### **TABLE OF CONTENTS**

VOLUME ONE

**SECTION A** 

-----

### PART I METHODS FOR ANALYTES AND PROPERTIES

### CHAPTER ONE - PROJECT QUALITY ASSURANCE AND QUALITY CONTROL

- 1.0 Introduction
- 1.1 Planning
- 1.2 Implementation
- 1.3 Assessment
- 1.4 References and Sources for Additional Information on Project Quality Assurance and Control
- 1.5 Glossary

### CHAPTER TWO - CHOOSING THE CORRECT PROCEDURE

- 2.0 Introduction
- 2.1 Guidance Regarding Flexibility Inherent to SW-846 Methods and the Precedence of SW-846 Quality Control Criteria
- 2.2 Information Necessary for Choosing the Correct Procedure
- 2.3 Choosing Procedures for Organic Analyses
- 2.4 Choosing Procedures for Characteristic Analyses
- 2.5 Choosing Procedures for Groundwater Analyses
- 2.6 Choosing Procedures for Inorganic Analyses
- 2.7 References

### CHAPTER THREE - INORGANIC ANALYTES

- 3.0 Introduction
- 3.1 Definitions
- 3.2 Safety
- 3.3 Sampling Considerations
- 3.4 Special Considerations for Determining Inorganic Analytes at Ultra-trace Concentration Levels
- 3.5 Reagent Purity
- 3.6 Sample Digestion Methods

Method 3005A: Acid Digestion of Waters for Total Recoverable or Dissolved Metals

for Analysis by FLAA or ICP Spectroscopy

**Method 3010A:** Acid Digestion of Aqueous Samples and Extracts for Total Metals

for Analysis by FLAA or ICP Spectroscopy

Method 3015A: Microwave Assisted Acid Digestion of Aqueous Samples and

**Extracts** 

Method 3020A: Acid Digestion of Aqueous Samples and Extracts for Total Metals

for Analysis by GFAA Spectroscopy

Method 3031: Acid Digestion of Oils for Metals Analysis by Atomic Absorption or

**ICP Spectrometry** 

Method 3040A: Dissolution Procedure for Oils, Greases, or Waxes Method 3050B: Acid Digestion of Sediments, Sludges, and Soils

Method 3051A: Microwave Assisted Acid Digestion of Sediments, Sludges, Soils,

and Oils

Method 3052: Microwave Assisted Acid Digestion of Siliceous and Organically

**Based Matrices** 

**Method 3060A:** Alkaline Digestion for Hexavalent Chromium

**Method 3200:** Mercury Species Fractionation and Quantification by Microwave

Assisted Extraction, Selective Solvent Extraction and/or Solid

Phase Extraction

### 3.7 Methods for Determination of Inorganic Analytes

Method 6010D: Inductively Coupled Plasma-Atomic Emission Spectrometry

Method 6020B: Inductively Coupled Plasma-Mass Spectrometry

**Method 6200:** Field Portable X-Ray Fluorescence Spectrometry for the

Determination of Elemental Concentrations in Soil and Sediment

**Method 6500:** Dissolved Inorganic Anions in Aqueous Matrices by Capillary Ion

Electrophoresis

Method 6800: Elemental and Speciated Isotope Dilution Mass Spectrometry

**Method 7000B:** Flame Atomic Absorption Spectrophotometry

**Method 7010:** Graphite Furnace Atomic Absorption Spectrophotometry

**Method 7061A:** Arsenic (Atomic Absorption, Gaseous Hydride)

Method 7062: Antimony and Arsenic (Atomic Absorption, Borohydride Reduction)
Method 7063: Arsenic in Aqueous Samples and Extracts by Anodic Stripping

Voltammetry (ASV)

Method 7195: Chromium, Hexavalent (Coprecipitation)
Method 7196A: Chromium, Hexavalent (Colorimetric)

**Method 7197:** Chromium, Hexavalent (Chelation/Extraction)

Method 7198: Chromium, Hexavalent (Differential Pulse Polarography)
Method 7199: Determination of Hexavalent Chromium in Drinking Water,
Groundwater and Industrial Wastewater Effluents by Ion

