.

U.S. Environmental Protection Agency. (2002b). *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. EPA 821-R-02-013.

U.S. Environmental Protection Agency. (2002c). *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms*. EPA 821-R-02-014.

U.S. Environmental Protection Agency. (2002d). *Guidelines Establishing Test Procedures for the Analysis of Pollutants; Whole Effluent Toxicity Test Methods; Final Rule*. 40 CFR Part 136.

U.S. Environmental Protection Agency. (2010a). *National Pollutant Discharge Elimination System Test of Significant Toxicity Technical Document*. EPA 833-R-10-004.

U.S. Environmental Protection Agency. (2010b). *National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document*. EPA 833-R-10-003.

U.S. Environmental Protection Agency. (2010c). *NPDES Permit Writer's Manual: Chapter 6. Water Quality-Based Effluent Limitations*. EPA 833-K-10-001.

U.S. Environmental Protection Agency. (2016). *Clean Water Act Methods Update Rule for the Analysis of Effluent - Final Rule*. Available at: https://www.epa.gov/cwa-methods/methods-update-rule-support-documents

CHAPTER 9 – PRETREATMENT

Contents

List of Tables

List of Exhibits

Related Websites

Office of Wastewater Management (OWM) National Pretreatment Program Homepage:
https://www.epa.gov/npdes/national-pretreatment-program#overview

A. REVIEW OF THE GENERAL PRETREATMENT REGULATIONS

DEVELOPMENT OF 40 CFR PART 403

In addition to materials in this chapter, inspectors must be familiar with Chapter 1, "Introduction," and Chapter 2, "Inspection Procedures."

The Clean Water Act (CWA) requires the Environmental Protection Agency (EPA) to promulgate regulations to control the discharge of pollutants to the Nation's waters to preserve their physical, chemical, and biological integrity. The CWA addresses the problem of indirect discharges of pollutants from industrial and commercial users of Publicly Owned Treatment Works (POTWs) to waters of the United States by requiring the EPA to promulgate federal standards for the pretreatment of wastewater discharged to a POTW. See CWA section 307(b)(3). To address indirect discharges from nondomestic users[4] to POTWs, EPA has established the National Pretreatment Program as a component of the National Pollutant Discharge Elimination System (NPDES) program. (The NPDES permitting program is the primary regulatory mechanism to control point-source discharges to the surface waters of the United States.) Pretreatment regulations apply to all nondomestic sources that introduce pollutants into a POTW. These sources of indirect discharges are more commonly referred to as Industrial Users (IUs). The National Pretreatment Program requires industrial and commercial dischargers to treat or control pollutants in their wastewater before discharge to POTWs that could pass through or interfere with the treatment plant, impact the collection system, threaten worker health and safety, or contaminate sludges.

The CWA provides for EPA to approve states to administer their own NPDES program under prescribed conditions. Authorized state NPDES programs must have authority to issue permits for discharges from POTW that assure that compliance with pretreatment standards by significant sources subject to such standards (see CWA section 402(b)(8)).

EPA initially promulgated the General Pretreatment Regulations (40 CFR Part 403) on June 26, 1978. The regulations have been revised and updated multiple times. The most recent significant update to the Pretreatment Regulations was promulgated on October 14, 2005 (70 FR 60134). The 2005 rule, known as the Pretreatment Streamlining Rule, includes revisions that reduce the overall regulatory burden on both industrial users of the POTW system (IUs) and the pretreatment program Control Authorities (as explained below and defined in 40 CFR 403.3) without adversely affecting environmental protection. The rule is available at https://www.epa.gov/npdes/npdes-pretreatment-streamlining-rule-fact-sheets. It differs from other major amendments to the General Pretreatment Regulations in that it increased POTW flexibility in program implementation, allowing, in certain instances, a reduction in minimum program requirements. Approved pretreatment programs in existence at the time of the Streamlining Rule are likely based on the older, more restrictive requirements. POTWs may need to modify their approved pretreatment programs.

[4] Pretreatment regulations apply to all nondomestic sources that introduce pollutants into a POTW. These sources of indirect discharges are more commonly referred to as Industrial Users (IUs).

A summary of the General Pretreatment Regulations is provided in Table 9-1. Major technical changes resulting from final regulatory amendments or court decisions are included in this table.

SUMMARY AND BACKGROUND

The three specific objectives cited in 40 CFR 403.2 of the General Pretreatment Regulations are to:

- Prevent the introduction of pollutants that would cause interference with the POTW system or limit the use and disposal of its sludge.
- Prevent the introduction of pollutants that would pass through the treatment works or be otherwise incompatible.
- Improve the opportunities to recycle or reclaim municipal and industrial wastewaters and sludges.

In addition, objectives of the pretreatment program include improved POTW worker health and safety and reduction of influent loadings to sewage treatment plants. Briefly stated, the definitions for interference and pass through are the following (see 40 CFR 403.3 for exact definitions):

- "Interference" is a discharge that alone or in conjunction with other discharges, disrupts the POTW or sludge processes, uses, and disposal, and therefore causes violation of any requirement of the POTW's NPDES permit or prevents the POTW from using its chosen sludge use or disposal practice.
- "Pass through" is a discharge that exits the POTWs to waters of the United States in quantities or concentrations which, alone or in conjunction with other discharges, causes a POTW NPDES permit violation.

The General Pretreatment Regulations detail the procedures, responsibilities, and requirements of EPA, states, POTWs, and IUs. All regulated entities must properly implement their part of the pretreatment program for regulatory objectives to be met. The specific responsibilities of each are explained below.

EPA has chosen to promulgate pretreatment standards at the same time it promulgates effluent limitations guidelines for industry categories of direct dischargers under CWA sections 301(b) and 304(b). These pretreatment standards are applicable to industrial indirect dischargers—those discharging to POTWs—and are known as categorical pretreatment standards. EPA has also developed other nationally applicable pretreatment standards (*national pretreatment standards*) under CWA section 307(b) in its General Pretreatment Regulations for Existing and New Sources of Pollution at 40 CFR Part 403. Such pretreatment standards are applicable to any user of a POTW, defined as a source of an indirect discharge (40 CFR 403.3(i)).

These national pretreatment standards include 1) a general prohibition and 2) specific prohibitions. The general prohibition prohibits any user of a POTW from introducing a pollutant

into the POTW that will cause pass through or interference. As noted above, EPA's regulations define both pass through and interference. In addition, under the Pretreatment Regulations, certain POTWs must develop and enforce local limits to implement the general and specific prohibitions of the regulations at 40 CFR 403.5(a)(1) and (b). Local limits that are developed by a POTW in accordance with the regulations are pretreatment standards for purposes of section 307(d) of the CWA (40 CFR 403.5(d)). See also 40 CFR 403.3(l) ("The term *National Pretreatment Standard, Pretreatment Standard*, or *Standard* ... includes any prohibitive discharge limits established pursuant to Part 403.5.").

The term Publicly Owned Treatment Works or POTW means a treatment works as defined by section 212 of the CWA, which is owned by a state or municipality (as defined by section 502(4) of the CWA). This definition includes any devices and systems used in the storage, treatment, recycling and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes and other conveyances only if they convey wastewater to a POTW Treatment Plant. The term POTW also means the municipality as defined in section 502(4) of the CWA, which has jurisdiction over the discharges to and from such a treatment works.

Many of the specific prohibitions for discharge into a POTW system found in 40 CFR 403.5(b) provide municipalities with the basis for instituting a proactive capacity, management, operation, and maintenance (CMOM) program; and protecting the collection system from degradation due to explosion, corrosion, and obstruction. If they are not yet required to implement a local pretreatment program by the terms of 40 CFR Part 403 or equivalent state law, then such municipalities should evaluate implementation of local pretreatment controls, particularly if locations of overflows such as Sanitary Sewer Overflows (SSOs) and Combined Sewer Overflows (CSOs) are predictable (based on facility history) and persistent. The regulations at 40 CFR Part 403 authorize the creation of a local pretreatment program, even if it is not required by state or federal law.

Guidance manuals developed to assist EPA Regional Offices, States, and POTWs with implementation of the National Industrial Pretreatment Program are available on EPA's NPDES Pretreatment Publications website (https://www.epa.gov/npdes/national-pretreatment-program-events-training-and-publications#publications). Select publications are listed in Section C, "References," of this chapter.

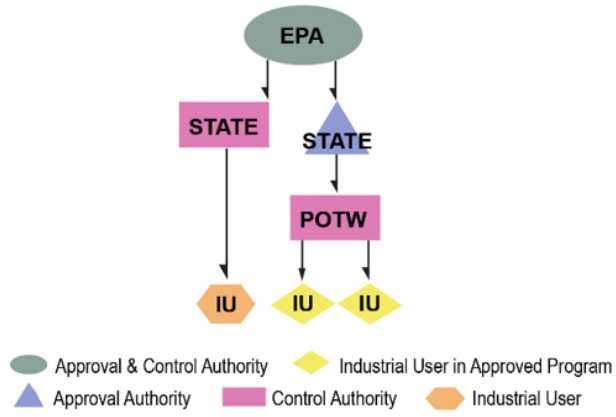
PROGRAM DEVELOPMENT AND NPDES REQUIREMENTS

The General Pretreatment Regulations at 40 CFR 403.8(a) require all POTWs with design flows greater than 5 million gallons per day (MGD) and receiving industrial discharges that pass through or interfere with the operation of the POTW, or are otherwise subject to Pretreatment Standards, to develop local pretreatment programs (unless the state government has elected to administer the local program). EPA or a state authorized to implement a state pretreatment program) may also require other POTWs to implement pretreatment programs. A POTW with an approved local pretreatment program is the "Control Authority." The terms of the POTW Control Authority's NPDES permit describes its implementation and enforcement responsibilities with respect to the local pretreatment program. Failure to adequately comply

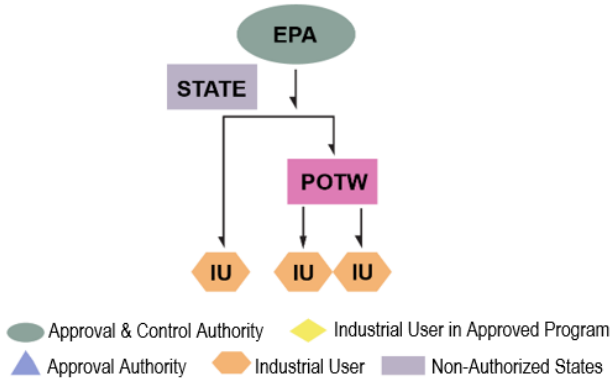
with its terms constitutes an NPDES violation that could subject the POTW to an enforcement action.

States with authority to approve local pretreatment programs are responsible for overseeing and coordinating the development and approval of these local pretreatment programs. Before state approval is obtained, EPA is the Approval Authority for local pretreatment programs. States with NPDES pretreatment programs must receive EPA authorization before they may function as Approval Authorities for pretreatment. The conditions for approval of an NPDES state pretreatment program are found at 40 CFR 403.10.

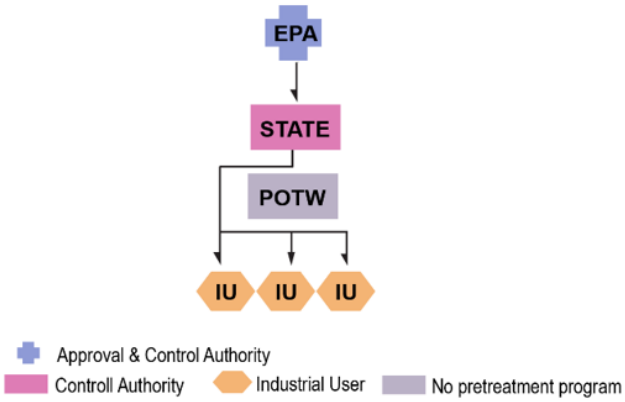
The EPA is the Approval Authority until a state is authorized to administer the pretreatment program. Once a state is authorized, the EPA maintains oversight responsibilities and enforcement authority. A state can serve as both the Approval Authority for local programs and as the Control Authority for IUs that discharge to POTWs without an approved local program. POTWs never serve as Approval Authorities. See Exhibit 9-1 for a visual representation of Control Authority and Approval Authority. Before any pretreatment inspection, the inspector should gain a clear understanding of who serves as the Approval Authority and the Control Authority in the municipality.



Authorized States



Non-Authorized States



States Assuming Direct Responsibility
Under 40 CFR 403.10(e)

Exhibit 9-1. Approval Authority versus Control Authority

The NPDES permit issued to a POTW that is required to develop a pretreatment program must include development and implementation requirements that become enforceable components of the permit. The General Pretreatment Regulations detail the requirements of a pretreatment program and implementation of the program. Among other things, POTWs must have the legal authority to control the contribution the POTW receives from significant industrial users (SIUs)[5] through a permit, order or similar means that may include either general or individual control mechanisms. Individual permits or general control mechanisms authorize the discharge of wastewater to a POTW upon condition that the discharger complies with the permit terms. An SIU permit is effective for only a limited period and must be revocable by the issuing authority at any time for just cause. In addition, the Control Authority's legal authority will typically include a provision that forbids the discharge of industrial wastewater from an SIU without a current Industrial User permit.

An IU individual permit or general control mechanism should describe, in a single document, all the duties and obligations of the permittee including all applicable Pretreatment Standards and Requirements (40 CFR 403.8(f)(2)). At a minimum, it must include the following:

- Prohibited discharge standards, applicable categorical standards, local limits.
- Effluent limits (including Best Management Practices (BMPs) that are based on applicable general Pretreatment Standards, categorical Pretreatment Standards, local limits, and state and local law.
- Monitoring and reporting requirements.
- Statement of permit duration.
- Statement of nontransferability.
- Statement of applicable civil and criminal penalty.
- Requirements to control slug discharges if determined by the POTW to be necessary.

Permits should not simply reference the applicable laws, but they must contain effluent limitations (expressed in terms of concentration or mass of pollutants that may be discharged over a given period including applicable BMPs), schedules for monitoring and reporting, requirements regarding sampling location and scope, and actual civil and criminal penalties as set forth by the POTW's legal authority. Such conditions must reflect the most stringent of applicable federal, state, and local Pretreatment Standards and Requirements.

[5] The term *significant industrial user* is defined at 40 CFR 403.3(v)(1).

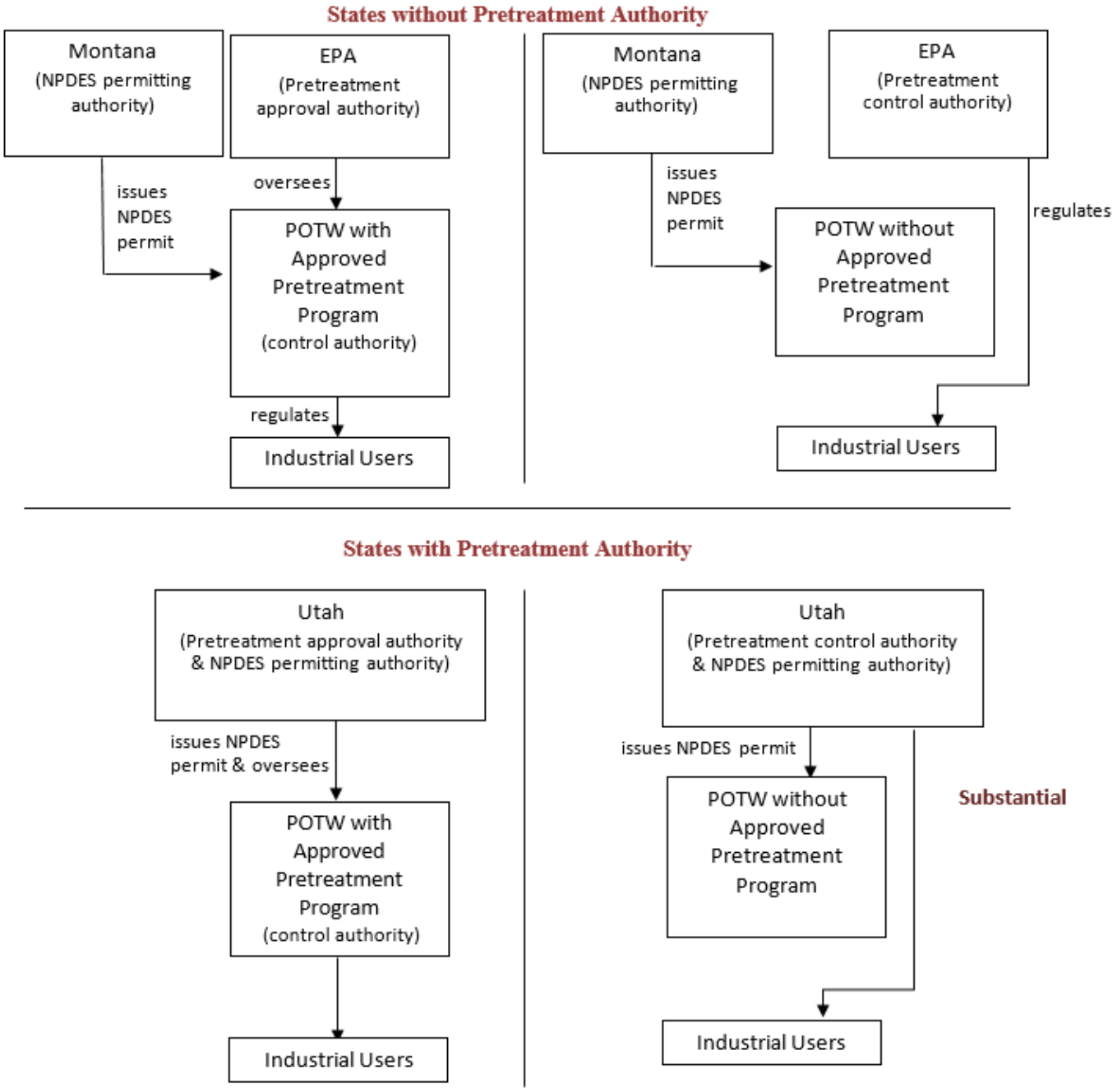


Exhibit 9-2. Pretreatment Implementation Flow Diagram

APPROVAL AUTHORITY RESPONSIBILITIES

The EPA Regional Office or an approved state administers a pretreatment program. The principal tasks for which an Approval Authority (EPA Regional Office or delegated state) is responsible are the following:

- Reviewing and approving POTW pretreatment programs and minor modifications (see "Control Authority Responsibilities" for what Control Authority program development entails).
- Overseeing POTW program implementation—i.e., conducting Pretreatment Compliance Inspections (PCIs) and audits—and reviewing annual report reviews.
- Providing POTWs with technical assistance on the requirements of the General Pretreatment Regulations, categorical pretreatment standards, and POTW pretreatment program requirements.
- Notifying POTWs of new and existing program requirements.
- Determining SIU and POTW compliance with all applicable federal requirements.
- Applying and enforcing pretreatment standards and requirements at IUs discharging to POTWs that do not have an approved local pretreatment program.
- Initiating enforcement action against noncompliant POTWs or IUs.

