US Army Corps
of Engineers

Landfill 5 Cover Improvements at the Former Griffiss Air Force Base Rome, New York

Sampling and Analysis Plan Document Series 5 of 5

Conti Environmental, Inc.
South Plainfield, N.J.

EA Engineering, P.C. and Its Affiliate
EA Engineering, Science,
and Technology

July 2002

FINAL

DOCUMENT SERIES OVERVIEW

The U.S. Army Corps of Engineers–Kansas City District issued Task Order No. 0001 under Contract No. DACA41-01-D-0004 to Conti Environmental, Inc. Under this Task Order, Conti Environmental, Inc. and its subcontractor, EA Engineering, P.C. and its affiliate EA Engineering, Science, and Technology have been tasked to prepare documents to support landfill closure activities at the former Griffiss Air Force Base, Rome, New York.

A series of documents has been developed in support of each of the five landfills to be closed. The series includes one primary document and four supporting documents and associated appendixes. The following is a list of the documents in the series developed in support of landfill closure, and an abbreviated description of the document. Bold highlighting indicates which document in the series the reader is currently reviewing.

The Closure Plan is the primary document and is the first document in a series of five documents. The Closure Plan has been developed in accordance with New York Codes, Rules and Regulations Part 360. The Closure Plan provides project history and background information for the site, the regulatory status, the proposed design elements with supporting calculations, specifications, and design drawings.

The Project Work Plan is the second document in the series. The Project Work Plan has been developed to outline the scope of work to be implemented and the general methodologies used to execute the scope of work. The Project Work Plan presents Conti's work approach and sequence of activities for accomplishing the construction of landfill cover improvements. The Project Work Plan also includes, as appendixes, the Environmental Protection and Soil Erosion Control Plan and the Traffic Control Plan. The Environmental Protection and Soil Erosion Control Plan outlines the procedures to be implemented to minimize impacts on the surrounding environment during construction. The Traffic Control Plan details the policies and procedures for proper control of vehicles during construction to protect workers and increase efficiency.

The Site Safety and Health Plan is the third document in the series. The Site Safety and Health Plan has been developed to outline the safety and health requirements and guidelines to be followed during construction-related activities associated with the landfill closures.

The Contractor Quality Control Plan is the fourth document in the series. The Contractor Quality Control Plan has been developed to outline the policies and procedures to be followed to ensure that proper quality control measures are implemented to provide usable defendable data, ensure compliance with contract drawings and specifications, and to meet contractual requirements with the U.S. Army Corps of Engineers.

The Sampling and Analysis Plan is the fifth document in the series. The Sampling and Analysis Plan has been developed to outline the sampling and analysis procedures to be conducted at each landfill during closure activities. This document includes the Field Sampling Plan and Quality Assurance Project Plan.

Sampling and Analysis Plan for Landfill 5 at the Former Griffiss Air Force Base Rome, New York

Contract No. DACA41-01-D-0004

Prepared for

U.S. Army Corps of Engineers–New York District
Fort Drum Resident Office
Building T-4895
Watertown, New York 13602-5200

Submitted by

Conti Environmental, Inc.
3001 South Clinton Avenue
South Plainfield, New Jersey 07080

Prepared in Association with

EA Engineering, P.C. and Its Affiliate
EA Engineering, Science, and Technology
3 Washington Center
Newburgh, New York 12550

July 2002
FINAL
30002.01

Sampling and Analysis Plan for Landfill 5 at the Former Griffiss Air Force Base Rome, New York

Contract No. DACA41-01-D-0004

Prepared for

U.S. Army Corps of Engineers–New York District
Fort Drum Resident Office
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Newburgh, New York 12550

David S. Santoro, P.E., L.S., President
EA Engineering, P.C.

30 July 2002
Date

Charles E. McLeod, Jr., P.E., Project Manager
EA Engineering, Science, and Technology

30 July 2002
Date

July 2002
FINAL
30002.01

QUALITY REVIEW STATEMENT

EA Project No.: 30002.01

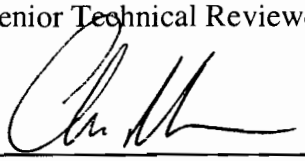
Description of Report/Deliverable:

Final Sampling and Analysis Plan for Landfill 5 at the Former Griffiss Air Force Base, Rome, New York

EA Project Manager: Charles E. McLeod, P.E.

In compliance with EA's Policy and Procedures for review of deliverables, this final deliverable has been reviewed for quality by the undersigned Senior Technical Reviewer(s). The information presented in this report/deliverable has been prepared in accordance with the approved scope of services for the project and reflects a proper presentation of the data and/or the conclusions drawn and/or the analyses or design completed during the conduct of the work. This statement is based upon the standards identified in the contract and/or the standard of care existing at the time of preparation.