Chromatography

Method 7470A: Mercury in Liquid Waste (Manual Cold-Vapor Technique)
Method 7471B: Mercury in Solid or Semisolid Waste (Manual Cold-Vapor

Technique)

Method 7472: Mercury in Aqueous Samples and Extracts by Anodic Stripping

Voltammetry (ASV)

**Method 7473:** Mercury in Solids and Solutions by Thermal Decomposition,

Amalgamation, and Atomic Absorption Spectrophotometry

Method 7474: Mercury in Sediment and Tissue Samples by Atomic Fluorescence

Spectrometry

**Method 7580:** White Phosphorus (P<sub>4</sub>) by Solvent Extraction and Gas

Chromatography

**Method 7741A:** Selenium (Atomic Absorption, Gaseous Hydride)

**Method 7742:** Selenium (Atomic Absorption, Borohydride Reduction)

3.8 References for Previous Sections and the Tables and Figures

### VOLUME ONE

### **SECTION B**

\_\_\_\_\_

### CHAPTER ONE, REPRINTED - PROJECT QUALITY ASSURANCE AND QUALITY CONTROL

- 1.0 Introduction
- 1.1 Planning
- 1.2 Implementation
- 1.3 Assessment
- 1.4 References and Sources for Additional Information on Project Quality Assurance and Control
- 1.5 Glossary

### CHAPTER FOUR - ORGANIC ANALYTES

- 4.1 Sampling Considerations
- 4.2 Sample Preparation Methods

### 4.2.1 Extractions and Preparations

Method 3500C: Organic Extraction and Sample Preparation
Method 3510C: Separatory Funnel Liquid-Liquid Extraction
Method 3511: Organic Compounds in Water by Microextraction

Method 3520C: Continuous Liquid-Liquid Extraction Method 3535A: Solid-Phase Extraction (SPE)

**Method 3540C:** Soxhlet Extraction

**Method 3541:** Automated Soxhlet Extraction

Method 3542B: Extraction of Semivolatile Analytes Collected Using Method 0010

(Modified Method 5 Sampling Train)

**Method 3545A:** Pressurized Fluid Extraction (PFE)

Method 3546: Microwave Extraction Method 3550C: Ultrasonic Extraction

**Method 3560:** Supercritical Fluid Extraction of Total Recoverable Petroleum

**Hydrocarbons** 

**Method 3561:** Supercritical Fluid Extraction of Polynuclear Aromatic

Hydrocarbons

Method 3562: Supercritical Fluid Extraction of Polychlorinated Biphenyls (PCBs)

and Organochlorine Pesticides

**Method 3572:** Extraction of Wipe Samples for Chemical Agents

Method 3580A: Waste Dilution

**Method 3585:** Waste Dilution for Volatile Organics

**Method 5000:** Sample Preparation for Volatile Organic Compounds

Method 5021A: Volatile Organic Compounds in Soils and Other Solid Matrices

Using Equilibrium Headspace Analysis

**Method 5030B:** Purge-and-Trap for Aqueous Samples

**Method 5031:** Volatile, Nonpurgeable, Water-Soluble Compounds by Azeotropic

Distillation

**Method 5032:** Volatile Organic Compounds by Vacuum Distillation

SW-846 Update V CONTENTS - 4 Revision 8
July 2014

Closed-System Purge-and-Trap and Extraction for Volatile Method 5035:

Organics in Soil and Waste Samples

Method 5041A: Analysis for Desorption of Sorbent Cartridges from Volatile Organic

Sampling Train (VOST)

4.2.2 Cleanup

Method 3600C: Cleanup

Method 3610B: Alumina Cleanup

Alumina Column Cleanup and Separation of Petroleum Wastes **Method 3611B:** 

Method 3620C: Florisil Cleanup Method 3630C: Silica Gel Cleanup

**Gel-Permeation Cleanup** Method 3640A: Method 3650B: Acid-Base Partition Cleanup

Method 3660B: Sulfur Cleanup

Sulfuric Acid/Permanganate Cleanup Method 3665A:

#### 4.3 **Determination of Organic Analytes**

### 4.3.1 Gas Chromatographic Methods

Method 8000D: **Determinative Chromatographic Separations** 

Method 8011: 1,2-Dibromoethane and 1,2-Dibromo-3-chloropropane by

Microextraction and Gas Chromatography

Method 8015C: Nonhalogenated Organics by Gas Chromatography

Aromatic and Halogenated Volatiles by Gas Chromatography Method 8021B:

Using Photoionization and/or Electrolytic Conductivity Detectors

Method 8031: Acrylonitrile by Gas Chromatography Acrylamide by Gas Chromatography Method 8032A:

Method 8033: Acetonitrile by Gas Chromatography with Nitrogen-Phosphorus

Detection

Method 8041A: Phenols by Gas Chromatography

Method 8061A: Phthalate Esters by Gas Chromatography with Electron Capture

Detection (GC/ECD)

Nitrosamines by Gas Chromatography Method 8070A:

Method 8081B: Organochlorine Pesticides by Gas Chromatography

Polychlorinated Biphenyls (PCBs) by Gas Chromatography Method 8082A: Method 8085: Compound-independent Elemental Quantitation of Pesticides by

Gas Chromatography with Atomic Emission Detection (GC/AED)

Method 8091: Nitroaromatics and Cyclic Ketones by Gas Chromatography

**Method 8095:** Explosives by Gas Chromatography **Method 8100:** Polynuclear Aromatic Hydrocarbons Haloethers by Gas Chromatography **Method 8111:** 

Chlorinated Hydrocarbons by Gas Chromatography: Capillary Method 8121:

Column Technique

Aniline and Selected Derivatives by Gas Chromatography Method 8131: **Method 8141B:** Organophosphorus Compounds by Gas Chromatography Chlorinated Herbicides by GC Using Methylation or Method 8151A:

Pentafluorobenzylation Derivatization

### 4.3.2 Gas Chromatographic/Mass Spectrometric Methods

**Method 8261:** Volatile Organic Compounds by Vacuum Distillation in Combination

with Gas Chromatography/Mass Spectrometry (VD/GC/MS)

Method 8270D: Semivolatile Organic Compounds by Gas Chromatography/Mass

Spectrometry (GC/MS)

**Method 8275A:** Semivolatile Organic Compounds (PAHs and PCBs) in

Soils/Sludges and Solid Wastes Using Thermal Extraction/Gas

Chromatography/Mass Spectrometry (TE/GC/MS)

**Method 8276:** Toxaphene and Toxaphene Congeners by Gas

Chromatography/Negative Ion Chemical Ionization Mass

Spectrometry (GC-NICI/MS)

**Method 8280B:** Polychlorinated Dibenzo-*p*-Dioxins (PCDDs) and Polychlorinated

Dibenzofurans (PCDFs) by High Resolution Gas Chromatography/Low Resolution Mass Spectrometry

(HRGC/LRMS)

Method 8290A: Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated

Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High-Resolution Mass Spectrometry

(HRGC/HRMS)

Appendix A: Procedures for the Collection, Handling, Analysis, and

Reporting of Wipe Tests Performed within the Laboratory

### 4.3.3 High Performance Liquid Chromatographic Methods

**Method 8310:** Polynuclear Aromatic Hydrocarbons

**Method 8315A:** Determination of Carbonyl Compounds by High Performance

Liquid Chromatography (HPLC)

Appendix A: Recrystallization of 2,4-Dinitrophenylhydrazine

(DNPH)

Method 8316: Acrylamide, Acrylonitrile and Acrolein by High Performance Liquid

Chromatography (HPLC)

**Method 8318A:** *N*-Methylcarbamates by High Performance Liquid Chromatography

(HPLC)

Method 8321B: Solvent-Extractable Nonvolatile Compounds by High-Performance

Liquid Chromatography/Thermospray/Mass

Spectrometry(HPLC/TS/MS) or Ultraviolet (UV) Detection

Method 8325: Solvent Extractable Nonvolatile Compounds by High Performance

Liquid Chromatography/Particle Beam/Mass Spectrometry

(HPLC/PB/MS)

**Method 8330A:** Nitroaromatics and Nitramines by High Performance Liquid

Chromatography (HPLC)

Method 8331: Tetrazene by Reverse Phase High Performance Liquid

Chromatography (HPLC)