The General Pretreatment Regulations at 40 CFR 403.10 of identify the requirements a state must meet to receive approval of the pretreatment program as part of its NPDES authority, that is, to become an Approval Authority. For states preferring to assume the responsibility of directly regulating IUs discharging to POTWs and, hence, being considered the Control Authority in lieu of POTWs within the state, 40 CFR 403.10(e) provides that option.

CONTROL AUTHORITY RESPONSIBILITIES

Before the Approval Authority approves a POTW to operate the local Authority's pretreatment program as the Control Authority, the Approval Authority (EPA or State) is the Control Authority for IUs discharging to the POTW. After program approval, the Control Authority becomes responsible for implementing the General Pretreatment Regulations (40 CFR 403.8(f)), its approved local POTW pretreatment program, and the requirements of its NPDES permit. Note the POTW must comply with its NPDES permit regardless of program approval. To fully implement the pretreatment program throughout the entire service area, the Control Authority has responsibilities related to several specific areas:

- As provided in 40 CFR 403.8(f)(1), the Control Authority must have the legal authority to:
  - Deny (or condition) any new or increased contribution to the POTW from each IU.
  - Require IUs to comply with applicable pretreatment standards and requirements.
  - Require development of compliance schedules for the installation of technology necessary to meet pretreatment standard.

  - Control through permit, order, or similar means the contribution of each IU to ensure compliance with applicable pretreatment requirements.
  - Require submission of notices and self-monitoring reports as necessary to assure IU compliance and carry out all required inspections, surveillance, and monitoring necessary to determine industrial user compliance.
  - Enter premises of IUs to assure compliance.
  - Obtain remedies for noncompliance including seeking injunctive relief for noncompliance; Seeking or assessing civil or criminal penalties of at least $1,000 a day per violation; Immediately halting a discharge that presents or appears to present an imminent endangerment to the health or welfare of persons or to the environment or that threatens to interfere with the POTW's operation.
  - Comply with confidentiality requirements.
  - Develop and enforce an adequate sewer use ordinance, and if necessary, interjurisdictional agreements.

- As provided in 40 CFR 403.8(f)(2) and 403.5(c), the Control Authority must develop and implement procedures to ensure compliance with pretreatment standards including:
  - Identify and locate all possible IUs that may be subject to the pretreatment program.
  - Identify the character and volume of pollutants contributed to the POTW.
  - Notify all IUs of appropriate pretreatment standards, any changes to the regulations, and applicable requirements of the Resource Conservation and Recovery Act (RCRA).
  - Update the industrial survey to identify new IUs that should be regulated by the Control Authority's pretreatment program, and identify changes in manufacturing processes and wastewater discharge characteristics at existing facilities.
  - Identify categorical IUs that qualify as non-significant categorical IUs or middle tier IUs and determine appropriate permitting and monitoring requirements if state and local legal authority allows the control authority to make such designations.
  - Maintain a list of SIUs and submit updates to the Approval Authority annually.

- As provided in 40 CFR 403.8(f)(2), to ensure IU compliance, the Control Authority must:
  - Establish reporting, inspection, and monitoring requirements and procedures to enable evaluation of compliance, including proper QA/QC and chain-of-custody procedures for sampling and analysis.
  - Inspect and sample IUs. At a minimum, SIUs must be sampled and inspected at least once a year.
  - Evaluate each SIU at least once for the need for a slug discharge control program.
  - Perform sampling and analysis in a manner to produce evidence admissible in enforcement proceedings or in judicial actions.
  - Develop and implement an Enforcement Response Plan to guide compliance evaluation and enforcement activities.

  - Evaluate industry compliance by reviewing and analyzing industrial user self-monitoring reports and Control Authority monitoring data.
  - Investigate instances of noncompliance.
  - Initiate appropriate enforcement action to bring users into compliance.
  - Establish other procedures as required and/or determined to be needed to regulate the SIUs discharging to the POTW.

- As provided in 40 CFR 403.8(f)(2)(viii), the Control Authority must develop and implement procedures to comply with public participation requirements of EPA regulations, including:
  - Develop and implement a procedure to evaluate IUs that are in significant noncompliance as defined in 40 CFR 403.8(f)(2)(vii).
  - Publish at least annually, in the local newspaper with the greatest circulation, a list of the IUs that were in significant noncompliance within the past 12 months.
  - Notify the public of any changes to the sewer use ordinance or local limits after approval by the Approval Authority.
  - Submit substantial pretreatment program modifications to the Approval Authority and notify the Approval Authority of non-substantial modifications.

- Data management:
  - Maintain records of pertinent industrial user activities and compliance status, including compliance with Best Management Practices (BMP) requirements.
  - Maintain a current understanding of the categorical pretreatment standards and General Pretreatment Regulations, and notify IUs of any changes.
  - Provide the Approval Authorities with any reports required.

- As provided in 40 CFR 403.8(f)(3), the Control Authority must:
  - Provide adequate resources and qualified personnel for program implementation.

INDUSTRY RESPONSIBILITIES

Industrial dischargers to POTWs must comply with the following:

- Prohibited Discharge Standards—The general and specific prohibited discharge standards (40 CFR 403.5) noted in Table 9-1 and any specific local limits required to implement the prohibitions.
- Appropriate Pretreatment Standards—Categorical pretreatment standards (40 CFR Parts 405–471), state requirements.
- Reporting Requirements—As required by 40 CFR 403.12 or 403.3, and/or by the Control Authority. The requirements provided in 40 CFR 403.12 are summarized in Table 9-1.
- POTW Requirements—As specified in the approved POTW's legal authority.

The categories for which the EPA has developed categorical pretreatment standards are listed in Table 9-2. IUs that meet a pretreatment standard's applicability are considered categorical IUs. Categorical pretreatment standards are national, uniform, technology-based standards that apply to dischargers to POTWs from specific industrial categories (i.e., indirect dischargers). They are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTW. Dischargers subject to categorical pretreatment standards are required to comply with those standards by a specified date, typically no more than three years after the effective date of the categorical standard. EPA develops these standards at the same time it is developing effluent limitations guidelines for specific industry categories and typically, like effluent limitations. These categorical pretreatment standards apply to the wastewaters from specific manufacturing processes. The standards apply at the point of discharge from the pretreatment unit for the regulated process, or if there is no pretreatment unit, they apply at the end of the regulated process.

As previously noted, EPA has also developed national pretreatment standards that apply to all indirect dischargers that include general prohibitions (i.e., no pass through or interference) and specific prohibitions (e.g., no introduction of pollutants that create a fire hazard). To protect the POTW system from interference, pass through, and sludge contamination or any of the specific prohibitions, the Control Authority must develop and enforce local limits to control the introduction of such pollutants. These local limitations are generally applied at the point where the industrial facility discharges to the POTW.

Where there is both a categorical pretreatment standard and local limit applied over the same time period (e.g., both daily maximum limits), a categorical industrial user must meet the categorical pretreatment standard or the local limit for each pollutant regulated, whichever is the more stringent. The point at which the Control Authority's local limit applies may differ from the point at which the categorical pretreatment standard applies. In this case, the control authority must either calculate an adjustment to the categorical pretreatment standard to compare it to the local limit or sample at both points to determine compliance with both the categorical pretreatment standards and local limits.

When evaluating the pretreatment standards to determine the appropriate limitation, the inspector should understand that different categorical pretreatment standards are developed for each type of industry. If the industry combines the flows from more than one regulated process or combines a regulated process flow with other flows before these wastes are treated, the Control Authority and the industry must adjust the categorical pretreatment standard using the Combined Wastestream Formula (CWF). The equation is provided in 40 CFR 403.6(e) of the General Pretreatment Regulations. If the wastewaters are mixed after treatment, the categorical pretreatment standards must still be adjusted, in this case by flow weighted averaging of all flows introduced prior to the sample point. In either case, the resulting alternative limit cannot be set below the level of detection for that pollutant. Additional information on the combined wastestream formula and the flow weighted averaging formula is provided in EPA's *Guidance Manual for Implementing Production-Based Pretreatment Standards and the Combined Wastestream Formula* (EPA, 1985) available at https://www3.epa.gov/npdes/pubs/owm0260.pdf.

Categorical IUs have specific reporting requirements as per 40 CFR 403.12 and the respective categorical standard regulation. A summary of the reports that categorical industries are required to submit is provided in Table 9-1. A Control Authority may require additional reports from all IUs discharging to the system, including categorical IUs. A control authority may reduce sampling and reporting requirements for facilities that meet the definition of non-significant categorical IUs or middle-tier categorical IUs established by the pretreatment streamlining rule.

Table 9-1. Summary of the General Pretreatment Regulations

403.1	**Purpose and Applicability**
403.2	**Objectives of General Pretreatment Regulations**
403.3	**Definitions**
403.4	**State or Local Law**
	The Federal General Pretreatment Regulations are not meant to affect any state or local regulatory requirements as long as these requirements are at least as stringent as the federal regulations.
403.5	**National Pretreatment Standards: Prohibited Discharges**
	This section specifies general and specific prohibited discharge standards that Control Authorities must incorporate into their pretreatment programs. The general prohibitions specify that pollutants introduced into POTWs by a nondomestic source shall not pass through the POTW or interfere with the operation or performance of the works. The section provides that Control Authorities required to develop local pretreatment programs and POTWs where interference and pass through are likely to recur develop and enforce specific limitations (local limits, including Best Management Practices) to implement the general prohibitions against interference, pass through, and sludge contamination.
	The specific prohibitions specify prevention of discharge of pollutants that cause any of the following at the POTW:
	• Fire or explosion hazard, including no discharge with a closed-cup flashpoint of less than 60°C (140°F) using test methods in 40 CFR 261.21.
	• Corrosive structural damage (no pH<5.0).
	• Obstruction to the flow in the POTW.
	• Interference.
	• Heat causing inhibition of biological activity and temperatures at the POTW treatment plant to exceed 40°C (104°F). • Petroleum oils, non-biodegradable cutting oils, or products of mineral oils in amounts that will cause interference or pass through. • Fume toxicity or reactivity. • Trucked or hauled pollutants except at designated discharge points.

Table 9-1. Summary of the General Pretreatment Regulations

	Additionally, IUs are provided with an affirmative defense (if specified conditions are met) for actions brought against them for alleged violations of the general or specific prohibitions contained in this section.
403.6	**National Pretreatment Standards: Categorical Standards**
	This section discusses development and implementation of categorical pretreatment standards including, but not limited to, compliance deadlines, concentrations and mass limits, prohibition of dilution as a substitute treatment, and the Combined Wastestream Formula (CWF) to determine discharge limitations.
403.7	**Revision of Categorical Pretreatment Standards to Reflect POTW Removal of Pollutants**
	This section (referred to as the removal credits provision) provides the criteria and procedures to be used by a POTW in revising the pollutant discharge limits specified in categorical pretreatment standards to reflect removal of pollutants by the POTW.
403.8	**Pretreatment Program Requirements: Development & Implementation by POTW**
	This section covers the requirements for pretreatment program development by a Control Authority. Included in this section are criteria for determining which POTWs must develop pretreatment programs, incorporation of approved programs and compliance schedules into NPDES permits, deadlines for program approvals, and program and funding requirements. 403.8(f) sets out the requirements for an approvable POTW program. Specifically, it requires, among other things, that the Control Authority must have sufficient legal authority to enforce the approved pretreatment program that must include either individual industrial user control mechanisms such as a permit as well as, in certain cases, general control mechanisms for groups of similar IUs. The section also discusses that all Control Authorities with approved programs, or programs under development, must develop and implement procedures to ensure compliance with the requirements of a pretreatment program (which includes annual inspection and sampling requirements and the definition of SNC).
403.9	**Control Authority Pretreatment Programs and/or Authorization to Revise Pretreatment Standards: Submission for Approval**
	This section discusses requirements and procedures for submission and review of Control Authority pretreatment programs. Included in this section are discussions of conditional program approval, approval authority action, and notification where submissions are defective.
403.10	**Development and Submission of NPDES State Pretreatment Programs**
	This section discusses requirements and procedures for submission and review of NPDES state pretreatment programs. Included in this section are discussions of approvals and deadlines for state programs, legal authority, program and funding requirements, and contents of program submissions.
403.11	**Approval Procedures for Control Authority Pretreatment Programs and Revision of Categorical Pretreatment Standards**

Table 9-1. Summary of the General Pretreatment Regulations

	This section provides the administrative procedures for the review and approval or denial of Control Authority pretreatment program submissions and requests for removal credit authority.
403.12	**Reporting Requirements for POTWs and IUs**
	This section presents reporting requirements for Control Authorities and IUs. Reports required by IUs include the following:
	• Baseline Monitoring Report (BMR). Due to the Control Authority within 180 days of the effective date of the categorical pretreatment standards (40 CFR 403.6). In addition, new source BMR reporting requirements are discussed in this section.
	• Compliance schedule progress reports. Due to the Control Authority within 14 days of completion of compliance schedule milestones or due dates.
	• 90-day compliance report. Due to the Control Authority within 90 days of the compliance date of the categorical standards or 90 days after beginning discharge for a new source.
	• Periodic reports on continued compliance. Due to the Control Authority at least semiannually, usually in June and December after the compliance date. The Control Authority may waive monitoring requirements if specified conditions are met.
	• Notices of potential problems including slug loadings. Due to the Control Authority immediately upon identification of discharges, including slug loadings that could cause problems to the POTW for both non-categorical and categorical IUs.
	• Notice of changed discharge. Due to the Control Authority from categorical and non-categorical users in advance of any significant change in volume or character of pollutants discharged.
	• Notice of violation and resampling. Notification due to the Control Authority within 24 hours of noting a violation; results of resampling due within 30 days.
	• Notification of hazardous waste discharge. Notification to the POTW, EPA, and state Hazardous Waste authorities of the hazardous wastes discharges to the POTW.
	Reports required from Control Authorities include the following:
	• Compliance schedule (for development of pretreatment programs) progress reports
	• Annual POTW reports to the Approval Authority. • Annual certification by Non-Significant Categorical IUs.
	This section also discusses in detail the monitoring requirements for IUs and signatory and recordkeeping requirements (including requirements for electronic documents) for Control Authorities and IUs.