Senior Technical Reviewer(s)



7/29/02

Christopher J. Canonica, P.E.
Senior Project Manager

Date

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1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE)–Kansas City District, issued Task Order No. 0001 under Contract No. DACA41-01-D-0004 to Conti Environmental, Inc. Under this Task Order, EA Engineering, P.C. and its affiliate EA Engineering, Science, and Technology are tasked as a subcontractor to support closure activities at Landfill 5 at the former Griffiss Air Force Base, Rome, New York.

This Sampling and Analysis Plan (SAP) has been developed in accordance with Chapter 3, Chemistry Scope of Work, of the Scope of Work (USACE 2001a), USACE Engineer Manuals 200-1-3 (USACE 2001b) and 200-1-6 (USACE 1997), and the New York State Department of Environmental Conservation Part 360 Regulations to outline the sampling and analysis procedures to be conducted at Landfill 5 during landfill closure activities, including landfill cover improvements and potential landfill reclamation.

REFERENCES

Conti Environmental, Inc. 2002. Site Safety and Health Plan, Landfill 5 Cover Improvements, Former Griffiss Air Force Base, Rome, New York.

U.S. Army Corps of Engineers (USACE). 1997. Chemical Quality Assurance for HTRW Projects. USACE Engineer Manual 200-1-6. October.

USACE. 2001a. The Former Griffiss Air Force Base, Rome, Oneida County, New York. Task Order No. 1, WAD No. 2. Landfill 5 Workplan Preparation Scope of Work. Forwarding Instructions and Addendum Items. March.

USACE. 2001b. Requirements for the Preparation of Sampling and Analysis Plan. USACE Engineer Manual 200-1-3. February.

Section A

Field Sampling Plan

Field Sampling Plan for Landfill 5 at the Former Griffiss Air Force Base Rome, New York

Contract No. DACA41-01-D-0004

Prepared for

U.S. Army Corps of Engineers–New York District
Fort Drum Resident Office
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Submitted by

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Prepared for

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1. INTRODUCTION

The U.S. Army Corps of Engineers (USACE)–Kansas City District, issued Task Order No. 0001 under Contract No. DACA41-01-D-0004 to Conti Environmental, Inc. Under this Task Order, EA Engineering, P.C. and its affiliate EA Engineering, Science, and Technology are tasked as a subcontractor to conduct closure activities at Landfill 5 at the former Griffiss Air Force Base, Rome, New York.

This Field Sampling Plan has been developed in accordance with Chapter 3, Chemistry Scope of Work, of the Scope of Work (USACE 2001a), USACE Engineer Manuals 200-1-3 (USACE 2001b) and 200-1-6 (USACE 1997), and the New York State Department of Environmental Conservation (NYSDEC) Part 360 Regulations to outline the sampling and analysis procedures to be conducted at Landfill 5 during landfill closure activities, including landfill cover improvements and potential landfill reclamation.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

This section lists key project personnel and identifies their respective responsibilities.

2.1 PROJECT PERSONNEL

The project personnel for this project are presented below and includes the Project Manager, Project Superintendent, Contractor Quality Control System Manager, Chemical Quality Control Coordinator, and additional internal and/or subcontracted chemical quality control personnel assigned to the project.

Mr. Luis Seijido, P.E., has been assigned as *Project Manager* for this contract. Mr. Seijido is responsible for the execution of the project in accordance with the requirements contained in the plans and specifications. He reports directly to ***Mr. James Stewart***, who, in his role as *Senior Corporate Officer*, is ultimately responsible to USACE for the quality of the project. Mr. Seijido also serves as the Point-of-Contact for the USACE Contract Officer Representative, and represents Conti in all matters related to the project.

Mr. Richard Hamlin has been assigned as *Project Superintendent* for the project, and reports to Mr. Seijido. Mr. Hamlin is responsible for ensuring that all field activities performed by Conti and/or subcontractors under Conti's control are conducted in conformance with project plans and specifications. Mr. Hamlin is also responsible for scheduling and coordinating all field efforts conducted by Conti and its subcontractors.

Mr. Scott Freeman has been assigned as *Contractor Quality Control System Manager* for the project, and is responsible for implementation of the Quality Assurance Project Plan. Mr. Freeman reports to ***Mr. James Stewart***, *Vice President of Conti* and a senior corporate officer, on all project quality control matters that may require involvement at a corporate level. Mr. Stewart is the Executive Sponsor for the project. Mr. Freeman will communicate with both the Project Manager and Project Superintendent on a daily basis regarding quality control aspects of the project and will be responsible for scheduling, coordinating, and implementing all aspects of the Chemical Quality Control Plan. In addition, Mr. Freeman will be Conti's Point-of-Contact for scheduling and coordinating chemical data quality control activities being implemented by Conti in the field to ensure that this element of the Quality Assurance Project Plan is properly executed.