**Method 8332:** Nitroglycerine by High Performance Liquid Chromatography

### 4.3.4 Infrared Methods

Method 8410: Gas Chromatography/Fourier Transform Infrared (GC/FT-IR)

Spectrometry for Semivolatile Organics: Capillary Column

Method 8430: Analysis of Bis(2-chloroethyl) Ether and Hydrolysis Products by

Direct Aqueous Injection GC/FT-IR

Method 8440: Total Recoverable Petroleum Hydrocarbons by Infrared

Spectrophotometry

### 4.3.5 Miscellaneous Spectrometric Methods

**Method 8520:** Continuous Measurement of Formaldehyde in Ambient Air

### 4.4 Immunoassay Methods

Method 4000: Immunoassay

**Method 4010A:** Screening for Pentachlorophenol by Immunoassay

Method 4015: Screening for 2,4-Dichlorophenoxyacetic Acid by Immunoassay Method 4020: Screening for Polychlorinated Biphenyls by Immunoassay

**Method 4025:** Screening for Polychlorinated Dibenzodioxins and Polychlorinated

Dibenzofurans (PCDD/Fs) by Immunoassay

Method 4030: Soil Screening for Petroleum Hydrocarbons by Immunoassay Method 4035: Soil Screening for Polynuclear Aromatic Hydrocarbons by

**Immunoassay** 

Method 4040:Soil Screening for Toxaphene by ImmunoassayMethod 4041:Soil Screening for Chlordane by ImmunoassayMethod 4042:Soil Screening for DDT by ImmunoassayMethod 4050:TNT Explosives in Soil by Immunoassay

**Method 4051:** Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) in Soil by

**Immunoassay** 

**Method 4425:** Screening Extracts of Environmental Samples for Planar Organic

Compounds (PAHs, PCBs, PCDDs/PCDFs) by a Reporter Gene on

a Human Cell Line

Method 4430: Screening For Polychlorinated Dibenzo-p-Dioxins And Furans

(PCDD/Fs) By Aryl Hydrocarbon-Receptor PCR Assay

**Method 4435:** Method For Toxic Equivalents (TEQS) Determinations For

Dioxin-Like Chemical Activity with the CALUX® Bioassay

**Method 4670:** Triazine Herbicides as Atrazine in Water by Quantitative

**Immunoassay** 

### 4.5 Miscellaneous Screening Methods

Method 3815:Screening Solid Samples for Volatile OrganicsMethod 3820:Hexadecane Extraction and Screening of Purgeable OrganicsMethod 8510:Colorimetric Screening Procedure for RDX and HMX in SoilMethod 8515:Colorimetric Screening Method for Trinitrotoluene (TNT) in SoilMethod 8535:Screening Procedure for Total Volatile Organic Halides in WaterMethod 8540:Pentachlorophenol by UV-Induced Colorimetry

Method 9074: Turbidimetric Screening Method for Total Recoverable Petroleum

Hydrocarbons in Soil

Method 9078: Screening Test Method for Polychlorinated Biphenyls in Soil Method 9079: Screening Test Method for Polychlorinated Biphenyls in

Transformer Oil

## VOLUME ONE

### **SECTION C**

-----

### CHAPTER ONE, REPRINTED - PROJECT QUALITY ASSURANCE AND QUALITY CONTROL

- 1.0 Introduction
- 1.1 Planning
- 1.2 Implementation
- 1.3 Assessment
- 1.4 References and Sources for Additional Information on Project Quality Assurance and Control
- 1.5 Glossary

### CHAPTER FIVE - MISCELLANEOUS TEST METHODS

**Method 5050:** Bomb Preparation Method for Solid Waste

Method 9000: Determination of Water in Waste Materials by Karl Fischer Titration Method 9001: Determination of Water in Waste Materials by Quantitative Calcium

Hydride Reaction

**Method 9010C:** Total and Amenable Cyanide: Distillation

Method 9012B: Total and Amenable Cyanide (Automated Colorimetric, with

Off-Line Distillation)

Method 9013A: Cyanide Extraction Procedure for Solids and Oils

**Method 9014:** Titrimetric and Manual Spectrophotometric Determinative Methods

for Cyanide

Method 9015: Metal Cyanide Complexes by Anion Exchange Chromatography

and UV Detection

Method 9020B: Total Organic Halides (TOX)
Method 9021: Purgeable Organic Halides (POX)