Table 9-1. Summary of the General Pretreatment Regulations

403.13	**Variances from Categorical Pretreatment Standards for Fundamentally Different Factors**
	This provision allows an industrial user, POTW or any interested person, to request a variance for the establishment of limits either more or less stringent than that required by a categorical pretreatment standard. The primary criterion required for approval of this variance is that the factors relating to the industrial user's discharges be fundamentally different from factors considered by EPA in establishing categorical pretreatment standards for these discharges.
403.14	**Confidentiality**
	This section covers confidentiality requirements and prohibitions for EPA, states, and Control Authorities. Effluent data are available to the public without restriction.
403.15	**Net/Gross Calculation**
	This provision provides for adjustment of categorical pretreatment standards to reflect the presence of pollutants in the industrial user's intake water.
403.16	**Upset Provision**
	This provision is consistent with the NPDES regulations and allows an upset of an industry's pretreatment system (which meets the conditions of an upset as specified in this provision) to be an affirmative defense to an action brought for noncompliance with categorical pretreatment standards. The industrial user shall have the burden of proof for such a defense.
403.17	**Bypass**
	This provision requires IUs to operate their treatment systems at all times and includes criteria for allowing a bypass to occur and notification procedures for both an anticipated and unanticipated bypass.
403.18	**Modification of Control Authority Pretreatment Programs**
	This provision specifies procedures and criteria for "minor" and "substantial" modifications to approved Control Authority pretreatment programs and incorporation of substantial modifications into the Control Authority.
403.19	**Provisions of specific applicability to the Owatonna Waste Water Treatment Facility**
	This section provides specific regulatory requirements for the Owatonna Waste Water Treatment Facility and its participating IUs to implement a project under the Project XLC program in Steele County, Minnesota. This project includes legal authorities and requirements that are different than the administrative requirements otherwise specified in 40 CFR Part 403.
403.20	**Pretreatment Program Reinvention Pilot Projects Under Project XL**
	This section provides administrative procedures to allow any POTW with a final "Project XL" agreement to implement a Pretreatment Program that includes legal authorities and

Table 9-1. Summary of the General Pretreatment Regulations

	requirements that are different than the administrative requirements otherwise specified in 40 CFR Part 403.
Appendix A	[Reserved]
Appendix B	[Reserved]
Appendix C	[Reserved]
Appendix D	Selected Industrial Subcategories Considered Dilute for Purposes of the Combined Wastestream Formula (previously titled "Selected Industrial Subcategories Exempted from Regulation Pursuant to Paragraph 8 of the NRDC v. Costle Consent Decree"
	The Appendix D published on January 21, 1981, provided a list of industrial subcategories that had been exempted (pursuant to paragraph 8 of the NRDC vs. EPA Consent Decree) from regulation by categorical pretreatment standards. Appendix D was revised on October 9, 1986, to update the list of exempted industrial categories and to correct previous errors by either adding or removing various subcategories or by changing the names of some categories or subcategories. Each of the subcategories, as indicated by the revised Appendix D title, contains wastestreams that are classified as dilute for purposes of applying categorical pretreatment standards to other wastestreams and for using the combined wastestream formula to adjust these standards.
Appendix E	**Sampling Procedures**
	This Appendix provides a general description of composite and grab sampling procedures.
Appendix F	[Reserved]
Appendix G	**Pollutants Eligible for a Pollutant Credit**

Table 9-2. Categorical Pretreatment Standards

Industrial Categories with Categorical Pretreatment Standards in Effect			Effluent Guidelines Currently Under Development[a]
	N	Aluminum Forming (Part 467)	
E	N	Battery Manufacturing (Part 461)	• Steam Electric Power Generation
E	N	Builder's Paper and Board Mills (Part 431)	
E	N	Carbon Black Manufacturing (Part 458)	
E	N	Centralized Waste Treatment (Part 437)	• Shale Gas Extraction
	N	Coil Coating (Part 465)	• Dental Amalgam
E	N	Copper Forming (Part 468)	
	N	Duck Operations (Part 412)	
E	N	Electrical and Electronic Components (Part 469)	
E	N	Electroplating (Part 413)	
	N	Fertilizer Manufacturing (Part 418)	
	N	Glass Manufacturing (Part 426)	
	N	Grain Mills Manufacturing (Part 406)	

Table 9-2. Categorical Pretreatment Standards

Industrial Categories with Categorical Pretreatment Standards in Effect			Effluent Guidelines Currently Under Development[a]
	N	Ink Formulating (Part 447)	
E	N	Inorganic Chemicals (Part 415)	
E	N	Iron and Steel Manufacturing (Part 420)	
E	N	Leather Tanning and Finishing (Part 425)	
E	N	Metal Finishing (Part 433)	
E	N	Metal Molding and Casting (Part 464)	
E	N	Nonferrous Metals Forming and Metal Powders (Part 471)	
E	N	Nonferrous Metals Manufacturing (Part 421)	
E	N	Organic Chemicals, Plastics, and Synthetic Fibers (Part 414)	
	N	Paint Formulating (Part 446)	
E	N	Paving and Roofing Materials (Part 443)	
E	N	Pesticide Chemicals (Part 455)	
E	N	Petroleum Refining (Part 419)	
E	N	Pharmaceutical Manufacturing (Part 439)	
E	N	Porcelain Enameling (Part 466)	
	N	Pulp, Paper, and Paperboard (Part 430)	
	N	Rubber Manufacturing (Part 428)	
E	N	Soap and Detergent Manufacturing (Part 417)	
E	N	Steam Electric Power Generating (Part 423)	
E	N	Timber Products Processing (Part 429)	
E	N	Transportation Equipment Cleaning (Part 442)	
		Waste Combustors (Part 444)	

E = Standards in effect for existing sources.

N = Standards in effect for new sources.

[a] From 2010 final Effluent Guidelines Program Plan (October 2011).

B. PRETREATMENT COMPLIANCE INSPECTIONS AND OTHER COMPLIANCE EVALAUTION ACTIVITIES

SCOPE OF PCIS AND AUDITS

The Pretreatment Compliance Inspection (PCI), the pretreatment program audit, and the program performance report (submitted at least annually by the Control Authority) are tools EPA and state officials use to assess the Control Authority's pretreatment program.

EPA uses the PCI to evaluate Control Authority compliance monitoring and enforcement activities. The inspector also determines whether any changes have been made to the Control Authority program since the last PCI, audit, performance report (i.e., annual report), or Control Authority modification request for approval. Further, the inspector collects information on Control Authority program implementation for further evaluation by compliance personnel.

The inspector may conduct the PCI in conjunction with other NPDES inspections to conserve travel resources and allow integration of information on a POTW's operations. PCIs can be

conducted along with Compliance Evaluation Inspections (CEIs), Compliance Sampling Inspections (CSIs), Performance Audit Inspections (PAIs), Diagnostic Inspections (DIs), and other non-routine inspections, such as Toxics Sampling Inspections, and Compliance Biomonitoring Inspections. The inspector may combine a PCI with a site visit regarding sludge compliance as discussed in Chapter 10.

Note that the POTW personnel involved in a CSI may be different from the ones involved in a PCI. Also, PCIs and audits rely heavily on file and record reviews to evaluate the Control Authority's pretreatment program. These records may have little bearing on the sampling inspection of the treatment facility. This distinction of a PCI to a CSI should be addressed during planning for the inspection.

Audits provide a comprehensive review of the Control Authority pretreatment program. The audit addresses all the items covered in a PCI, but in greater detail. Consequently, the audit is more resource intensive than the PCI. Additionally, the pretreatment audit is generally considered to be a program function and it is not the focus of this Chapter. More information about how to conduct pretreatment compliance audits is available at https://www3.epa.gov/npdes/pubs/final_pca_checklist_and_instructions_%20feb2010.pdf.

In general, there are three major components of a PCI:

- Pre-visit preparation for the PCI:
  - Coordination with the EPA Regional or State Pretreatment Coordinator.
  - Review of background information: approved program documentation, Control Authority annual reports (if available), NPDES permit/NPDES permit fact sheet, NPDES permit compliance status, previous inspection reports, and program modification requests from the Control Authority.
  - Notification of Control Authority (if appropriate).
- On-site:
  - Entry (presenting credentials)
  - Opening conference with Control Authority officials
  - Review of pretreatment files
  - IU site visits (as appropriate)
  - Interview of officials using PCI or audit checklist
  - Tour of POTW (optional)
  - Closing conference
- Follow-up:
  - Preparation of report
  - Data entry into ICIS-NPDES
  - Reportable Noncompliance/Significant Noncompliance (RNC/SNC) determination
  - Follow-up letter to the Control Authority

- Enforcement action (when necessary)
- NPDES permit or program modifications (when necessary)

EPA's *Clean Water Act National Pollutant Discharge Elimination System Compliance Monitoring Strategy* (CMS) (EPA, 2014) describes the off-site desk audit as a compliance monitoring activity that regions and states can use, under certain circumstances, to make a compliance determination. In order for the off-site desk audit to count toward CMS implementation, the region or state must report the activity to ICIS-NPDES and the desk audit must be conducted by an authorized inspector or other credible regulator with sufficient knowledge, training or experience to assess compliance. The off-site desk audit may include, but is not limited to, the following activities:

- Review of POTW permit, reports and records, including annual pretreatment reports and annual biosolids reports for years covering the period since the last PCI or audit.
- Review of agency-gathered testing, sampling and ambient monitoring data.
- Evaluation of responses to CWA section 308 information requests, such as IU self-monitoring reports.
- Consideration of other information to identify any unpermitted IUs or mis-categorized IUs.
- Consideration of the POTW's sewer use ordinance and enforcement response policy.
- Review of compliance deliverables submitted pursuant to permits or enforcement actions.
- Analysis of aerial or satellite images.

If a PCI is conducted with an unannounced NPDES inspection, it also may be unannounced, but the Control Authority officials should be notified of the PCI upon arrival of the inspection team. At many POTWs, personnel responsible for implementing the pretreatment program may not be the same as those operating the treatment plant.

The protocol involved in the on-site portion of the inspection is comparable to that of other NPDES inspections. The Pretreatment Program PCI typically includes site visits of industrial facilities discharging to the POTW. The inspector should select IUs for site visits as needed to evaluate the Control Authority's procedures for properly categorizing, monitoring and inspecting IUs. For more detailed information on conducting PCIs, refer to EPA's *Guidance for Conducting a Pretreatment Compliance Inspection* (EPA, 1991a).

PCI CHECKLIST COMPONENTS AND INSPECTION REPORT

EPA developed the PCI checklist to assist NPDES inspectors in conducting and documenting the PCI. However, it should be noted that the checklist in the 1991 PCI guidance has not been updated to evaluate changes in the regulations as a result of the 2007 Pretreatment Streamlining Rule. EPA pretreatment inspectors may find EPA's *Control Authority Pretreatment Audit Checklist and Instructions* (EPA, 2010) helpful for conducting pretreatment inspections. See the next section for a description of this checklist.

In addition to the completed checklist, the inspector may include other materials collected during the PCI in the final report as appendices, such as:

- Example of Control Authority control mechanism or enforcement actions
- Names of IUs that were not sampled or inspected in the past year
- Control Authority's Enforcement Response Plan
- Annual list of IUs in significant noncompliance

See the EPA's *Guidance for Conducting a Pretreatment Compliance Inspection* (EPA, 1991a) for the PCI checklist. The manual goes through each checklist section individually and explains the intent of the questions. As noted earlier, the manual provides more detailed information concerning the procedures for conducting the PCI.

PRETREATMENT AUDIT CHECKLIST COMPONENTS

The audit checklist has been developed to assist with a detailed review of a POTW pretreatment program, including pretreatment program modification, legal authority, industrial user characterization, control mechanism evaluation, application of pretreatment standards and requirements, compliance monitoring, enforcement, data management/public participation, resources, and environmental effectiveness/pollution prevention. The audit checklist is part of the *Control Authority Pretreatment Audit Checklist and Instructions* (EPA, 2010). The manual provides specific guidance on conducting an audit and using the checklist.

The audit checklist is divided into the following sections:

- Section I: Data Review
- Section II: File Evaluation
- Section III: Observations and Concerns
- Attachment A: Pretreatment Program Status Update
- Attachment B: Pretreatment Program Profile
- Attachment C: Legal Authority Review Checklist
- Industrial User Site Visit Data Sheet
- WENDB Data Entry Worksheet;
- Pretreatment Compliance Audit Required ICIS Data Elements Worksheet
- RNC Worksheet.

Inspectors should note that the 2010 audit checklist includes the WEN database entry worksheet; however, the WEN database is no longer utilized. Inspectors should now enter audit information into the ICIS-NPDES database and may use the ICIS-NPDES Data Entry Worksheet to do so.

The audit checklist collects more detailed information than the PCI checklist and, as with the completed PCI checklist, also may be augmented by additional audit data:

- NPDES pretreatment permit conditions.

- Control Authority enforcement documents with pretreatment requirements (i.e., administrative order, consent decree).
- Locally developed discharge limitations as included in the approved program (or any limits that have been changed by the Control Authority).
- Copy of sewer use ordinance if different from that in the approved program.
- Control Authority sampling and inspection schedule for regulated IUs.
- List of IUs not sampled or inspected in the past year.
- Control Authority chain-of-custody form.
- List of noncompliant IUs and history of enforcement actions taken.
- Annual list of IUs in significant noncompliance.

C. REFERENCES

EPA's Guidance for Conducting a Pretreatment Compliance Inspection (September 1991) contains a list of reference materials (publications and memoranda) available from EPA or the Pretreatment Coordinator in your region. These documents and additional guidance manuals developed to assist EPA Regional Offices, states, POTWs, and IUs with implementation of the General Pretreatment Program are available on EPA's NPDES Pretreatment Publications website (https://www.epa.gov/npdes/national-pretreatment-program#overviewhttps://cfpub.epa.gov/npdes/pubs.cfm?program_id=3).

Checklists for conducting pretreatment compliance inspections and audits are provided in EPA's *Guidance for Conducting a Pretreatment Compliance Inspection* (EPA, 1991a) and *Control Authority Pretreatment Audit Checklist and Instructions* (EPA, 2010). It should be noted that these checklists have not been updated to evaluate changes in the regulations as a result of the 2007 Pretreatment Streamlining Rule. Each checklist provides a list of questions that should be considered during an audit or PCI. The inspector should contact the Regional or State Pretreatment Coordinator before a PCI or an audit is done.

The following is a list of resources providing additional information on the NPDES pretreatment program.

Memoranda

Determining Industrial User Significant Noncompliance (January 17, 1992).

Determining Industrial User Compliance Using Split Samples (January 21, 1992).

Use of Grab Samples to Detect Violations of Pretreatment Standards (October 1, 1992).

Using Split Samples to Determine Industrial User Noncompliance (April 12, 1993).

Information on the Misuse of Sodium Dimethyldithiocarbamate (June 2, 2000).

Regulatory Determination for the PreKote™ Surface Preparation Process (April 1, 2003).

Product and Product Group Discharges Subject to Effluent Limitations and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Point Source Category—40 CFR Part 414 (April 2005).

New Source Dates for Direct and Indirect Dischargers (September 28, 2006).

Oversight of SIUs Discharging to POTWs without Approved Pretreatment Programs (May 18, 2007).

Applicability of Effluent Guidelines and Categorical Pretreatment Standards to Biodiesel Manufacturing (August 11, 2008).

Best Practices for NPDES Permit Writers and Pretreatment Coordinators to Address Toxic and Hazardous Chemical Discharges to POTWs (November 3, 2016)

EPA Guidance

U.S. Environmental Protection Agency. (1983). *Guidance Manual for POTW Pretreatment Program Development*. EPA 833/B-83-100.

U.S. Environmental Protection Agency. (1985). *Guidance Manual for Implementing Production-Based Pretreatment Standards and the Combined Wastestream Formula*. EPA 833-B-85-201.

U.S. Environmental Protection Agency. (1991a). *Guidance for Conducting a Pretreatment Compliance Inspection*. EPA300/R-92-009.

U.S. Environmental Protection Agency. (1991b). *Control of Slug Loadings to POTWs: Guidance Manual*. 21 W-4001.

U.S. Environmental Protection Agency. (1992). *Guidance to Protect POTW Workers from Fume Toxic and Reactive Gasses and Vapors.* EPA 812-B-92-001.

U.S. Environmental Protection Agency. (1994a). *Industrial User Inspection and Sampling Manual for POTWs*. EPA 831-B-94-001.

U.S. Environmental Protection Agency. (1994b). *Multijurisdictional Pretreatment Programs Guidance Manual*. EPA 833-94-005.

U.S. Environmental Protection Agency. (1999). *Guidance Manual for Control of Wastes Hauled to Publicly Owned Treatment Works*. EPA 833-B-98-003.

U.S. Environmental Protection Agency. (2004a). *Local Limits Development Guidance*. EPA 833-R-04-002A.

U.S. Environmental Protection Agency. (2004b). *Mercury Pollutant Minimization Program Guidance.* Region 5, NPDES Programs Branch.

U.S. Environmental Protection Agency. (2007a). *EPA Model Pretreatment Ordinance*. EPA 833-B-06-002.

U.S. Environmental Protection Agency. (2007b). *Checklist – Pretreatment Program Legal Authority Reviews*.