Mr. Robert Scerbo has been designated as the *Chemical Quality Control Coordinator*. He is qualified to ensure proper sample management, quality control of sampling, chain-of-custody, and data management and evaluation. Mr. Scerbo will be responsible for all aspects of chemical data quality control and will report to and coordinate with the Contractor Quality Control System Manager on all such matters.

Project chemists and environmental samplers will support the project as needed to implement field sampling.

2.2 ANALYTICAL LABORATORY

Analytical services will be provided by [to be contracted] (additional information regarding the laboratory will be provided after the laboratory is contracted). The contracted laboratory will be responsible for:

- Performance of specified analyses for projects at prescribed levels of quality
- Custody control and traceability from sample delivery to reporting of results
- Implementation and maintenance of quality control procedures
- Documentation for those samples analyzed according to approved, written instructions and methods.

2.2.1 Laboratory Personnel

Roles and responsibilities of laboratory personnel are outlined below.

Laboratory Director

- Provides resources and staffing to ensure data quality
- Provides resources and staffing to ensure laboratory safety
- Maintains an independent quality assurance staff.

Director of Operations

- Responsible for all operational and support activities
- Ensures staff are qualified and trained
- Ensures all operations and support groups follow the Quality Assurance Program and work closely with the Quality Services Manager to maintain compliance
- Coordinates all Client Services Group activities to ensure quality of services provided to clients.
- Establishes and maintains a documented communication mechanism between Client Services and the laboratory to ensure that contractual and operational reporting requirements are met.

Quality Services Manager

- Develops Analytical Laboratory's quality assurance program
- Manages state and federal laboratory certifications
- Maintains a document control system
- Reviews non-conformance reports and verifies corrective actions
- Exercises authority to shut down any process or procedure that impacts data quality
- Assesses effectiveness of the quality system through performance, systems, and data audits
- Ensures personnel qualifications and training are documented.

Laboratory Project Manager

- Serves as client liaison through project duration
- Identifies analytical requirements for each project
- Ensures coordination of production efforts, and on-time delivery of data packages that meet all client specifications for parameters, methods, quality control, and report format.

Information Systems Manager

- Responsible for the site preparation, and onsite configuration of hardware and software for the Laboratory Information Management System
- Identifies custom programming needs, and prepares protocols for system operation
- Responsible for user training and routine system maintenance.

Section Chief

- Responsible for the implementation of their respective analytical programs operating in the inorganics and organics laboratories
- Responsible for data review against project requirements and internal quality control criteria
- Initiates and coordinates all quality control measures for the section

- Monitors and verifies the status and quality of analytical data within the section
- Responsible for coordinating and facilitating the section(s) interaction with the Quality Services and Client Services departments to ensure that clients' expectations and requirements are met and the section's performance meets and exceeds such criteria
- Reviews training documentation for section staff to ensure analysts have the qualifications and training to perform quality work and generate acceptable packages
- Ensures 100 percent technical review of all data packages and preparation of the narrative
- Ensures section staff implementation of and compliance with all applicable Standard Operating Procedures and Method Standard Operating Procedures.

Sample Management Officer

- Receives, logs, and assigns control numbers to incoming samples
- Inspects sample shipping containers for custody seals and container integrity
- Records condition of both shipping containers and sample containers
- Signs documents shipped with samples (i.e., air bills, chain-of-custody records, etc.)
- Verifies and records discrepancies in information on sample documents (i.e., sample tags, chain-of-custody records, traffic reports, air bills, etc.) in appropriate logbooks or on appropriate forms; notifies the Laboratory Project Manager for direction
- Controls samples in storage and assures that laboratory Standard Operating Procedures are followed when samples are removed from and returned to storage
- Monitors storage conditions for proper sample preservation such as refrigerator/freezer temperatures and checks for cross-contamination through maintenance and evaluation of volatile storage blanks.

2.3 QUALITY ASSURANCE ANALYTICAL LABORATORY

In accordance with USACE guidelines and the project specification, a quality control laboratory will be contracted. (Additional information regarding the laboratory will be provided after the laboratory is contracted.)

3. FIELD SAMPLING PROGRAM

This section presents the overall approach and details the field sampling activities that will be performed at the site to meet the objectives stated in Section 1.3. The field sampling program will address the following elements:

- Sampling objectives
- Sample designation
- Sampling locations and frequency
- Sampling equipment and procedures
- Sample handling and analysis.

This section also presents sampling objectives, number and location of samples, sample rationale, and field sampling procedures. Analytical procedures and quality assurance/quality control provisions are addressed in the Quality Assurance Project Plan that is included as a companion document to this Field Sampling Plan.