Method 9022: Total Organic Halides (TOX) by Neutron Activation Analysis

**Method 9023:** Extractable Organic Halides (EOX) in Solids

Method 9030B: Acid-Soluble and Acid-Insoluble Sulfides: Distillation

Method 9031: Extractable Sulfides

Method 9034: Titrimetric Procedure for Acid-Soluble and Acid-Insoluble Sulfides

**Method 9035:** Sulfate (Colorimetric, Automated, Chloranilate)

Method 9036: Sulfate (Colorimetric, Automated, Methylthymol Blue, AA II)

**Method 9038:** Sulfate (Turbidimetric)

**Method 9056A:** Determination of Inorganic Anions by Ion Chromatography Determination of Chloride from HCl/Cl<sub>2</sub> Emission Sampling Train

(Methods 0050 and 0051) by Anion Chromatography

Method 9060A: Total Organic Carbon

Method 9065:Phenolics (Spectrophotometric, Manual 4-AAP with Distillation)Method 9066:Phenolics (Colorimetric, Automated 4-AAP with Distillation)Method 9067:Phenolics (Spectrophotometric, MBTH with Distillation)Method 9070A:n-Hexane Extractable Material (HEM) for Aqueous SamplesMethod 9071B:n-Hexane Extractable Material (HEM) for Sludge, Sediment, and

Solid Samples

Method 9075: Test Method for Total Chlorine in New and Used Petroleum

Products by X-Ray Fluorescence Spectrometry (XRF)

Method 9076: Test Method for Total Chlorine in New and Used Petroleum

Products by Oxidative Combustion and Microcoulometry

**Method 9077:** Test Methods for Total Chlorine in New and Used Petroleum

Products (Field Test Kit Methods)

Method A: Fixed End Point Test Kit Method

Method B: Reverse Titration Quantitative End Point Test Kit Method Method C: Direct Titration Quantitative End Point Test Kit Method

**Method 9131:** Total Coliform: Multiple Tube Fermentation Technique

Method 9132: Total Coliform: Membrane-Filter Technique

**Method 9210A:** Potentiometric Determination of Nitrate in Aqueous Samples with

an Ion-Selective Electrode

Method 9211: Potentiometric Determination of Bromide in Aqueous Samples with

Ion-Selective Electrode

Method 9212: Potentiometric Determination of Chloride in Aqueous Samples with

Ion-Selective Electrode

Method 9213: Potentiometric Determination of Cyanide in Aqueous Samples and

Distillates with Ion-Selective Electrode

Method 9214: Potentiometric Determination of Fluoride in Aqueous Samples with

Ion-Selective Electrode

Method 9215: Potentiometric Determination of Sulfide in Aqueous Samples and

Distillates with Ion-Selective Electrode

**Method 9216:** Potentiometric Determination of Nitrite in Aqueous Samples with

Ion-Selective Electrode

Method 9250: Chloride (Colorimetric, Automated Ferricyanide AAI)
Method 9251: Chloride (Colorimetric, Automated Ferricyanide AAII)

**Method 9253:** Chloride (Titrimetric, Silver Nitrate)

Method 9320: Radium-228

#### **CHAPTER SIX - PROPERTIES**

Method 1030: Ignitability of Solids

Method 1040: Test Method for Oxidizing Solids

Method 1050: Test Methods to Determine Substances Likely to Spontaneously

Combust

Method 1120: Dermal Corrosion

**Method 1312:** Synthetic Precipitation Leaching Procedure (SPLP)

**Method 1320:** Multiple Extraction Procedure

Method 1330A: Extraction Procedure for Oily Wastes

Method 9041A: pH Paper Method Method 9045D: Soil and Waste pH Method 9050A: Specific Conductance

Method 9080: Cation-Exchange Capacity of Soils (Ammonium Acetate)
Method 9081: Cation-Exchange Capacity of Soils (Sodium Acetate)
Method 9090A: Compatibility Test for Wastes and Membrane Liners