U.S. Environmental Protection Agency. (2010). *Control Authority Pretreatment Audit Checklist and Instructions*. EPA 833-B-10-001.

U.S. Environmental Protection Agency. (2011a). *Introduction to the National Pretreatment Program*. EPA 833-B-11-001.

U.S. Environmental Protection Agency. (2011b). *Procuring Analytical Services: Guidance for Industrial Pretreatment Program*s. EPA 833-B-11-001.

U.S. Environmental Protection Agency. (2012). *Industrial User Permitting Guidance Manual*. 833-R-12-001A.

U.S. Environmental Protection Agency. (2014). *Clean Water Act National Pollutant Discharge Elimination System Compliance Monitoring Strategy*. Available at: https://www.epa.gov/compliance/clean-water-act-national-pollutant-discharge-elimination-system-compliance-monitoring

CHAPTER 10 – SEWAGE SLUDGE (BIOSOLIDS)

Contents

List of Tables

List of Exhibits

Associated Appendices

P. Sludge Inspection Checklists

Related Websites

Office of Wastewater Management (OWM) home page: http://www.epa.gov/owm
Office of Science and Technology (OST) home page: https://www.epa.gov/aboutepa/about-office-water#science

A. REVIEW OF THE SEWAGE SLUDGE REGULATIONS (BIOSOLIDS)

In addition to materials in this chapter, inspectors must be familiar with Chapter 1, "Introduction," and Chapter 2, "Inspection Procedures."

Section 405 of the Clean Water Act (CWA) mandated the development of a federal sludge management program. On February 19, 1993, the Environmental Protection Agency (EPA) promulgated technical standards for the final use or disposal of sewage sludge (see Title 40 *Code of Federal Regulations* (CFR) Part 503, Volume 58 *Federal Register* (FR) 9248). These regulations contain technical standards for three sewage sludge use or disposal practices:

- Land Application (Subpart B)
- Surface Disposal (Subpart C)
- Incineration (Subpart E)

The regulations at 40 CFR Part 503 also include pathogen and alternative vector attraction reduction requirements for sewage sludge applied to the land or placed on a surface disposal site (Subpart D).

The federal and state sludge management programs currently regulate the final use and disposal of sewage sludge, the residual generated from the treatment of domestic sewage in a treatment works. Although the regulations refer to the residual generated from the treatment of domestic sewage as sewage sludge, the term "biosolids" is the current term in general use for those sewage sludges that have been treated and conditioned through biological, chemical, and/or physical processes for beneficial reuse as a soil amendment for growing plants and trees.

In preparation for the issuance of the final technical standards, the National Pollutant Discharge Elimination System (NPDES) regulations were revised to include sludge use or disposal requirements. EPA considers the sludge regulations at 40 CFR Part 503 as the minimum requirements applicable to and enforceable against any facility engaged in a regulated sludge use or disposal practice, regardless of whether that facility's NPDES permit contains sludge use or disposal conditions. EPA has the authority to issue a notice of violation or take other appropriate enforcement actions against facilities that do not comply with 40 CFR Part 503 regulations.

Facilities that are subject to NPDES permit requirements for aqueous discharges to surface waters, such as Publicly Owned Treatment Works (POTWs), are also subject to 40 CFR Part 503 regulations as generators and preparers of sewage sludge. Additionally, facilities that may not have previously been permitted under the NPDES program and are subject to 40 CFR Part 503 regulations will be required to apply for an NPDES permit. Regulated facilities include:

- Facilities designated by the permitting authority as treatment works treating domestic sewage.[6]
- Industrial facilities that separately treat domestic sewage and generate biosolids regulated by 40 CFR Part 503.
- All surface disposal site owners/operators.
- Septage haulers who land apply septage.
- All biosolids incinerator owners/operators.
- Facilities changing the quality of biosolids regulated by 40 CFR Part 503.

The regulations at 40 CFR Part 503 only apply to use and disposal of sewage sludge (including domestic septage), which replaces only a portion of the original 1979 regulations on land application and surface disposal of sludge in 40 CFR Part 257. The land application of industrial sludge continues to be regulated by 40 CFR Part 257. However, disposal of sewage sludge in Municipal Solid Waste Landfills (MSWLFs) is regulated in 40 CFR Part 258 and the operations and air emissions of sewage sludge incinerators is regulated by the Clean Air Act (CAA) under 40 CFR Part 60 and 40 CFR Part 129.

In general, the regulations at 40 CFR Part 503 apply the following types of requirements to the three practices for sewage sludge use or disposal:

- Pollutant limits—9 pollutants under land application (40 CFR 503.13), 3 pollutants under surface disposal (40 CFR 503.23), and 7 pollutants under incineration (40 CFR 503.43).
- Pathogen and vector attraction reduction requirements.
- Nitrogen application rate requirements.
- Management practices for siting and operation of sludge use or disposal activities.
- Minimum monitoring requirements.
- Specific recordkeeping and reporting requirements.

A brief explanation of the requirements that apply to each sewage sludge use or disposal practice is provided below. Pathogen and alternative vector attraction reduction requirements in Subpart D are included in the descriptions for land application (Subpart B) and surface disposal (Subpart C) of sewage sludge and are not described separately in this document.

[6] *Treatment works* is either a federally owned, publicly owned, or privately owned device or system used to treat (including recycle and reclaim) either domestic sewage or a combination of domestic sewage and industrial waste of a liquid nature. *Domestic sewage* is waste and wastewater from humans or household operations that is discharged to or otherwise enters a treatment works. *Domestic septage* is either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage (and does not receive either commercial wastewater or industrial wastewater and does not include grease removed from a grease trap at a restaurant). Note the Part 503 regulations also include simplified requirements for the land application of domestic septage.

LAND APPLICATION REQUIREMENTS (40 CFR PART 503, SUBPART B)

Land application consists of the spreading, spraying, injection, or incorporation of biosolids, including material derived from sewage sludge (e.g., compost, sewage sludge pellets), onto or below the surface of the land to take advantage of the soil-enhancing qualities of the sewage sludge.

General

The general requirements in 40 CFR Part 503, Subpart B prohibit the land application of sewage sludge to agricultural land, forest, a public contact site, or a reclamation site if the sludge does not meet the pollutant limits or ceiling concentrations established in 40 CFR 503.13(b)(1). The person who prepares bulk sewage sludge for land application is responsible for providing the applicator of the sewage sludge a written notification of the concentration of total nitrogen (as N, on a dry weight basis) in the bulk sewage sludge. The preparer of the sewage sludge is responsible for obtaining this information and disseminating this information to respective owners or lease holders to comply with 40 CFR 503.7 regulations.

For sewage sludge that is applied to land in a state other than the state in which the bulk sewage sludge is prepared, the applicator will also provide written notice, prior to the initial application, to the permitting authority for the state in which the bulk sewage sludge is proposed to be applied. The notice shall include:

- The location, by either street address or latitude and longitude, of each land application site.
- The approximate time period bulk sewage sludge will be applied to the site.
- The name, address, telephone number, and NPDES permit number (if appropriate) for the person who prepares the bulk sewage sludge.
- The name, address, telephone number, and NPDES permit number (if appropriate) for the person who will apply the bulk sewage sludge.

Pollutant Limits

The regulations establish four types of limits for nine pollutants. Exhibit 10-1 at the end of this section illustrates which limits apply, based on the final sludge use; conversely, Exhibit 10-2 illustrates which requirements apply, based on the level of treatment achieved.

- Ceiling Concentration Limits—Maximum limits as milligram of pollutant per kilogram of sludge on a dry weight basis for bulk sewage sludge or sewage sludge sold or given away in a bag or other container that can be land applied (listed in Table 1 of 40 CFR 503.13).
- Cumulative Pollutant Loading Rates (CPLRs)—Total amount of pollutant (kilograms) in sludge that does not meet pollutant concentration limits that can be applied to a hectare of agricultural land, forest, public contact site, or reclamation site. When this loading rate is reached, no additional sludge can be applied to the site. CPLRs are listed in Table 2 of 40 CFR 503.13.

- Pollutant Concentration Limits—Monthly average concentration of pollutant as milligram per kilogram of sludge on a dry weight basis (listed in Table 3 of 40 CFR 503.13). They apply to sewage sludge sold or given away in a bag or other container that can be applied to land and as an alternative limit to CPLRs for bulk sewage sludge.
- Annual Pollutant Loading Rates—The amount of pollutant (kilograms) in a bagged product that can be applied in a 365-day period on an area (hectare) of land, calculated as the product of the concentration of each pollutant in the sewage sludge (kilograms of pollutant per kilograms of sludge) and the annual whole sludge application rate for the sewage sludge (kilograms sludge per year). The loading rates (listed in Table 4 of 40 CFR 503.13) are alternative limits to pollutant concentration limits for sewage sludge sold or given away in a bag or other container on a dry weight basis that can be applied each year.

Management Practices

The regulations at 40 CFR 503.14 lists five management practices that supplement the pollutant limits and provide additional protection to endangered species and their habitats, surface water, wetlands, groundwater, and human exposure to the sludge. Four of these practices are applicable to the land application of bulk sludge; one practice is applicable to the labeling or reporting of the bag or other container in which sewage sludge is sold or given away for land application.

Operational Standards: Pathogen and Vector Attraction Reduction Requirements

Prior to land application, sludge must meet both pathogen reduction (i.e., reduction of disease-causing organisms) and vector attraction reduction (i.e., reduction of rodents, flies, mosquitoes, or other organisms capable of transporting infectious agents, ultimately to humans) requirements.

The 1993 40 CFR Part 503 regulations (58 FR 9387) retained substantially the same pathogen reduction requirements as the original 1979 40 CFR Part 257 (44 FR 53460) requirements for land applied sludge. Land-applied sludge must meet one of two categories of pathogen reduction requirements:

- Class A requirements (40 CFR 503.32(a)) must be met when applying bulk sewage sludge to a lawn or home garden or when sewage sludge is sold or given away in a bag or other container to be applied to land. Class A requirements result in a pathogen reduction of the sludge to at or below the detection limits of the method. Class A sewage sludge may be used without site restrictions or limiting public access. Six alternative pathogen reduction approaches are available for achieving Class A sludge in Subpart D.
- Class B requirements (40 CFR 503.32(b)) significantly reduce (but do not eliminate) the pathogens in the sludge and require a waiting period before the land on which the sludge was applied may be used for certain activities. Site restrictions limit the application of Class B sewage sludge to agricultural land, forest, public contact site, or a reclamation site. To meet pathogen reduction requirements, land-applied domestic septage must meet site restriction requirements in 40 CFR 503.32(b)(5) or meet pH

requirements at 40 CFR 503.32(c)(2) and a subset of the site restriction requirements (40 CFR 503.32(b)(5)(i)–503.32(b)(5)(iv)). Three pathogen reduction alternatives (with specific site restrictions for use of the treated sludge) are provided for achieving Class B sludge in Subpart D.

The regulations at 40 CFR Part 503 also require compliance with one of eight vector attraction reduction treatment alternatives if the sludge will be sold or given away in a bag or other container (40 CFR 503.33(a)(3)). Bulk sewage sludge applied to lawns or home gardens must also meet one of eight vector attraction reduction treatment alternatives (40 CFR 503.33(a)(2)). Bulk sewage sludge applied elsewhere must meet one of ten treatment alternatives (40 CFR 503.33(a)(1)).

Monitoring, Recordkeeping, and Reporting Requirements

The regulations at 40 CFR Part 503 requires a minimum monitoring frequency for pollutants and pathogen and vector reduction parameters based on the annual amount of sewage sludge generated by a facility (as shown in Table 1 of 40 CFR 503.16). As with other NPDES provisions, the permitting authority may reduce monitoring frequencies based upon consistent demonstrated performance for at least two years. Land application of domestic septage requires monitoring for pathogen and vector attraction reduction parameters to ensure compliance with those requirements.

The recordkeeping requirements at 40 CFR Part 503 differ depending on the type of pollutant limits applied. Recordkeeping requirements, including certification statements specified in 40 CFR Part 503, are imposed on generators/preparers of sewage sludge and on appliers of domestic septage. The regulations require the facility to retain the specific information for 5 years, except that some information on applicable cumulative pollutant loading rates must be retained by the facility indefinitely.

While all facilities must maintain records, only a subset must report under the regulations at 40 CFR Part 503. Facilities should verify reporting requirements with the permitting authority. Those facilities that must report at least once per year are listed below.

- Class I sludge management facilities[7]
- POTWs with a design capacity equal to or greater than 1 Million Gallons per Day (MGD)
- POTWs serving a population of 10,000 or more

[7] *Class I sludge management facility* is any publicly owned treatment works (POTW), as defined in 40 CFR 501.2, required to have an approved pretreatment program under 40 CFR 403.8(a) (including any POTW located in a state that has elected to assume local program responsibilities pursuant to 40 CFR 403.10(e)) and any treatment works treating domestic sewage, as defined in 40 CFR 122.2, classified as a Class I sludge management facility by the EPA Regional Administrator, or, in the case of approved State programs, the Regional Administrator in conjunction with the State Director, because of the potential for its sewage sludge use or disposal practice to affect public health and the environment adversely.

SURFACE DISPOSAL REQUIREMENTS (40 CFR PART 503, SUBPART C)

A surface disposal site is an area of land that contains one or more active sewage sludge units (i.e., land on which only sewage sludge is placed for final disposal). This does not include land on which sewage sludge is either stored or treated. Surface Disposal includes monofills (sewage sludge-only landfills), dedicated disposal surface application sites, piles or mounds, impoundments, or lagoons.

General

Subpart C requires that sewage sludge shall not be placed on an active sewage sludge unit unless the pollutant limits in 40 CFR 503.23 are met. If an active unit is located within 60 meters of a geologic fault with displacement in Holocene time, located in an unstable area, or located in a wetland, the unit must be enclosed. The operator/owner must notify the permitting authority 180 days prior to closing a unit. Prior owners are required to notify the subsequent owner of the presence of sewage sludge.

Pollutant Limits

The surface disposal regulations at 40 CFR 503.23 control three pollutants. Limits apply to sewage placed at a surface disposal site that does not have a liner and leachate collection system. There are no pollutant limits on sewage sludge placed in sewage sludge units equipped with a liner and leachate collection system. The distance between the active sewage sludge unit and the site property line/boundary determine the specific pollutant limits that apply; the closer to the boundary, the more stringent the limits (see Table 10-3). An owner/operator can request site-specific pollutant limits; the permitting authority establishes these limits through a permit.

Management Practices

The regulations at 40 CFR 503.24 establish a total of 14 management practice requirements. Many are one-time surface disposal site location restrictions. Others address operational activities (e.g., liner, leachate and runoff collection systems, methane gas monitoring) and post-closure activities.

Operational Standards

Prior to surface disposal, sludge must meet both pathogen reduction and vector attraction reduction requirements. Sludge that is placed at a surface disposal site must meet one of the Class A or Class B pathogen reduction alternatives, unless the sewage sludge is covered daily with soil or other material. The inspector should note, however, that the site restrictions included in the Class B pathogen reduction alternatives only apply to land applied sewage sludge, not to surface disposal. In addition to pathogen reduction, surface disposed sludge must also meet one of eleven vector attraction reduction alternatives specified in 40 CFR Part 503, Subpart D. Although domestic septage does not have pathogen reduction requirements, one of four vector attraction reduction requirements must be met prior to placing it on an active sewage sludge unit.

Monitoring, Recordkeeping, and Reporting Requirements

The regulations at 40 CFR Part 503 require a minimum monitoring frequency for pollutants and pathogen and vector reduction parameters based on the annual amount of sewage sludge disposed by a facility (as shown in Table 1 of 40 CFR 503.26). Like land application requirements for monitoring, the permitting authority may reduce monitoring frequencies based upon consistent demonstrated performance for at least two years. Surface disposal of domestic septage requires monitoring for vector attraction reduction parameters to ensure compliance with those requirements.

Recordkeeping requirements (40 CFR 503.26 to 503.28) include certification statements specified for the sludge generator or final preparer and/or the owner/operator of the surface disposal site. The facility must maintain all records for 5 years. While all facilities must maintain records, only a subset must report under the sewage sludge regulations. Facilities should verify reporting requirements with the permitting authority. Those facilities that must report at least once per year are listed below.

- Class I sludge management facilities
- POTWs with a design capacity equal to or greater than 1 Million Gallons per Day (MGD)
- POTWs serving a population of 10,000 or more

INCINERATION REQUIREMENTS (SUBPART E)

Incineration of sewage sludge is the firing of sludge at high temperatures in an enclosed device.

General

Sewage sludge incineration must be in compliance with the requirements in this subpart.