3.1 SAMPLING OBJECTIVES

The main objective of this Field Sampling Plan is to provide procedures for the collection and analysis of environmental samples collected during landfill cap activities. Activities anticipated to be conducted during this process include collection and analysis of surface soils from reclaimed areas of the landfill, collection and analysis of soils from offsite borrow sources, and collection and analysis of samples supporting offsite disposal of derived wastes.

Data quality objectives are developed to ensure that the data collected will be of sufficient quantity and quality for their intended uses (U.S. EPA 1987). Data use is defined by the types of decisions made with the data; required quantity; precision, accuracy, representativeness, comparability, and completeness; and methods by which data will be collected and analyzed.

3.2 SOLID MATERIALS

3.2.1 Borrow Source Sampling Rationale

The purpose of collecting and analyzing samples from borrow sources is to ensure that materials brought onto Government property have not been adversely impacted by chemical contaminants. One composite sample will be collected from each borrow source for common fill, low permeability soil or native topsoil, and 1 sample per every 2,400 yd^3 of an alternate topsoil material, prior to bringing the material to the site. Each sample for analysis will be a composite of 5 subsamples collected to represent a soil type. The subsamples will be randomly spaced samples with bias to areas that appear stained, stressed, disturbed, or show readings on the HNu organic vapor analyzer. Samples collected for volatile organic compounds (VOCs) will be analyzed on grab samples. Prior to collecting the sample for compositing, a separate grab sample from each subsample source will be collected for VOCs.

One sample, based on either having the highest HNu reading, or apparent stain, or other characteristic, will be selected for analysis. In the event that no subsample appears potentially higher in VOCs, a random sample will be analyzed. Samples for VOC analysis will be collected first to minimize potential loss of volatiles.

3.2.2 Waste Relocation Sampling Rationale

If, in the process of relocating waste from the peripheral areas of the landfill to the main landfill pile, a reduction in the total footprint of the landfill occurs, soil samples must be collected from the reclaimed areas. The purpose of collecting and analyzing samples from reclaimed areas is to confirm that the reclaimed areas do not contain residual contamination, that the areas have not been adversely impacted by the landfill contents as per 6 NYCRR Part 360 pertaining to Solid Waste Management Facilities, and to certify that the area will be exempt from post-closure monitoring.

Surface soil samples for chemical analysis will be collected at a rate of one sample per 2,500 ft^2 of reclaimed areas. Samples will be randomly spaced along a designated 50-ft $\times$ 50-ft grid system in order to provide a representative sample of the area. Soil samples will not be collected until sufficient waste relocation has occurred to removed soils that appear stained, stressed, or disturbed, or show readings on the HNu organic vapor analyzer. Reclamation area confirmatory soil samples will be grab samples. Procedures for sample collection and analysis are described in Subsection 3.2.3.

3.2.3 Soil Sampling Procedures

Procedures to collect soil samples from the borrow area are discussed in Attachment A.1, (Surface Soil Sampling). Samples will be collected to a depth of approximately 3 ft using a stainless steel auger, heavy equipment, or trowel dependent on the nature of the soil. Dedicated sampling equipment will be used for each borrow source material in order to eliminate the need for onsite decontamination of equipment. Equipment will be scraped of excess soil and wiped clean after each subsample. A total of 5 subsamples will be composited into 1 sample per borrow source material for each borrow source.

Soil samples for VOC analysis will be placed in glass/Teflon-coated septum containers. Sample containers will be filled to the extent possible to prevent headspace degradation of VOCs. Sample containers will be immediately placed into coolers packed with ice to maintain a temperature of 4°C $\pm$ 2°C.

Composite samples will be composited in accordance with the Procedures for Homogenization of Soil and Sediment Samples (Attachment A.2). After the soil has been thoroughly homogenized, it will be placed into laboratory-cleaned glass jars using dedicated stainless steel implements (spoons and spatulas). Sample containers will be labeled and sealed and immediately placed into temporary storage coolers packed with ice to maintain a temperature of 4°C $\pm$ 2°C.

3.2.3.1 Decontamination Procedures

As detailed below, non-dedicated equipment involved in field sampling activities will be decontaminated prior to, between, and after sampling to minimize the potential for cross-contamination. Decontamination of sampling equipment will be kept to a minimum in the field and, whenever possible, dedicated sampling equipment will be used. Decontamination water generated during the decontamination of sampling equipment will be containerized and brought back to the decontamination pad. Once at the decontamination pad, it will be combined with decontamination water that is generated at the site (i.e., decontamination water that was generated during the decontamination of construction equipment) and temporarily containerized. The decontamination fluids will be sampled to determine disposal options. Personnel directly involved in equipment decontamination will wear appropriate personal protective equipment as stated in the Site Safety and Health Plan (Conti 2002).