Method 9095B: Paint Filter Liquids Test

**Method 9096:** Liquid Release Test (LRT) Procedure

Appendix A: Liquid Release Test Pre-Test

**Method 9100:** Saturated Hydraulic Conductivity, Saturated Leachate

Conductivity, and Intrinsic Permeability

Method 9310: Gross Alpha and Gross Beta

Method 9315: Alpha-Emitting Radium Isotopes

### PART II CHARACTERISTICS

### CHAPTER SEVEN - CHARACTERISTICS INTRODUCTION AND REGULATORY DEFINITIONS

- 7.1 Ignitability
- 7.2 Corrosivity
- 7.3 Reactivity (See Narrative Standard in 40 CFR 261.23 and 24)
- 7.4 Toxicity Characteristic Leaching Procedure

### CHAPTER EIGHT - METHODS FOR DETERMINING CHARACTERISTICS

8.1 Ignitability

**Method 1010A:** Test Methods for Flash Point by Pensky-Martens Closed Cup

Tester

Method 1020B: Standard Test Methods for Flash Point by Setaflash (Small Scale)

Closed-cup Apparatus

8.2 Corrosivity

**Method 9040C:** pH Electrometric Measurement

Method 1110A: Corrosivity Toward Steel

8.3 Toxicity

**Method 1310B:** Extraction Procedure (EP) Toxicity Test Method and Structural

Integrity Test

**Method 1311:** Toxicity Characteristic Leaching Procedure (TCLP)

# VOLUME TWO

### CHAPTER ONE, REPRINTED - PROJECT QUALITY ASSURANCE AND QUALITY CONTROL

- 1.0 Introduction
- 1.1 Planning
- 1.2 Implementation
- 1.3 Assessment
- 1.4 References and Sources for Additional Information on Project Quality Assurance and Control
- 1.5 Glossary

### PART III SAMPLING

### **CHAPTER NINE - SAMPLING PLAN**

### **CHAPTER TEN - SAMPLING METHODS**

**Method 0010:** Modified Method 5 Sampling Train

Appendix A: Preparation of XAD-2 Sorbent Resin

Appendix B: Total Chromatographable Organic Material Analysis

Method 0011: Sampling for Selected Aldehyde and Ketone Emissions from

Stationary Sources

Method 0020: Source Assessment Sampling System (SASS)

Method 0023A: Sampling Method for Polychlorinated Dibenzo-p-Dioxins and

Polychlorinated Dibenzofuran Emissions from Stationary Sources

Method 0030: Volatile Organic Sampling Train

Method 0031: Sampling Method for Volatile Organic Compounds (SMVOC)
Method 0040: Sampling of Principal Organic Hazardous Constituents from

Combustion Sources Using Tedlar® Bags

**Method 0050:** Isokinetic HCI/Cl<sub>2</sub> Emission Sampling Train **Method 0051:** Midget Impinger HCI/Cl<sub>2</sub> Emission Sampling Train

**Method 0060:** Determination of Metals in Stack Emissions

**Method 0061:** Determination of Hexavalent Chromium Emissions from Stationary

Sources

**Method 0100:** Sampling for Formaldehyde and Other Carbonyl Compounds in

Indoor Air

**Method 25D:** Determination of the Volatile Organic Concentration of Waste

Samples

**Method 25E:** Determination of Vapor Phase Organic Concentration in Waste

Samples

Method 207: A Method for Measuring Isocyanates in Stationary Source

**Emissions** 

### PART IV MONITORING

### CHAPTER ELEVEN - GROUND WATER MONITORING

Referral to the EPA Office of Solid Waste guidance document entitled "RCRA Ground-water Monitoring: Draft Technical Guidance," published in 1992.

### CHAPTER TWELVE - LAND TREATMENT MONITORING

- 12.1 Background
- 12.2 Treatment Zone
- 12.3 Regulatory Definition
- 12.4 Monitoring and Sampling Strategy
- 12.5 Analysis
- 12.6 References and Bibliography

### **CHAPTER THIRTEEN - INCINERATION**

- 13.1 Introduction
- 13.2 Regulatory Definition
- 13.3 Waste Characterization Strategy
- 13.4 Stack-Gas Effluent Characterization Strategy
- 13.5 Additional Effluent Characterization Strategy
- 13.6 Selection of Specific Sampling and Analysis Methods
- 13.7 References