Pollutant Limits

The sewage sludge regulations impose pollutant limits on seven pollutants in the exit gas from a sewage sludge incinerator stack. Beryllium and mercury must comply with the national emissions standards in subparts C and E of 40 CFR Part 61. Limits on the five remaining metals are calculated by the permitting authority based on-site-specific factors using the equations specified in 40 CFR 503.43. Lead limits factor in the National Ambient Air Quality Standard for lead. Limits for arsenic, cadmium, chromium, and nickel are based on chemical-specific risk-specific concentrations. Limits for the remaining two pollutants (mercury and beryllium) are derived from air emission standards promulgated under 40 CFR Part 61. These limits appear in the permit issued to the owner/operator of the sewage sludge incinerator.

Management Practices

The seven management practices in 40 CFR 503.45 ensure that certain detection and measurement instruments are correctly installed, calibrated, operated, and maintained; that incinerator maximum combustion temperature and air pollution control equipment operating standards are established; and that endangered species and their habitats are protected. The permitting authority is required to include specific management practice requirements based on-site-specific factors and these should appear in the incinerator's permit.

Operational Standards

The sewage sludge regulations establish an average monthly standard on the total hydrocarbons (THC) or carbon monoxide (CO) concentration in the exit gases (i.e., stack gas) of an incinerator to protect from excessive emissions of organic pollutants. The owner/operator must correct the measured concentrations to account for variations in moisture and oxygen content in the stack gas. The monthly standards must be normalized to 0 percent moisture and 7 percent oxygen in the stack gas. Monthly average concentrations of 100 parts per million (ppm) for TCH or CO must be met.

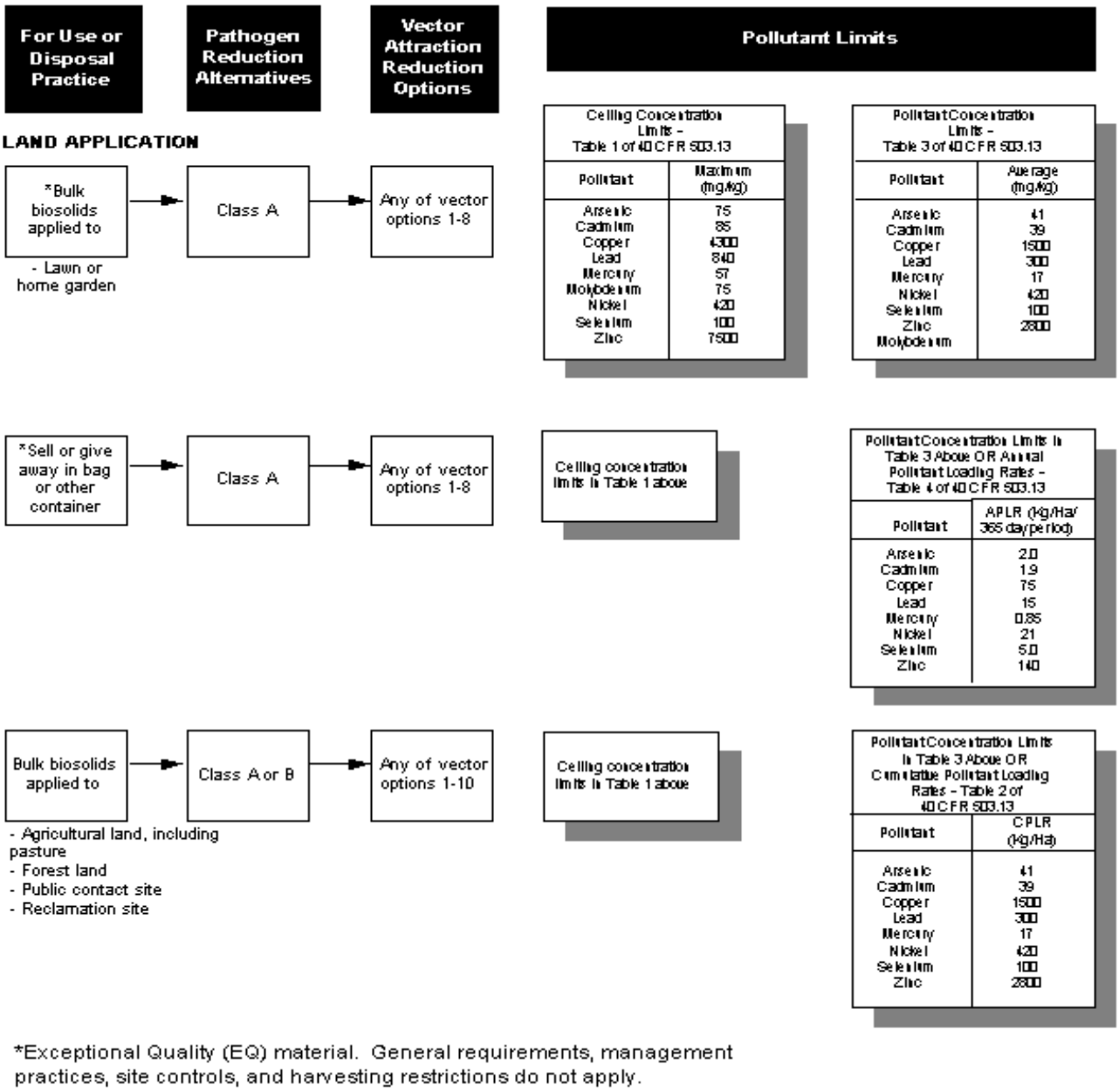
Monitoring, Recordkeeping and Reporting Requirements

The regulations at 40 CFR 503.47 and 503.48(a) impose monitoring requirements on the incinerator owner/operator. Sections 503.46 to 503.48 of the sludge regulations require monitoring of (a) sewage sludge for pollutant (i.e., seven metals) concentrations; (b) incinerator stack exit gases for total hydrocarbon or, alternatively, carbon monoxide (CO), oxygen concentrations and moisture content; and (c) incinerator combustion temperatures and air pollution control equipment operating parameters. Monitoring requirements to demonstrate compliance with Part 61 beryllium and mercury standards are also imposed on owners/operators of sewage sludge incinerators (40 CFR 503.47(d)–(e)).

Records required to be maintained by owners/operators of incinerators are specified both in 40 CFR 503.47 and site-specific conditions in the NPDES or sludge permit. Owners/operators must keep records for a minimum of five years and include information on sludge pollutant limits, management practices, and monitoring requirements.

While all facilities must maintain records, only a subset must report under the sewage sludge regulations. Facilities should verify reporting requirements with the permitting authority. Those facilities that must report at least once per year are listed below.

- Class I sludge management facilities
- POTWs with a design capacity equal to or greater than 1 million gallons per day (MGD)
- POTWs serving a population of 10,000 or more



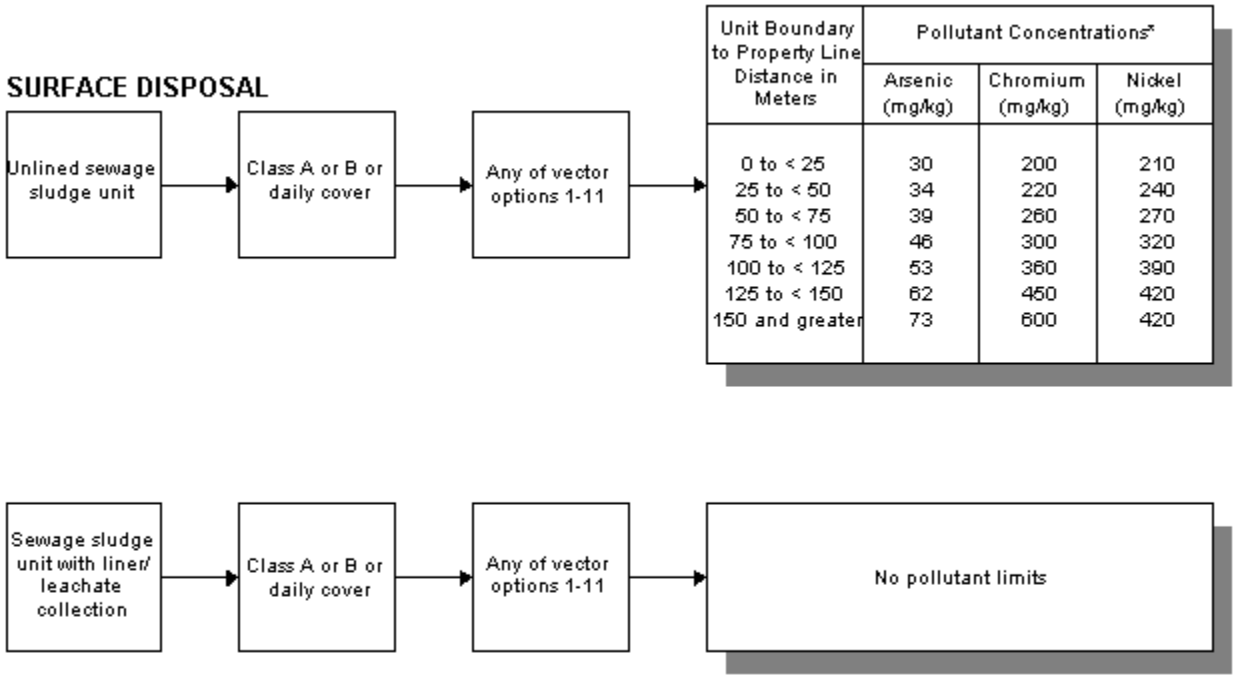
*Exceptional Quality (EQ) material. General requirements, management practices, site controls, and harvesting restrictions do not apply.

Exhibit 10-1. Sludge Quality Requirements for Land Application Uses

SLUDGE TYPE	RESULTING REQUIREMENTS
Exceptional Quality (EQ)	
1) Meets all pollutant concentration limits (Table 2-1, p. 29) 2) Meets any of the Class A alternatives (Table 2-5, p. 37) 3) Meets any of V.A.R. Options 1-8 (Table 2-6, p. 37)	Unregulated for Use Monitoring, Recordkeeping, and Reporting Requirements
Pollutant Concentration (PC)	
1) Meets all pollutant concentration limits (Table 2-1, p. 29) 2) Meets any of the Class B alternatives (Table 2-5, p. 37) 3) Meets any of V.A.R. Options 1-10 (Table 2-6, p. 37)	Site Restrictions (Fig. 2-4, p. 38) Management Practices (Fig. 2-9, p. 45) General Requirements (Fig. 2-8, p. 44) Monitoring, Recordkeeping, and Reporting Requirements
OR	
1) Meets all pollutant concentration limits (Table 2-1, p. 29) 2) Meets any of the Class A alternatives (Table 2-5, p. 37) 3) Meets V.A.R. Option 9 or 10 (Table 2-6, p. 37)	Management Practices (Fig. 2-9, p. 45) General Requirements (Fig. 2-8, p. 44) Monitoring, Recordkeeping, and Reporting Requirements
Cumulative Pollutant Loading Rate (CPLR)	
1) Meets ceiling concentration limits (Table 2-1, p. 29) 2) Meets any Class A or Class B alternative (Table 2-5, p. 37) 3) Meets any of V.A.R. Options 1-10 (Table 2-6, p. 37)	Site Restrictions (Fig. 2-4, p. 38) Management Practices (Fig. 2-9, p. 45) General Requirements (Fig. 2-8, p. 44) Monitoring, Recordkeeping, and Reporting Requirements CPLR Loading Rate Limits (Table 2-1, p. 29)
Annual Pollutant Loading Rate (APLR) **(For solids sold or given away)**	
1) Meets ceiling concentration limits (Table 2-1, p. 29) 2) Meets any of the Class A alternatives (Table 2-5, p. 37) 3) Meets any of V.A.R. Options 1-8 (Table 2-6, p. 37)	Site Restrictions (Fig. 2-4, p. 38) Management Practices (Fig. 2-9, p. 45) General Requirements (Fig. 2-8, p. 44) Monitoring, Recordkeeping, and Reporting Requirements APLR Loading Rate Limits (Table 2-1, p. 29)

Note: Tables and pages numbers reference above are from EPA's *A Plain English Guide to the EPA Part 503 Biosolids Rule*, September 1994

Exhibit 10-2. Land Applied Sludge Requirements Based on Level of Treatment Achieved



Unit Boundary to Property Line Distance in Meters	Pollutant Concentrations*		
	Arsenic (mg/kg)	Chromium (mg/kg)	Nickel (mg/kg)
0 to < 25	30	200	210
25 to < 50	34	220	240
50 to < 75	39	260	270
75 to < 100	46	300	320
100 to < 125	53	360	390
125 to < 150	62	450	420
150 and greater	73	600	420

** Site-specific limits may be approved by the permitting authority, if requested.*

Exhibit 10-3. Sludge Quality Requirements for Surface Disposal

B. SLUDGE (BIOSOLIDS) INSPECTION PROCEDURES

SCOPE OF INSPECTION ACTIVITIES

Inspectors should verify compliance with the following general activities:

- Sludge monitoring, recordkeeping, and reporting
- Sludge treatment operations and maintenance
- Sludge sampling and laboratory Quality Assurance (QA)

EPA intends for the evaluation of sludge management activities to be incorporated into the existing NPDES inspection structure so that inspection resources can be used most efficiently. The inspector can identify and investigate problems that might contribute to noncompliance with sludge requirements during any inspection site visit. The Pretreatment Compliance Inspection (PCI), the Compliance Evaluation Inspection (CEI), the Compliance Sampling Inspection (CSI), and the Performance Audit Inspection (PAI) are the most likely vehicles for evaluating compliance with sludge requirements. Examples of how the NPDES inspector may use existing NPDES inspections when evaluating sludge requirements are presented below.

- PCI—During a PCI, the inspector evaluates a POTW's compliance with its pretreatment program, which includes consideration of whether any pollutants from non-domestic sources are passing through the treatment processes and accumulating in the sludge.
- CEI—The inspector has historically looked at sludge treatment as part of the CEI because of its effect on wastewater treatment. Evaluation of sludge treatment during a CEI should be expanded to include a review of sludge monitoring, reporting, and record-keeping, and a more comprehensive evaluation of the Operation and Maintenance (O&M) of sludge treatment processes, to evaluate compliance with sludge permit requirements.
- CSI—The CSI is used if the inspector decides that sludge sampling is necessary to determine compliance with applicable requirements.
- PAI—The PAI may evaluate compliance with sludge monitoring requirements, and evaluate the permittee's sludge sampling and analytical procedures.

While NPDES inspectors are not required to conduct an in-depth compliance assessment of sludge final use and disposal practices when such practices occur away from the wastewater treatment plant (WWTP), it can help ascertain the vector reduction compliance status at these sites rather than at the WWTP. In situations where final use and disposal requirements have been established in the facility's NPDES permit (e.g., management practices such as 10-meter buffer zones between the sludge application site and surface waters) and the activity is off-site, the inspector should verify compliance with those requirements through a records review at the facility. As part of a sampling inspection, the inspector may need to sample the sludge to determine compliance with pollutant limits.

EPA intends to focus sludge inspection activities on those aspects of sludge management that the inspector can easily evaluate during an existing NPDES compliance or pretreatment inspection. Inspectors will rely on an evaluation of sludge treatment operations, the observation of on-site sludge storage and disposal activities, and the review of sludge monitoring and disposal records to identify actual and potential noncompliance with sludge requirements. Inspectors should document compliance or noncompliance with sludge final use or disposal requirements in accordance with standard NPDES compliance inspection procedures. An optional inspection checklist is useful for documenting that all necessary information has been collected. Sludge Inspection checklists are included in Appendix P of this manual. These checklists are based on the checklists in EPA's *Guidance for NPDES Compliance Inspector: Evaluation of Sludge Treatment Processes* (EPA, 1991a) and *Guidance for NPDES Compliance Inspector: Verifying Compliance with Sludge Requirements* (EPA, 1991b), as modified by EPA Region 8. The checklists should be used in conjunction with the checklist questions found in the 1991 guidance manuals. However, sludge permits may contain additional sludge permit conditions based on case-by-case considerations that are not included on the checklist. The inspector should identify additional permit requirements and verify compliance with these conditions as well. To accomplish this, it is recommended that the inspector expand the checklist, if necessary, to ensure that it is specific to the NPDES permit and the sludge final use or disposal activity. The inspector should complete the checklist and should incorporate his/her findings and conclusions in the final inspection report prepared for the facility.

The NPDES compliance inspector should also consult EPA's *Guidance for NPDES Compliance Inspector: Evaluation of Sludge Treatment Processes* (EPA, 1991a) when preparing to conduct a sludge inspection. This technical reference presents a detailed examination of sludge unit processes and contains extensive technical checklists that summarize the most critical elements of sludge thickening, stabilization, conditioning, dewatering, and disinfection. A technical understanding of the proper design and operation of the sludge treatment processes is essential for conducting thorough and informed sludge inspections.