Field Measurement Equipment Decontamination

Prior to performing a measurement at each well, the probe of the water level indicator (e.g., QED) will be cleaned following the following protocol:

- Wash with water (from an approved source) and laboratory-grade detergent (e.g., Alconox® detergent)
- Rinse with deionized water
- Rinse with methanol or isopropyl (laboratory-grade)
- Rinse with deionized water
- Air dry; decontamination of measurement equipment will be kept to a minimum in the field and, wherever possible, dedication sampling equipment will be used.

Personnel directly involved in equipment decontamination will wear protective clothing, as stated in the Site Safety and Health Plan (Conti 2002).

3.2.4 Sample Analysis

Reclaimed soil samples will be sent to a New York State- and USACE-certified laboratory for analysis of VOCs, semivolatile organic compounds (SVOCs), organochlorine pesticides, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and Target Analyte List inorganics (plus cyanide). Specific parameters and analytical methods are listed in Table 7 of the Quality Assurance Project Plan.

Borrow source samples will be sent to a New York State- and USACE-certified laboratory for analysis of VOCs, SVOCs, polychlorinated biphenyls, Target Analyte List inorganics (plus cyanide), and organochlorine pesticides (topsoil only).

A summary of sample containers, preservatives, and holding times is included in Table 4 of the Quality Assurance Project Plan.

Results of chemical analysis must be sent to the Air Force Base Conversion Agency (AFBCA) for approval at least 24 hours prior to transporting the material onto Government Property.

If a triplicate (quality assurance split) sample is to be collected, it will be sent to the external quality assurance laboratory at the following address:

U.S. Army Corps of Engineers
Missouri River Laboratory
420 South 18th Street
Omaha, NE 68102
ATTN: Laura Percifield

3.2.5 Offsite Disposal of Derived Wastes

The following is a list of the major items that could be generated during the project that will be disposed of offsite:

- Unusable chain-link fence and associated posts and concrete
- General garbage from the field office
- Personal protective equipment
- Decontamination liquids
- Erosion and sediment control devices
- Potential identified hazardous materials.

Of these items, only personal protective equipment, decontamination liquids, and potential identified hazardous materials are analyzed to determine disposal options for derived waste. Sampling will be conducted for hazardous waste characterization of the derived waste by the Toxicity Characteristic Leaching Procedure of VOCs, SVOCs, total polychlorinated biphenyls, metals, pesticides, herbicides, ignitability, reactivity (as releasable sulfide and cyanide), and corrosivity (pH in soil).

Liquids and decontamination fluids will be collected and contained in Department of Transportation-approved 55-gal drums. Filled drums will be dated, labeled as derived waste, and temporarily stored at an onsite staging area. Disposal options for the decontamination liquids will be based on results of the analytical sampling program.

Decontamination residue consists of disposable personal protective equipment (such as Tyvek, gloves, tape, and cartridges) and settled solids. Decontamination residue will be drummed and stored in the Exclusion Zone until subsequent disposal or shipment to a disposal facility.

Potential identified hazardous materials will be stockpiled onsite at a pre-approved staging area. Upon receipt of analytical data of a suspected material, AFBCA will contact NYSDEC and EPA to discuss appropriate disposition of the material. Disposal procedures and paperwork are the responsibility of the contractor, however, AFBCA must approve and sign all paperwork as the generator for both hazardous and non-hazardous materials.

All disposal procedures and paperwork are the responsibility of the contractor, however, AFBCA must approve and sign all paperwork as the generator.

3.3 SAMPLE CHAIN-OF-CUSTODY/DOCUMENTATION

3.3.1 Sample Designation

Composite or discrete grab samples collected will be assigned a unique sample tracking number. Sample designation will be an alpha-numeric code that will identify each sample by borrow source, soil type (e.g., topsoil, common fill or low permeability soil), and date.

Location Identifiers:

If landfill reclamation occurs, each sampling location will include a sequential location identifier (i.e., R1, R2, if required).

S1 = Borrow Source 1
S2 = Borrow Source 2 (if required).

Soil Type Identifiers:

D = Discrete-Grab
C = Composite.

Soil Matrix Identifiers:

TS = Top Soil
LP = Low Permeability Soil
CF = Common Fill
RA = Reclaimed Areas
DW = Derived waste.

The field quality control samples remain anonymous to the analytical laboratory.

A sampling master log and labeled site map will be maintained. As each sample is collected, the sample will be identified by the sampling location, soil type, and soil type matrix. Duplicate samples will also be referenced by their matrix type and location in the master log.

3.3.2 Sample Labeling

Samples will be packaged and shipped in accordance with the USACE requirements (USACE 2001b). The following records are associated with the labeling and shipping process:

- Determine if soils from offsite borrow sources are free of contamination
- Sample tag or label
- Custody seal
- Chain-of-custody form
- Bill of lading (airbill or similar document).

3.4 CHAIN-OF-CUSTODY

Samples are physical evidence collected from a facility or the environment. Laboratory chain-of-custody procedures have been established to ensure sample traceability from the time of receipt through completion of analysis. Attachment A.3 shows the project chain-of-custody form.

Chain-of-custody originates as samples are collected. Chain-of-custody documentation accompanies the samples as they are moved from the field to the laboratory with shipping information and appropriate signatures indicating custody changes along the way.

Chain-of-custody sample forms will be completed to the fullest extent possible prior to sample shipment. The forms will include the following minimum information:

- Determine if soils from offsite borrow sources are free of contamination
- Project name
- Sample number (includes location and type)
- Matrix of the sample
- Type of sample (grab, composite, etc.)
- Sample time and date
- Preservation applied (or "None" if no preservation)
- Name of the person collecting the sample
- Analyses requested for each sample
- USACE-Missouri River Laboratory project number (split samples only)
- If any excessive photoionization detector readings are recorded during the collection of the samples, they will be noted in the comment section of the chain-of-custody.

3.5 FIELD LOGBOOK AND DOCUMENTATION

Field personnel will be issued weatherproof logbooks. The site manager and field staff are responsible for recording all pertinent project information including, but not limited to, field work documentation; field instrumentation readings; calculations; calibration records; work plan distributions; photograph references; sample tag/label numbers; meeting information; and important times and dates of telecons, correspondence, or deliverables. This site logbook will also contain an abbreviated version of notes listed in the team or individual field logbooks. The sample team or individual performing a particular sampling activity is required to maintain a field logbook that will be filled out at the location of sample collection immediately after sampling. It will contain sample particulars including sample number, sample collection time, sample location, sample descriptions, sampling methods used, daily weather conditions, field measurements, name of sampler, and other site-specific observations. It will address deviations from the Field Sampling Plan, Quality Assurance Project Plan, or Site Safety and Health Plan (Conti 2002), including authorization obtained and the rationale for the deviation, visitors' names or community contacts during sampling, and geologic and other site-specific information determined by the field team leader as appropriate.

3.6 SAMPLE PACKAGING AND SHIPPING

Attachment A.4 contains packaging and shipping procedures for samples requiring postal courier shipment. The section on procedures for low concentration samples is appropriate for the borrow source samples and reclaimed soil samples.

4. QUALITY ASSURANCE REPORTS AND PROCEDURES FOR FIELD CHANGES AND CORRECTIVE ACTIONS

4.1 QUALITY ASSURANCE/QUALITY CONTROL FIELD AUDIT

Periodically during the performance of the field investigation, field personnel will be required to report the performance of all measurement systems and status of the field sampling program to the Project Manager. The frequency of reporting will be daily or weekly as appropriate during the period of time that measurements and sampling are being performed in the field. Reporting will generally be written. However, if a problem requiring corrective action is encountered, a formal written report will be prepared.

4.2 FIELD CHANGES AND CORRECTIVE ACTIONS

The Project Manager is responsible for all site activities. Modification to site programs may be required due to site-specific conditions, needs, or unforeseen events. When modifications to a program are necessary, the Project Superintendent will notify the Project Manager of the anticipated change. The client will also be notified before any changes are implemented. If these changes are subsequently determined to be unacceptable, the actions taken during a period of deviation from the program will be evaluated for their significance. Changes in the program will be documented on a Field Change Request Form that is signed by the initiator and Project Manager.

The Project Manager is responsible for the control, tracking, and implementation of the identified changes. Completed Field Change Request forms are distributed to affected parties which will include, at a minimum, the Project Manager, Project Superintendent, and Quality Assurance Manager.

As a result of an unforeseen event that takes place in the field, the Project Manager will be notified by the Project Superintendent. If previously reported data are affected by the situation requiring correction, or if the corrective action will impact the project budget or schedule, the action should directly involve the Project Manager and the client.

Two kinds of corrective actions are as follows:

1. **Immediate**—To correct or repair nonconforming equipment and systems. The need for such an action will most frequently be identified by the analyst as a result of calibration checks.

2. **Long-Term**—To eliminate causes of non-conformance. The need for such actions will be identified by audits. Examples of this type of action include:

- Staff training in technical skills or in implementing the Quality Assurance/Quality Control Program

- Reassessment of field operation procedures and/or personnel.

The essential steps in the corrective action system are as follows:

1. Assign responsibility for investigating the problem
2. Investigate and determine the cause of the problem
3. Assign and accept the responsibility for implementing the corrective action
4. Establish effectiveness of the corrective action and implement the correction
5. Verify that the corrective action has eliminated the problem.

Depending on the nature of the problem, the corrective action employed may be formal or informal. In either case, occurrence of the problem, corrective action employed, and verification that the problem has been eliminated are routinely documented and maintained in the project files.