INSPECTION PREPARATION

On preparing for the inspection, the inspector should:

- Review the NPDES permit (or the facility's sludge permit, if applicable). When reviewing the NPDES permit file in preparation for the inspection, identify:
  - Permit conditions applicable to sludge including treatment; general requirements; management practices; and monitoring, reporting, and recordkeeping requirements.
  - Any additional requirements in the NPDES permit that may reflect state regulations. Additionally, the NPDES permit may incorporate a separate state permit by reference, in which case the state permit is also enforceable under the federal CWA.
- Review sludge self-monitoring data.
- Become familiar with the sludge disposal practices used.

- Review appropriate federal regulations (i.e., 40 CFR Part 503, or 40 CFR Part 258 if sludge is disposed of in a municipal solid waste landfill, and any other applicable state or local regulations).
- Review relevant guidance for background information and implementation procedures (e.g., guidelines on calculating agronomic rate, EPA's Process Design Manuals (EPA, 1975; EPA, 1979; EPA, 1982; EPA, 1995a)).
- Verify that records kept by the permittee help in evaluation of compliance with sludge requirements.

RECORDS REVIEW

The sewage sludge regulations contain recordkeeping and reporting requirements. The facility's NPDES or sludge permit may have additional recordkeeping or reporting requirements. The inspector should conduct an evaluation of the sludge records and reports found at the facility to determine compliance with these recordkeeping and reporting requirements. The inspector may find sampling records and files containing sludge feed rate measurements from several different wastestreams. The inspector should use the procedures listed below for these routine inspections. If suspected violations are uncovered during the routine evaluation, a more intensive investigation should be conducted.

The inspector should evaluate compliance by asking the following questions:

- Does the facility have all required information available for review?
- Does the facility address all regulated pollutants and sludge use and disposal practices?
- Does the facility have all the current sludge information?
- Does the facility maintain sludge records for at least 5 years?
- Does the facility's information contained in the sludge records support the data submitted to the permitting authority?
- Do the facility's records indicate areas needing further investigation?

The inspector should also identify whether violations of sludge-related permit requirements (e.g., concentration limits and/or management practices) have been reported to the control authority, as required by the permit. Finally, the inspector should verify that the permittee has notified EPA of any changes to sludge use or disposal practices.

Evaluation Procedures

The inspector should first review the permit and fact sheet and list all sludge recordkeeping requirements.

Table 10-1 is a list of records that may be relevant for sludge. This list is supplemented by Table 10-2, which describes records relevant to the operation of specific sludge treatment unit processes. Throughout the inspection, compare the facility's operations with the permit conditions to verify that required permit activities for sludge are correct, current, and complete.

An evaluation of sludge self-monitoring records and/or procedures involves the same elements as an evaluation of their wastewater monitoring data; however, there are some special considerations inherent in sludge sampling. In evaluating the permittee's records, inspectors should look for documentation regarding:

- Regulated pollutants—As identified in the NPDES permit or applicable federal or state regulations.
- Monitoring frequency—As identified in the NPDES permit or applicable federal or state regulations. The inspector should note that 40 CFR Part 503 establishes minimum monitoring frequencies based on the quantity of sewage sludge used or disposed of.
- Sample location—The appropriate sampling point is the final treatment process the sludge goes through before leaving the treatment plant for use or disposal. For example, if a composted sludge is land applied, the finish compost pile/distribution pile should be sampled. If digested sludge is land applied, the sludge should be sampled as it is transferred from the digester or dewatering to the truck prior to being hauled off-site. Table 10-3 identifies sludge sampling points appropriate for the various types of treated sludge.
- Sample types—Grabs or composites may be appropriate depending on the situation, but it is important to note that a grab sample from a lagoon, drying bed, compost pile, or truck must consist of numerous samples collected from various places in the lagoon, bed, pile, or truck and must be combined to make a representative sample.
- Sample volume—If evaluating the sample collection process or taking samples, the inspector must ensure that the container is not filled completely. Some space should be left to allow for expansion of the sample due to gas production. Rapid cooling of the sample will also reduce gas production.
- Sample containers—Sample containers are generally the same types as those used for collection of wastewater samples.
- EPA sample identification methods—Same as for wastewater sampling.
- Preservation and holding times—The primary difference in sludge preservation is that samples should not be chemically preserved in the field because the sludge matrix makes it difficult to thoroughly mix the preservative into the sample. However, samples should be iced.
- Chain-of-custody—Same as for wastewater sampling.
- Quality control—Same as for wastewater sampling.
- Analytical procedures used by lab—The analytical methods used for sludge are different from those used for wastewater. Approved analytical methods are listed in 40 CFR 503.8 or 40 CFR Part 136, where 40 CFR Part 503 does not require a specific method. For example, 40 CFR Part 503 requires that analyses for inorganic pollutants use the procedures in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 1980a). The inspector should note the information recorded regarding sample

handling and analysis at the laboratory and verify that it is correct. If evaluating the laboratory, the procedures are the same as those followed in a PAI. The inspector should look at:

  - Analytical procedures
  - Laboratory services
  - Instruments and equipment
    - Calibration
    - Maintenance
  - Supplies
  - Quality Assurance/Quality Control (QA/QC)
    - Precision and accuracy of measurement process
    - Data handling and reporting
    - Records retention
    - Personnel qualifications

- Analytical results—Verify that results documented in the files are consistent with those reported.

The inspector should verify that reporting requirements are fulfilled according to the permit and applicable regulations. The NPDES permit may or may not have specific reporting requirements; however, the 40 CFR Part 503 sludge standards have specific reporting requirements that apply regardless of whether they appear in the NPDES permit. The May 1989 revisions to the NPDES regulations (54 FR 18716) established standard permit conditions regarding notification of change and at least annual reporting of sludge monitoring results. As NPDES permits are reissued, they will contain, at a minimum, these standard conditions as well as conditions specified in 40 CFR Part 503. Based on the applicable requirements, the inspector should verify that:

- Reports contain all required information.
- Reports are submitted at the required frequency.
- Data are reported in the Discharge Monitoring Report (DMR) or other approved form.

Inspectors should review unit operation records to verify compliance with pathogen and vector attraction reduction requirements. Table 10-4, Table 10-5, and Table 10-6 list the records and operating requirements for the 40 CFR Part 503, Class A pathogen reduction alternatives, the Class B pathogen reduction alternatives, and the vector attraction reduction options, respectively. Inspectors are not expected to review each monitoring record, but rather to verify that records are being maintained and are available for review. If a permittee has problems meeting either its pathogen or vector attraction reduction requirements (e.g., fecal coliform or percent volatile solids reduction), the inspector should review treatment operating records to identify potential noncompliance with the operating requirements specified in 40 CFR Part 503 for the pathogen and vector reduction process employed by the permittee. For example, an

inspector might check a treatment facility's pH or temperature records to determine whether the sludge has been maintained at the appropriate pH or temperature for the required duration during treatment.

The inspector should verify that records are available for all disposal practices:

- Volume of sludge disposed of.
- Sludge quality data.
- Specific records appropriate for demonstrating compliance with the general requirements, management practices, and operational standards.

The inspector should verify whether records are maintained in accordance with permit requirements. Federal regulations provide that all permits must include a provision requiring that sludge records be kept by the appropriate entity for five years. The regulations establish specific recordkeeping requirements for each party involved in the sewage sludge use or disposal process. During records review, the inspector may observe:

- Records not organized or placed in different areas throughout the facility.
- Non-representative sampling of disposed sludge.
- Incorrect reporting of sludge, e.g., failure to report on a dry weight basis.
- Inaccurate recordkeeping to determine pathogen and vector attraction reduction.
- Process control parameters that are not maintained.

FACILITY SITE REVIEW

In the facility site review, the inspector should include any area where sludge is generated, treated, stored, dewatered or disposed. A visual inspection can determine where monitoring devices are place and whether they are appropriate.

Inspection of Solids Handling Unit Processes

Sludge processing arguably poses the greatest challenges in wastewater treatment from the standpoints of design, operation, and maintenance.

When conducting the walk-through visual inspection of the facility, the inspector should be aware of, and look for, physical conditions that are indicative of potential or existing problems. The inspector should also note any out of service equipment and the general conditions of the area and equipment. Some of the more common indicators of potential problems are listed in Table 10-7. The presence of these conditions may warrant a more in-depth inspection of the sludge treatment processes. An optional checklist is provided at the end of this chapter to assist the inspector during the facility site review. The questions on this checklist are sludge-specific and should be asked in conjunction with the Facility Site Review checklist. In addition, many of the questions in the NPDES checklist relate to the overall operation of the facility and therefore, can also be applied to sludge evaluations (e.g., treatment units properly operated and maintained).

The inspector should determine whether the facility is operating its sludge treatment and disposal processes in a manner consistent with the requirements established in its NPDES permit. If the inspector discovers conditions at the facility that threaten public health or the environment (e.g., contaminating groundwater or surface water, exposing the public to pathogens or disease vectors, or compromising public safety), the inspector should inform the enforcement staff so that appropriate action can be taken. If known endangerment is discovered, the criminal investigations unit should be informed.

Many large-scale operations are conducted outside, such as sludge drying, composting, temporary and long-term storage, and loading and hauling. Inspectors should note these outside operations' exposure to rainfall and runoff collection and treatment methods. If stormwater collection devices have been constructed, the inspector should evaluate the performance and maintenance of these devices as well as their design capacity (e.g., the 10-year, 24-hour storm event or the 25-year, 24-hour storm event). Visual observations can detect obvious problems that may contribute to the contamination of surface water or groundwater such as erosion, breaches of dikes or berms, or cracks in the concrete or asphalt. The inspector should inquire as to whether the capacity of the collection devices has ever been exceeded during any storm event.

The sludge loading area should be inspected to determine how the sludge is being hauled or transported. The inspector should note the size of the truckloads and the number of truckloads hauled over a 1-day period (or another time period). Table 10-4, Table 10-5, and Table 10-6 are useful to the inspector in verifying the permittee's records and reports on the volume of sludge generated and disposed of.

Sludge Storage

The inspector should also verify that the permittee has adequate storage capacity for its sludge in the event that its preferred disposal method is interrupted for any reason (e.g., noncompliance with cumulative loading rates on the land application site). There are no federal requirements specifying a minimal storage capacity; the appropriate capacity will vary depending on the amount of sludge generated and the facility's use or disposal option(s). Storage capacity should address normal, routine storage prior to disposal and should anticipate emergency conditions, such as:

- Equipment malfunction
- Inclement weather
- Unanticipated loss of disposal site:
  - Farmer decides to discontinue use of sewage sludge
  - Landfill violates requirements and may no longer accept sludge or must close

Some states have developed storage capacity requirements. If the permittee cannot dispose of its sludge in the preferred manner, it should have either adequate storage capacity for its sludge or clearly established plans for alternative methods of disposal.

SAMPLING AND LABORATORY QUALITY ASSURANCE (QA)

The sludge inspection should evaluate the nature, scope, and adequacy of sludge sampling and analysis conducted by the permittee. The most likely existing inspection vehicle for conducting this evaluation is the PAI, since it involves a detailed assessment of the permittee's self-monitoring activities, including sample collection and laboratory analysis (likely completed by an off-site laboratory). The findings of the sampling and laboratory QA review should be summarized by the inspector and included in the final inspection report for the facility.

Sampling Procedures and Techniques

The inspector's evaluation of the permittee's sludge sampling procedures will address similar criteria as those evaluated in the context of wastewater sampling. The sampling procedure elements that should be evaluated during the inspection include:

- Sample collection techniques:
  - Selection of representative sampling sites
  - Sample types
  - Sample volume
  - Sample containers
- EPA sample identification methods
- Sample preservation and holding time
- Chain-of-custody and shipment of samples
- Quality control (QC):
  - Duplicates
  - Blanks
- Data handling and reporting

A detailed discussion on evaluating these elements can be found in Chapter 5. While many of these elements are evaluated using the same criteria, regardless of the media being sampled, sludge sample collection techniques and sample preservation are different. The inspector should review EPA's sewage sludge sampling video and refer to EPA's *POTW Sludge Sampling and Analysis Guidance Document* (EPA, 1989) for detailed information regarding sludge sampling procedures. Additionally, the inspector can review 40 CFR Part 136 for additional methods. Table 10-3 of this manual summarizes appropriate sample locations. Lists of approved biosolids analytical methods, sample containers, preservation techniques, and holding times for biosolids samples can be found on EPA's website at: https://www.epa.gov/biosolids/additional-information-biosolids-managers#analytical. In addition to these references, a few special sludge sampling considerations are described below.

- Equipment. The equipment used to collect sludge samples is different from that used to collect wastewater samples. The automatic composite samplers used to collect wastewater cannot be used to collect sludge samples because the high solids content of the sludge fouls the tubing. The type of equipment used to collect samples of soil or

other solid waste material is more appropriate for the collection of sludge samples. Stainless steel buckets, trowels, and augers are typically used to collect solid sludge cake. Graduated glass or plastic pitchers or cylinders, or plastic or stainless steel buckets are used to collect liquid sludge samples.

- Sample Location. If the permit does not identify a specific sludge sampling location, the inspector must select one. See EPA's 1993 sewage sludge sampling video for an overview of this process (EPA, 1993a). The inspector can review 40 CFR Part 136 for additional methods. EPA's *POTW Sludge Sampling and Analysis Guidance Manual* (EPA, 1989) states that for purposes of enforcement, sludge samples must come from the treatment unit process immediately prior to sludge disposal or end use. Often, the last unit process is one of the dewatering processes described in the accompanying technical guidance. Table 10-3, EPA's *POTW Sludge Sampling and Analysis Guidance Manual* (EPA, 1989a), suggests appropriate sampling points for a variety of unit processes.

Table 10-1. Records Relevant for Sludge Operations

Sludge Use/Disposal Records
• Volume • Type of use and/or disposal options used • Use/disposal sites
Sludge Operating Records
• Daily operating log • Equipment maintenance scheduled and completed
Sludge Monitoring Records
• Constituents/pollutants in sludge • Mass of sludge generated and disposed of (in dry metric tons per year)
Sludge Sampling and Analytical Data
• Dates, times, and locations of sampling • Sampling protocols and analytical methods • Results of analyses • Dates and times of analyses • Name(s) of analysis and sampling personnel
Sludge Laboratory Records
• Calibration and maintenance of equipment • Laboratory bench sheets or logs and calculations • Quality Assurance/Quality Control (QA/QC) records

Table 10-2. Operating Records for Specific Unit Processes

THICKENING PROCESSES		
Gravity Thickening	**Dissolved Air Flotation**	**Centrifuge**

• Overflow volume/rate
• Influent flow
• Percent solids
  - Sludge feed
  - Thickened sludge
  - Overflow
• Sludge blanket depth
	• Sludge feed rate
	• Recycle flow
	• Daily operating time
	• Percent solids
	  - Sludge feed
	  - Thickened sludge
	  - Subnatant
	• Floating sludge depth
	• Air flow rate
	• Retention tank pressure
	• Percent solids capture
	• Detention time
	• Air to solid ratio
		• Influent sludge flows
		• Volume cake produced
		• Percent solids
		  - Sludge feed
		  - Centrate
		  - Sludge cake
		• Daily operating time

STABILIZATION PROCESSES (Pathogen and/or Vector Attraction Reduction)		
Aerobic Digestion	**Anaerobic Digestion**	**Incineration**

• Air supply
• Solids retention time
• Temperature
• DO level
• pH
• Feed sludge
  - TS, TVS, and pH
  - Flow rate
• Digested sludge
  - SOUR
  - TS, TVS, and pH
  - Flow rate
• Supernatant
  - Flow rate and BOD
  - TSS and pH
	• Detention time
	• Temperature
	• pH and alkalinity
	• Gas production and quality
	• Volatile acids
	• Feed sludge
	  - TS, TVS, and pH
	  - Flow rate
	• Digested sludge
	  - TS, TVS, and pH
	  - Flow rate
	• Supernatant
	  - Flow rate and BOD
	  - TSS and pH
	• Cleaning frequency
		• Operating schedule
		• Sludge feed
		  - Solids content
		  - Feed rate
		  - Volatile solids
		• Combustion temperature
		• Sludge residence time
		• Fuel flow
		• Off-gas oxygen content
		• Air feed rate
		• Emission control equipment
		  - Pressure drop
		• Type of fuel
		• Volume of ash produced
		• Stack gas monitoring

Heat Temperature	**Composting**	**Chemical Conditioning/Stabilization**

• Temperature/time
• Pressure
• Detention time
• Feed sludge
  - TS and TVS
  - Flow rate
  - Percent solids
• End product volatile solids
	• Oxygen concentration
	• Temperature and time
	• Turning frequency
	• Percent sludge solids
	• Type and amount of bulking agent(s)
	• Header pressure
		• Chemical types and dosage
		• Mixing
		• pH
		• Temperature

Electron Irradiation	**Gamma Irradiation**	
• Sludge feed rate • Electron dosage • Temperature	• Sludge feed rate • Gamma ray source strength	
DEWATERING PROCESS		