4.3 QUALITY CONTROL SUMMARY REPORT

At the completion of the field program, the Site Manager will prepare a Quality Control Summary Report. The Quality Control Summary Report includes copies of the Daily Quality Control Reports, with a particular focus on the total numbers/location of samples taken; deviations from the Field Sampling Plan; Quality Assurance Project Plan; or Site Safety and Health Plan (Conti 2002); and a summary of any problems/correction actions.

REFERENCES

Conti Environmental, Inc. 2002. Site Safety and Health Plan, Landfill 5 Cover Improvements, Former Griffiss Air Force Base, Rome, New York.

U.S. Army Corps of Engineers (USACE). 1997. Chemical Quality Assurance for HTRW Projects. USACE Engineer Manual 200-1-6. October.

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USACE. 2001b. Requirements for the Preparation of Sampling and Analysis Plan. USACE Engineer Manual 200-1-3. February.

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Attachment A.1

Surface Soil Sampling

STANDARD OPERATING PROCEDURE

Surface Soil Sampling

I. Purpose

To provide general guidelines for the collection and handling of surface soil samples during field operations.

II. Scope

The method described for surface soil sampling is applicable for loosely packed earth and is used to collect disturbed-soil samples.

III. Equipment and Materials

- Sample jars.
- A hand auger or other device that can be used to remove the soil from the ground. Only stainless steel, Teflon, or glass materials should be used. The only exception is split spoons, which are most commonly available in carbon steel; these are acceptable for use only if they are not rusty.
- A stainless steel spatula should be used to remove material from the sampling device.
- Unpainted wooden stakes or pin flags
- Vermiculite
- Fiberglass measuring tape (at least 200 feet in length)

IV. Procedures and Guidelines

A. Wear protective gear, as specified in the Health and Safety Plan.

B. To locate samples, identify the correct location using the pin flags or stakes. Proceed to collect a sample from the undisturbed soil adjacent to the marker following steps C and D. If markers are not present, the following procedures will be used.

1. For samples on a grid:

   a. Use measuring tape to locate each sampling point on the first grid line as prescribed in the sampling plan. As each point is located, drive a numbered stake in the ground and record its location on the site map and in the logbook.

   b. Proceed to sample the points on the grid line.

   c. Measure to location where next grid line is to start and stake first sample. For subsequent samples on the line take two orthogonal

measurements: one to the previous grid line, and one to the previous sample on the same grid line.

d. Proceed to sample the points on the grid line as described in Section C below.

e. Repeat 1c and 1d above until all samples are collected from the area.

2. For non-grid samples:

a. Use steel measuring tape to position sampling point at location described in the sampling plan by taking two measurements from fixed landmarks (e.g., corner of house and fence post).

b. Note measurements, landmarks, and sampling point on a sketch in the field notebook, and on a site location map.

c. Proceed to sample as described in Section C below.

d. Repeat 2a through 2c above until all samples are collected from the area.

C. To the extent possible, differentiate between fill and natural soil. If both are encountered at a boring location, sample both as prescribed in the field-sampling plan. Do not locate samples in debris, tree roots, or standing water. In residential areas, do not sample in areas where residents' activities may impact the sample (e.g., barbecue areas, beneath eaves of rooves, driveways, garbage areas). If an obstacle prevents sampling at a measured grid point, move as close as possible, but up to a distance of one half the grid spacing in any direction to locate an appropriate sample. If an appropriate location cannot be found, consult with the Field Team Supervisor (FTS). If the FTS concurs, the sampling point will be deleted from the program. The FTS will contact the Conti project manager (PM) immediately. The PM and Client Representative will discuss whether the point should be deleted from the program. If it is deleted, the PM will follow-up with the Client Representative in writing.

D. To collect samples:

1. Use a decontaminated stainless steel scoop/trowel to scrape away surficial organic material (grass, leaves, etc.) adjacent to the stake. New disposable scoops or trowels may also be used to reduce the need for equipment blanks.

2. If sampling:

a. Surface soil: Obtain soil sample by scooping soil using the augering scoop/trowel, starting from the surface and digging down to a depth of about 6 inches, or the depth specified in the workplan.

b. Subsurface soil. Obtain the subsurface soil sample using an auger down to the depths prescribed in the field sampling plan.

3. Take an OVM reading of the sampled soil and record the response in the field notebook. Also record lithologic description and any pertinent observations (such as discoloration) in the logbook.

4. Empty the contents of the scoop/trowel into a decontaminated stainless steel pan.

5. Repeat this procedure until sufficient soil is collected to meet volume requirements.

6. For TCL VOC and field GC aliquots, fill sample jars directly with the trowel/scoop and cap immediately upon filling. DO NOT HOMOGENIZE.

7. For TCL pesticides/PCBs and SVOCs, TAL metals, and field XRF aliquots, homogenize cuttings in the pan using a decontaminated stainless steel utensil in accordance with SOP Decon.