Table 10-2. Operating Records for Specific Unit Processes

Vacuum Filter	Pressure Filter	Belt Filter Press

• Sludge feed
  - Total solids
• Sludge cake
  - Total solids
• Filtrate
  - Flow
  - BOD
  - TSS
• Maintenance
• Spare parts
	• Sludge feed percent solids
	• Sludge cake percent solids
	• Volume of sludge processed
	• Cycle length
	• Volume conditioning chemicals
	• Filtrate
	  - Flow
	  - BOD
	  - TSS
		• Loading rate
		• Operating speed
		• Feed slurry
		  - Total solids and flow
		• Dewatered sludge
		  - Total solids
		  - Flow
		• Filtrate and wash water
		  - BOD and SS
		  - TSS and flow
		• Preventive maintenance
		• Polymer

Drying Bed	**Drying Lagoons**	**Heat Drying**

• Sludge loading rate
• Quantity in bed
• Depth of sludge in bed
• Date deposited
• Detention time
• Ambient temperature
• Drying bed construction (i.e., lined)
• Undertrain destination
• Percent solids of the sludge feed and of the dewatered sludge
	• Sludge loading rate
	• Percent solids
	  - Sludge
	  - Decant
	• Quantity in lagoon
	• Depth in lagoon
	• Date deposited
	• Drying time
	• Rainfall
		• Operating schedule
		  - Start-up
		  - Shut down
		• Sludge feed rate
		• Percent solids
		  - Sludge feed
		  - Dried/Pelletized product
		• Fuel consumption
		• Air flow
		• Drying temperature
		• Detention time
		• Stack gas monitoring
		  - Oxygen
		  - Particulates
		  - Carbon monoxide
		  - Carbon dioxide

LEGEND:
DO = Dissolved Oxygen
TS = Total Solids
TVS = Total Volatile Solids
BOD = Biochemical Oxygen Demand
TSS = Total Suspended Solids
SS = Suspended Solids
SOUR = Specific Oxygen Uptake Rate

Table 10-3. Sludge Sampling Points

Sludge Type	Sampling Point
Anaerobically Digested	Sample from taps on the discharge side of positive displacement pumps.
Aerobically Digested	Sample from taps on the discharge lines from pumps. If batch digester is used, sample directly from the digester. Two cautionary notes regarding this practice: • If aerated during sampling, air entrains in the sample. Volatile organic compounds may purge with escaping air. • When aeration is shut off, solids separate rapidly in well-digested sludge.
Thickened	Sample from taps on the discharge side of positive displacement pumps.
Heat Treated	Sample from taps on the discharge side of positive displacement pumps after decanting. Be careful when sampling heat treatment sludge because of: • High tendency for solids separation. • High temperature of samples (frequently >60°C) can cause problems with certain sample containers due to cooling and subsequent contraction of entrained gases.
Dewatered by Belt Filter Press, Plate and Frame Press, Centrifuge, or Vacuum Filter Press	Sample from sludge cake discharge chute and conveyor.
	Alternatively, sample from collection container or storage bin for the dewatered sludge; sample from many locations within the storage bin and at various depths, collect equal samples from each point, and combine them to form one sample of the total storage bin.
Dewatered or Air Dried in Drying Beds, or Bin or Truck Bed	Divide bed into four quadrants, collect equal sample volume from the center of each quadrant, and combine them to form one sample of the total bed. Each grab sample should include the entire depth of the sludge (down to the sand).
Composted	Collect full core samples from randomly selected sites in the pile. Sample directly from front-end loader or other conveyance device as the sludge is being loaded into trucks to be hauled away.

- Sample Collection Techniques. Obtaining a representative sample of sludge is difficult when the sludge is not flowing through a pipe or along a conveyer. To obtain a representative sample of sludge from a sludge bed or lagoon, a compost pile, or a truck, several samples must be taken from various places in the pile and "combined" to make a representative sample.
- Sample Preservation. Samples of solid sludge are not usually preserved in the field because it is difficult to thoroughly mix the preservative throughout the sludge sample. It is best to preserve sludge samples that are high in solids at the laboratory. Use the appropriate field preservative to chill the sample to 4°C. Note, some exemptions do exist such as a sample for the Specific Oxygen Uptake Rate (SOUR), which should be

kept at the same temperature as the aerobic digester and analyzed within 30 minutes of sample collection.

Laboratory Analysis and Quality Assurance

During a PAI, the inspector is already conducting an in-depth evaluation of the permittee's laboratory analytical techniques and QA/QC procedures. The following elements are evaluated during this inspection:

- Permittee sample handling procedures in the laboratory.
- Laboratory analysis techniques:
  - Permittee laboratory analytical procedures (analytical methods specified by 40 CFR Part 503 or other methods established in the permit).
  - Laboratory services.
  - Instruments and equipment.
  - Supplies.
- QA/QC:
  - Precision and accuracy of the measurement process.
  - Data handling and reporting.
  - Sludge records retention (for 5 years).
  - Personnel qualifications.

Again, many of these elements are evaluated according to the same criteria regardless of the sample being analyzed. The inspector is referred to Chapter 7 and EPA's *NPDES Compliance Monitoring Inspector Training Module: Laboratory Analysis* (EPA, 1990a) for general guidance on inspecting the permittee's laboratory procedures. There are some differences in sample preparation and analytical techniques for sludge with which the inspector should be familiar.

In conducting the sludge component of the PAI, the inspector should closely evaluate the permittee's sample preparation procedures. The sludge matrix is more complex and variable than the wastewater matrix; therefore, the laboratory's development of sample preparation techniques is of particular concern.

The NPDES permit may require the permittee to analyze sludge for conventional pollutants, inorganic pollutants, metals, and pathogens (depending on the ultimate sludge disposal practice). For example, sludge that is going to be land applied will be analyzed for nine metals and nitrogen to determine the appropriate application rate. Table 10-8 lists the constituents required to be monitored by 40 CFR 503. The regulations at 40 CFR 503.8 contain a listing of approved analytical methods and volatile solids reduction calculations that must be used for monitoring sludge quality.

Lists of approved biosolids analytical methods, sample containers, preservation techniques, and holding times for biosolids samples can be found on EPA's website at: https://www.epa.gov/biosolids/additional-information-biosolids-managers#analytical.

The inspector should keep the following points in mind when reviewing the permittee's lab and analytical results:

- The sewage sludge standards are expressed on a dry weight basis. Laboratory results for sludge are typically reported in one of two forms, wet weight (i.e., mg/L) or dry weight (i.e., mg/kg). Watch out for mg/kg units that are wet weight rather than dry weight. The laboratory should be providing the results on a dry weight basis. If the laboratory results are reported on a wet weight basis (i.e., in mg/L), the results for each pollutant in each sample must be recalculated to determine the dry weight concentration. To accomplish this conversion, the percent total solids in the sludge sample must be known. Thus, the lab must analyze the sample for percent solids using Method 2540G of *Standard Methods for the Examination of Water and Wastewater*, 22nd Edition (American Public Health Association (APHA), American Water Works Association (AWWA), and World Economic Forum (WEF), 2013) or by another approved method in 40 CFR Part 136.

  The following equation can be used to determine the dry weight concentration because the equation uses the assumption that the specific gravity of water and sewage sludge are both equal to one. However, this assumption holds true only when the solids concentration in the sludge is low. The calculated dry weight concentration may vary slightly from the actual concentration as the solids content increases because the density of the sewage sludge may no longer be equal to that of water. This concern does not arise when the solids content of sludge is usually low. EPA is aware of this potential problem and may decide regarding this matter at a later date.

  Determine the pollutant concentration on a dry weight basis using the following abbreviated conversion (EPA, 1988):

$$\text{PC (dry, mg/kg)} = \frac{\text{PC (wet, mg/L)}}{\text{(\% total solids)}}$$

In this formula, PC = Pollutant concentration, and % total solids is in decimal format.

A unit conversion is incorporated into the equation.

- For metals, a common analytical error is that labs conduct the metals analyses using analytical methods developed for water and wastewater. Analytical methods for water and wastewater are found in 40 CFR Part 136. Additional information can be found in *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association (APHA), American Water Works Association (AWWA), and World Economic Forum (WEF), 2013), while the solid waste analytical methods are found in latest version of *Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods* (EPA, 2014). If non-detects are found for the metal concentrations, it is likely that the laboratory is not following the method requirement of digesting equivalent to one gram of dry weight of solid.

- For sludge samples, all metals must be analyzed according to the methods presented in 40 CFR Part 136. Note that more than one method is provided for each pollutant. The difference between the methods is usually the equipment used (i.e., direct aspiration, furnace, or Inductively Coupled Plasma (ICP) scan) and the level of detection desired. Each of the methods is EPA-approved, but certain sample characteristics may require one to be used instead of another.
- Methods for analyzing additional inorganic parameters (e.g., nitrite, Total Kjeldahl Nitrogen (TKN)) are also found in 40 CFR Part 136, as well as in *Standard Methods for the Examination of Water and Wastewater*.

EPA's *Control of Pathogens and Vector Attraction in Sewage Sludge* (EPA, 2003) is a primary reference for regional, state, and local regulatory authorities and their constituents for successful compliance with 40 CFR Part 503, Subpart D requirements. Several new equivalencies have been recommended by the Pathogen Equivalency Committee (PEC) since the latest edition of EPA's *Control of Pathogens and Vector Attraction in Sewage Sludge* (EPA, 2003) and are updated at EPA's Principal Biosolids Guidance website for processes to significantly reduce pathogens (PSRPs) and processes to further reduce pathogens (PFRPs) (accessible at: http://www.epa.gov/biosolids). Also note that EPA finalized pathogen reduction methods for fecal coliform (EPA Methods 1680 or 1681) and *Salmonella* (EPA Method 1682) in June 2005. EPA recommends that facilities testing under 40 CFR Part 503 use the new methods; however, these methods are not required by federal regulations.

Table 10-4. Recordkeeping Requirements for Class A Pathogen Reduction Alternatives[a]

Alternative A1—Time and Temperature
• Analytical results for density of *Salmonella sp*. bacteria or fecal coliform (most probable number).
• Sludge temperature at representative locations.
• Time (days, hours, minutes) temperature maintained.
Alternative A2—Alkaline Treatment
• Analytical results for density of *Salmonella sp*. bacteria or fecal coliform (most probable number).
• Sludge pH.
• Time (hours) pH maintained above 12 (at least 72 hours).
• Sludge temperature.
• Percent solids in sludge after drying (at least 50 percent).
Alternative A3—Analysis and Operation
• Analytical results for density of *Salmonella sp.* bacteria or fecal coliform (most probable number).
• Analytical results for density of enteric viruses (plaque forming unit/4 grams of total solids, on a dry weight basis) prior to pathogen reduction and, when appropriate, after treatment.
• Analytical results for density of viable helminth ova (number/4 grams of total solids, dry weight) prior to pathogen reduction and, when appropriate, after treatment.
• Values or ranges of values for operating parameters to indicate consistent pathogen reduction treatment.
Alternative A4—Analysis Only
• Analytical results for density of *Salmonella sp.* bacteria or fecal coliform (most probable number, dry weight basis).
• Analytical results for density of enteric viruses (plaque forming unit/4 grams of total solids, dry weight).

Table 10-4. Recordkeeping Requirements for Class A Pathogen Reduction Alternatives[a]

<table>
<tr><td colspan="2">• Analytical results for density of viable helminth ova (number /4 grams of total solids, dry weight).</td></tr>
<tr><td colspan="2">Alternative A5—Processes to Further Reduce Pathogens (PFRP)</td></tr>
<tr><td>• Heat Drying:
- Analytical results for density of Salmonella sp. bacteria or fecal coliform (most probable number).
- Moisture content of dried sludge <10 percent.
- Logs documenting temperature of sludge particles or wet bulb temperature of exit gas exceeding 80°C.
• Thermophilic Aerobic Digestion:
- Analytical results for density of Salmonella sp. bacteria or fecal coliform (most probable number).
- Dissolved oxygen concentration in digester ≤>1 mg/L.
- Logs documenting temperature maintained at 55–60°C for 10 days.
• Heat Treatment:
- Analytical results for density of Salmonella sp. bacteria or fecal coliform (most probable number).
- Logs documenting sludge heated to temperatures > greater than 180°C for 30 minutes.
• Pasteurization:
- Analytical results for density of Salmonella sp. bacteria or fecal coliform (most probable number).
- Temperature maintained at or above 70°C for at least 30 minutes.</td><td>• Composting:
- Analytical results for density of Salmonella sp. bacteria or fecal coliform (most probable number).
- Description of composting method.
- Logs documenting temperature maintained at or above 55°C for 3 days if within vessel or static aerated pile composting method.
- Logs documenting temperature maintained at or above 55°C for 15 days if windrow compost method.
- Logs documenting compost pile turned at least five times per day during the 15day period, if windrow compost method.
• Gamma Ray Irradiation:
- Analytical results for density of Salmonella sp. bacteria or fecal coliform (most probable number).
- Gamma ray isotope used.
- Gamma ray dosage at least 1.0 megarad.
- Ambient room temperature log.
• Beta Ray Irradiation:
- Analytical results for density of Salmonella spp. bacteria or fecal coliform (most probable number).
- Beta ray dosage at least 1.0 megarad.
- Ambient room temperature log.</td></tr>
<tr><td colspan="2">Alternative A6—PFRP Equivalent</td></tr>
<tr><td colspan="2">• Operating parameters or pathogen levels as necessary to demonstrate equivalency to the PFRP.
• Analytical results for density of Salmonella sp. bacteria or fecal coliform (most probable number).</td></tr>
</table>

[a] Note that several new equivalencies have been recommended by PEC since 2003, when EPA revised the principal biosolids guidance document. Also, EPA recommended new methods in 2005 for the analysis of fecal coliform and *Salmonella*.

Table 10-5. Recordkeeping Requirements for Class B Pathogen Reduction Alternatives[a]

Alternative B1—Fecal Coliform Count
• Number of samples collected during each monitoring event.
• Analytical results for density of fecal coliform for each sample collected.
Alternative B2—Processes to Significantly Reduce Pathogens (PSRP)
• Aerobic Digestion: - Dissolved oxygen concentration. - Volatile solids content before and after digestion. - Mean residence time of sludge in digester and the corresponding method used to calculate this value. - Logs showing temperature was maintained for sufficient period of time (ranging from 60 days at 15°C to 40 days at 20°C).
• Air Drying: - Description of drying bed design. - Depth of sludge on drying bed. - Drying time in days. - Daily average ambient temperature.
• Anaerobic Digestion: - Volatile solids content before and after digestion. - Mean residence time of sludge in digester and the corresponding method used to calculate this value. - Logs showing temperature was maintained for a sufficient period of time (ranging from 15 days at 35°C to 55°C and 60 days at 20°C). - Temperature logs of sludge in digester.
• Composting: - Description of composting method. - Daily temperature logs documenting sludge maintained at 40°C for 5 days. - Hourly readings showing temperature exceeded 55°C for 4 consecutive hours.
• Lime Stabilization: - pH of sludge immediately and then 2 hours after addition of lime, without any further addition of lime.
Alternative B3—PSRP Equivalent
• Operating parameters or pathogen levels as necessary to demonstrate equivalency to PSRP.

[a] Note that several new equivalencies have been recommended by PEC since 2003, when EPA revised the principal biosolids guidance document. Also, EPA recommended new methods in 2005 for the analysis of fecal coliform and *Salmonella*.

Table 10-6. Recordkeeping Requirements for Vector Attraction Reduction Sludge Processing Options

Option 1—Volatile Solids (VS) Reduction	**Option 5—Aerobic Processing (Thermophilic Aerobic Digestion/Composting)**
• Volatile solids concentration of raw and final sludge streams (mg/kg). • Calculations showing 38 percent reduction in volatile solids.[a]	• Sludge detention time in digester/composting. • Temperature logs showing average temperature above 45°C and minimum temperature above 40°C for 14 consecutive days.

Table 10-6. Recordkeeping Requirements for Vector Attraction Reduction Sludge Processing Options

Options 2 and 3—Bench-Scale VS Reduction	Options 6—Alkaline Treatment
• One-time description of bench-scale digester. • Time (days) that sample was further digested in bench-scale digester (30 days for aerobically and 40 days for anaerobically digested sludge). • Temperature logs showing temperature maintained at 20°C for aerobically or between 30°C and 37°C for anaerobically digested sludge. • Volatile solids concentration of sludge (mg/kg) before and after bench-scale digestion.	• Logs demonstrating the hours that pH of sludge/alkaline mixture was maintained (12 for 2 hours and 11.5 for an additional 22 hours). • Amount of alkaline added to sludge (lbs. or gals). • Amount of sludge treated.
Option 4—Specific Oxygen Uptake Rate for Aerobically Digested Sewage Sludge	**Options 7 and 8—Drying**
• Dissolved oxygen readings for sludge sample over 15-minute intervals (mg/L). • Temperature logs showing test was corrected to conducted at 20°C. • Total solids for sludge sample (g/L). • SOUR calculations (mg/g).	• Results of percent solids (dry weight) test. • Presence of unstabilized solids generated during primary treatment.

[a] Methods for calculating VS reduction under Option 1 can be found in Appendix C of EPA's *Control of Pathogens and Vector Attraction in Sewage Sludge*. EPA-625-R 92-013.

Table 10-7. Sludge Handling Process Evaluation

General Indicators of Problems
• Inadequate sludge removal from clarifiers or thickeners. • Poor dewatering characteristics of thermal treated sludge. • Thickened sludge too thin. • Fouling of overflow weirs on gravity thickeners. • Air flotation skimmer blade binding on beaching plate. • Substantial downtime of sludge treatment units. • Sludge disposal inadequate to keep treatment system in balance. • Mass balance inappropriate (ratio of sludge wasted should be 0.65–0.85 lbs. of sludge per lb. of BOD removed). • Sludge decant or return flows high in solids.[a] • Odors. • Improper loading rates.
Anaerobic Digestion Problems

Table 10-7. Sludge Handling Process Evaluation

- Inoperative mechanical or gas mixers.
- Inoperative sludge heater or low temperature.[a]
- Floating cover of digester tilting.
- Inadequate gas production.[a]
- Inoperative gas burner.
- Supernatant exuding sour odor from either primary or secondary digester.[a]
- Excessive suspended solids in supernatant.
- Supernatant recycle overloading the WWTP.
- pH problems.[a]

Aerobic Digestion Problems

- Excessive foaming in tank.[a]
- Objectionable odor in aerobically digested sludge.[a]
- Insufficient dissolved oxygen in digester.
- Digester overloaded.
- Clogging of diffusers in digester.
- Mechanical aerator failure in digester.
- Inadequate supernatant removal from sludge lagoons.
- Solids accumulation in tank.

Sludge Dewatering Problems

Drying Beds

- Poor sludge distribution on drying beds.
- Vegetation in drying beds (unless reed design).
- Dry sludge remaining on drying beds.
- Inadequate drying time on drying beds.[a]
- Some unused drying beds.
- Dry sludge stacked around drying beds where runoff may enter navigable waters.
- Filtrate from sludge drying beds returned to front of plant.

Centrifuge

- Excessive solids in fluid phase of sample after centrifugation.[a]
- Inadequate dryness of centrifugal sludge cake.[a]
- Excessive vibration or other mechanical problems.

Filter Press

- High level of solids in filtrate from filter presses or vacuum filters.[a]
- Thin filter cake caused by poor dewatering.
- Vacuum filter cloth binding.
- Low vacuum on filter.
- Improperly cleaned vacuum filter media.
- Sludge buildup on belts and/or rollers of filter press.
- Excessive moisture in belt filter press sludge cake.[a]
- Difficult cake discharge from filter presses.
- Filter cake sticks to solids conveying equipment of filter press.
- Frequent media binding of plate filter press.
- Sludge blowing out of filter press.
- Insufficient run time of sludge dewatering equipment.

Sludge Stabilization Problems

Lagoon

Table 10-7. Sludge Handling Process Evaluation

- Objectionable odor from sludge lagoon.
- Damage to dikes around sludge drying lagoons.
- Unlined sludge lagoons.
- Sludge lagoons full, overflowing sludge back to plant or to natural drainage.
- Deep rooted vegetation on dikes or berms.

Composting

- Piles that give off foul odor.
- Inoperable blower.
- Temperature does not reach 122–140°F (50–60°C) or is above 158°F (70°C).
- Uncontrolled stormwater runoff.

Heat Drying/Pelletizing

- Excess moisture in sludge feed.
- Insufficient air flow or drying temperature achieved.
- Inadequate drying of final product (excess moisture in final product).
- Excess odors associated with treatment area.
- Excess odors associated with treated product.

Alkaline Stabilization

- Insufficient amount of lime (or other alkaline additive) used to assure pH is raised sufficiently.
- Inadequate mixing provided to assure good contact of lime (or other alkaline additive) with sludge solids.
- pH problems.[a]
- Excess odors associated with treatment area.
- Excess odors associated with treated product.
- Excessive lime dust around treatment equipment.

Incineration

- Objectionable odors associated with treatment area.
- Evidence of excessive dust (ash) around unit.
- Visible smoke or dust exhaust from unit.
- Lack of compliance with air permit parameters.
- Spilling or leaking sludge from dewatered sludge transfer equipment.

Sludge Disposal Problems

- Sludge constituents not analyzed before disposal.
- Sludge not transported in appropriate and approved vehicle.
- Surface runoff of sludge at land application site.
- Liquid sludge (i.e., less than 10 percent solids) applied to landfill site.
- Sludge fails paint filter test.
- Inadequate coverage of sludge in subsurface plow injection system.
- Objectionable odors generated at land application site.[a]
- Slow drying of soil-sludge mixture in subsurface injection system.
- Sludge ponding at land application sites.
- Flies breeding, vectors, and/or odors at landfill site.
- Inadequate burial of sludge at landfill site.
- Excessive erosion at sludge sites.
- Sludge disposed of in non-permitted sites.
- Disposal not in accordance with federal, state, or local regulations.
- Sludge lagoons full and overflowing.[a]
- Inadequate runoff control at landfill or land application sites.

[a] Indicates serious problems with the sludge handling process.

Table 10-8. Pollutants Monitored for Land Application, Surface Disposal, and Incineration

Pollutant	Land Application	Surface Disposal (Unlined Units)	Incineration
Arsenic	✓	✓	✓
Beryllium			✓
Cadmium	✓		✓
Chromium		✓	✓
Copper	✓		
Lead	✓		✓
Mercury	✓		✓
Molybdenum	✓		
Nickel	✓	✓	✓
Selenium	✓		
Zinc	✓		
Nitrogen series	✓		

Organism to Be Monitored	Allowable Level in Sludge
Fecal Coliform[a]	1,000 Most Probable Number (MPN) per gram (Class A) of total solids (dry weight).
Salmonella sp.[a] Bacteria (in lieu of fecal coliform)	3 MPN per 4 grams of total solids (dry weight).
Enteric Viruses[b]	Less than one plaque-forming unit per 4 grams of total solids (dry weight).
Viable Helminth[b] Ova	Less than one viable helminth ovum per 4 grams of total solids (dry weight).
Fecal Coliform[c]	Less than 2 × 106 MPN or less than 2 × 106 colony-forming units per gram of total solids (dry weight) (expressed as geometric mean of the results of 7 individual samples).

[a] All Part 503 Class A Alternatives 1, 2, 3, 4, 5, 6.
[b] Class A Alternatives 3 and 4 only.
[c] Class B, Alternative 1.

C. REFERENCES

The following is a list of resources providing additional information on biosolids.

American Public Health Association (APHA), American Water Works Association (AWWA), and World Economic Forum (WEF). (2013). *Standard Methods for the Examination of Water and Wastewater*.

Clark, J.W., Wiessman, W., and Hammer, M. (1977) *Water Supply Pollution Control.* Harper and Row Publishers, 1977*Code of Federal Regulations. Standards for the Use or Disposal of Sewage Sludge*. 40 CFR Part 503, 58 FR 9387.

Culp, G.L., and Folks Heim, N. (1978). *Field Manual for Performance Evaluation and Troubleshooting at Municipal Wastewater Treatment Facilities*. U.S. Environmental Protection Agency, EPA 430/9-78-001.

Hinrichs, D.J. (1979). *Inspectors Guide for Evaluation of Municipal Wastewater Treatment Plants*. U.S. Environmental Protection Agency, 430/9-79-010.

Loeht, R.C. (1984). *Pollution Control for Agriculture*. Academic Press Inc.

National Research Council. (2002). *Biosolids Applied to Land: Advancing Standards and Practices*.

Metcalf and Eddy Inc. (2013). *Wastewater Engineering.* New York: McGraw-Hill Book Company.

Steel, E.W., and McGhee, T.J. (1979). *Water Supply and Sewerage*. New York: McGraw-Hill Book Company.

U.S. Congress. (1985). *Overview of Sewage Sludge and Effluent Management*. Office of Technology Assessment. C/R-36b/#10.

U.S. Environmental Protection Agency. (1973a). *Pathogen Risk Assessment Feasibility Study*. Office of Research and Development. EPA 670/2-73/098.

U.S. Environmental Protection Agency. (1973b). *Odors Emitted from Raw and Digested Sewage Sludge*. Office of Research and Development. EPA 670/2-73/098.

U.S. Environmental Protection Agency. (1975). *Process Design Manual for Suspended Solids Removal*. EPA 625/1-75-0032.

U.S. Environmental Protection Agency. (1976a). *Municipal Sludge Management: EPA Construction Grants Program*. Office of Water Program Operations. EPA 430/9-76/009.

U.S. Environmental Protection Agency. (1976b). *Application of Sewage Sludge to Cropland; Appraisal of Potential Hazards of the Heavy Metals to Plants and Animals.* Office of Water Program Operations. EPA 430/9-76/013.

U.S. Environmental Protection Agency. (1977). *Municipal Sludge Management: Environmental Factors*. Office of Water Program Operations. EPA 430/9-77/004.

U.S. Environmental Protection Agency. (1978a). *Applications of Sludge on Agricultural Land*. Municipal Construction Division, Office of Research and Development. EPA 600/2-78/131b.

U.S. Environmental Protection Agency. (1978b). *Sewage Disposal on Agricultural Soils: Chemical and Microbiological Implications*. Office of Research and Development. EPA 600/2-78/131b.

U.S. Environmental Protection Agency. (1978c). *Operations Manual, Sludge Handling and Conditioning*. Office of Water Program Operations. EPA 430/9-78-002.

U.S. Environmental Protection Agency. (1978d). *Municipal Sludge Landfills*. Environmental Research Information Center, Office of Solid Waste. EPA 625/1-78/010, SW-705.

U.S. Environmental Protection Agency. (1979). *Process Design Manual for Sludge Treatment and Disposal*. Municipal Environmental Research Laboratory. EPA 625/1-79-011.

U.S. Environmental Protection Agency. (1980a). *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)*. 3rd ed.

U.S. Environmental Protection Agency. (1980b). *Evaluation of Sludge Management Systems*. Office of Water Program Operations. EPA 430/9-80-001, MCD-61.

U.S. Environmental Protection Agency. (1981a). *Land Treatment of Municipal Wastewater*. EPA Center for Environmental Research Information. EPA 625/1-81-013.

U.S. Environmental Protection Agency. (1981b). *Composting Processes to Stabilize and Disinfect Municipal Sewage Sludge*. Office of Water Program Operations. EPA 430/9-81-011, MCD-79.

U.S. Environmental Protection Agency. (1982). *Process Design Manual for Dewatering Municipal Wastewater Sludges*. Office of Research and Development. EPA 625/1-82-014.

U.S. Environmental Protection Agency. (1983). *Land Application of Municipal Sludge*. Municipal Environmental Research Laboratory. EPA 625/1-83/016.

U.S. Environmental Protection Agency. (1984). *Use and Disposal of Municipal Wastewater Sludge*. Intra-Agency Sludge Task Force. EPA 625/10-84-003.

U.S. Environmental Protection Agency. (1985a). *Summary of Environmental Profiles and Hazard Indices for Constituents of Municipal Sludge*. Office of Water Regulations and Standards.

U.S. Environmental Protection Agency. (1985b). *Composting of Municipal Wastewater Sludges*. EPA Center for Environmental Research Information. EPA 625/4-85-014.

U.S. Environmental Protection Agency. (1985c). *Municipal Wastewater Sludge Combustion Technology*. EPA Center for Environmental Research Information, EPA 625/4-85-015.

U.S. Environmental Protection Agency. (1986). *Radioactivity of Municipal Sludge*. Office of Water Regulations and Standards.

U.S. Environmental Protection Agency. (1987a). *Dewatering Municipal Wastewater Sludges*, Office of Research and Development. EPA 625/1-87/014.

U.S. Environmental Protection Agency. (1987b). *Advanced Waste Treatment — Field Study Training Program.*

U.S. Environmental Protection Agency. (1988a). *Analytical Methods Used in the National Sewage Sludge Survey.*

U.S. Environmental Protection Agency. (1988b). *Sampling Procedures and Protocols for the National Sewage Sludge Survey*. Office of Water Regulations and Standards.

U.S. Environmental Protection Agency. (1989a). *POTW Sludge Sampling and Analysis Guidance Document*. Office of Water Enforcement and Permits. EPA 833-B-89-100.

U.S. Environmental Protection Agency. (1989b). *Control of Pathogens in Municipal Wastewater Sludge*. Center for Environmental Research Information. EPA 625/10-89/006.

U.S. Environmental Protection Agency. (1990a). *Analytical Methods for the National Sewage Sludge Survey*. Office of Water Regulations and Standards.

U.S. Environmental Protection Agency. (1990b). *NPDES Compliance Monitoring Inspector Training Module: Laboratory Analysis*. EPA 833-R-90-103.

U.S. Environmental Protection Agency. (1990c)*. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. EPA SW-846.

U.S. Environmental Protection Agency. (1991a). *Guidance Manual for NPDES Compliance Inspector: Evaluation of Sludge Treatment Processes*. EPA 833/B-91-100.

U.S. Environmental Protection Agency. (1991b). *Guidance Manual for NPDES Compliance Inspector: Verifying Compliance with Sludge Requirements*.

U.S. Environmental Protection Agency. (1992). *A Guide to the Federal EPA Rule for Land Application of Domestic Septage to Non-Public Contact Sites*. (Agricultural Land, Forests, and Reclamation Sites) Discussed in Relationship to Existing State Rules and Other Federal Regulations of Septage. EPA 832-B-92-005.

U.S. Environmental Protection Agency. (1993a). Video: *Sewage Sludge Sampling Techniques.*

U.S. Environmental Protection Agency. (1993b). *Preparing Sewage Sludge for Land Application or Surface Disposal; A Guide for Preparers of Sewage Sludge on the Monitoring, Recordkeeping, and Reporting Requirements of the Federal Standards for the Use or Disposal of Sewage Sludge in 40 CFR Part 503*. Office of Water. EPA 831-B-93-002a.

U.S. Environmental Protection Agency. (1994a). L*and Application of Sewage Sludge; A Guide for Land Appliers on the Recordkeeping and Reporting Requirements of the Federal Standards for the Use and Disposal of Sewage Sludge Management in 40 CFR Part 503*. EPA 831-B-93-002b.

U.S. Environmental Protection Agency. (1994b). *Surface Disposal of Sewage Sludge; A Guide for Owners/Operators of Surface Disposal Facilities on the Monitoring, Recordkeeping, and Reporting Requirements of the Federal Standards for the Use and Disposal of Sewage Sludge in 40 CFR Part 503.* EPA 831-B-93-002c.

U.S. Environmental Protection Agency. (1994c). *A Plain English Guide to the EPA Part 503 Biosolids Rule*. EPA 831-B-94-001.

U.S. Environmental Protection Agency. (1994d). *A Guide for Land Appliers on the Requirements of the Federal Standards for the Use or Disposal of Sewage Sludge, 40 CFR Part 503*. EPA/831-B-93-002b.

U.S. Environmental Protection Agency. (1995a). *Process Design Manual: Land Application of Sewage Sludge and Domestic Septage.* EPA/625/R-95/001.

U.S. Environmental Protection Agency. (1995b). *A Guide to the Biosolids Risk Assessments for the EPA Part 503 Rule*. EPA 832-B-93-005.

U.S. Environmental Protection Agency. (1999). *Proposed Rule Revising the Standards for Use and Disposal of Biosolids*. EPA 822-F-99-005.

U.S. Environmental Protection Agency. (2000a). *Biosolids Technology Fact Sheet Alkaline Stabilization of Biosolids*. EPA 832-F-00-052.

U.S. Environmental Protection Agency. (2000b). *Biosolids Technology Fact Sheet Centrifuge Thickening and Dewatering*. EPA 832-F-00-053.

U.S. Environmental Protection Agency. (2000c). *Biosolids Technology Fact Sheet Belt Filter Press*. EPA 832-F-00-057.

U.S. Environmental Protection Agency. (2000d). *Guide to Field Storage of Biosolids*. EPA 832-B-00-007.

U.S. Environmental Protection Agency. (2003). *Control of Pathogens and Vector Attraction in Sewage Sludge.* Office of Research and Development, EPA 625/R-92/013. Guidance updates accessible on Principal Biosolids Guidance website at: https://www.epa.gov/biosolids/control-pathogens-and-vector-attraction-sewage-sludge

U.S. Environmental Protection Agency. (2014). *Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods*. SW846 Update V.