8. Transfer sample for analysis into appropriate containers with a decontaminated utensil.

9. Backfill the hole with vermiculite. To the extent possible, replace topsoil and grass and attempt to return appearance of sampling area to its pre-sampled condition. For samples in non-residential, unmowed areas, mark the sample number on the stake and leave stake in place. In mowed areas, remove stake.

V. Attachments

None.

VI. Key Checks and Items

- Phthalate-free latex or surgical gloves and other personal protective equipment.
- Transfer volatiles first, avoid mixing.
- Decontaminate utensils before reuse, or use dedicated, disposable utensils.

Attachment A.2

Homogenization of Samples

STANDARD OPERATING PROCEDURE

Homogenization of Samples

I. Purpose

The homogenization of soil and sediment samples is performed to minimize any bias of sample representativeness introduced by the natural stratification of constituents within the sample.

II. Scope

Standard techniques for soil and sediment homogenization and equipment are provided in this SOP. These procedures do not apply to aliquots collected for VOCs or field GC screening; samples for these analyses should NOT be homogenized.

III. Equipment and Materials

Sample containers, stainless steel spoons or spatulas, and stainless steel pans.

IV. Procedures and Guidelines

Soil and sediment samples to be analyzed for semivolatiles, pesticides, PCBs, metals, cyanide, or field XRF screening should be homogenized in the field. After a sample is taken, a stainless steel spatula should be used to remove the sample from the split spoon or other sampling device. The sampler should not use fingers to do this, as gloves may introduce organic interferences into the sample.

Samples for VOCs should be taken immediately upon opening the spoon and should not be homogenized.

Prior to homogenizing the soil or sediment sample, any rocks, twigs, leaves, or other debris should be removed from the sample. The sample should be placed in a decontaminated stainless steel pan and thoroughly mixed using a stainless steel spoon. The soil or sediment material in the pan should be scraped from the sides, corners, and bottom, rolled into the middle of the pan, and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the sample should be mixed individually, and then rolled to the center of the pan and mixed with the entire sample again.

All stainless steel spoons, spatulas, and pans must be decontaminated following procedures specified in Section 3.2.3.1 of the Field Sampling Plan prior to homogenizing the sample. A composite equipment rinse blank of homogenization equipment should be taken each day it is used.

Attachment A.3

Chain-of-Custody Form

ATTACHMENT A.3

CHAIN-OF-CUSTODY FORM

CHAIN of CUSTODY

PLEASE PRINT IN PEN Page of ____

Client	Contact	Phone # ( )	Fax # ( )
Address	City	State	Zip Code
Purchase Order #	Proj. Name / No.		Katahdin Quote #
Bill (if different than above)	Address		
Sampler (Print / Sign)		Copies To:	

LAB USE ONLY WORK ORDER #: _ *

KATAHDIN PROJECT MANAGER _____

REMARKS: _____

SHIPPING INFO: ☐ FED EX ☐ UPS ☐ CLIENT

AIRBILL NO: _____

TEMP°C _____ ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	ANALYSIS AND CONTAINER TYPE PRESERVATIVES Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N
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FORMSOURCE INC. (207) 782-3311

ORIGINAL

Attachment A.4

Sample Packaging and Shipping Procedures

Packaging and Shipping Procedures

I. Low-Concentration Samples

A. Prepare coolers for shipment:

- Tape drains shut.
- Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
- Place mailing label with laboratory address on top of coolers.
- Fill bottom of coolers with about 3 inches of vermiculite.

B. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks.

C. Affix appropriate adhesive sample labels to each container. Protect with clear label protection tape.

D. Seal each sample bottle within a separate ziplock plastic bag or bubble wrap, if available. Tape the bag around bottle. Sample label should be visible through the bag.

E. Arrange sample bottles in coolers so that they do not touch.

F. If ice is required to preserve the samples, cubes should be repackaged in zip-lock bags and placed on and around the containers.

G. Fill remaining spaces with vermiculite.

H. Complete and sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.

I. Separate copies of forms. Seal proper copies (traffic reports, packing lists) along with a return address label within a large zip-lock bag and tape to inside lid of cooler.

J Close lid and latch.

K. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear protection tape.

L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. **Do not** cover custody seals.

M. Relinquish to Federal Express or to a courier arranged with the laboratory. Place airbill receipt inside the mailing envelope and send to the sample documentation coordinator along with the other documentation.

II. Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with several additional restrictions. First, a special airbill including a Shipper's Certification for Restricted Articles is

required. Second, "Flammable Liquid N.O.S." or "Flammable Solid N.O.S." (as appropriate) labels must be placed on at least two sides of the cooler. Third, sample containers are packaged in metal cans with lids before being placed in the cooler, as indicated below:

- Place approximately ½ inch of vermiculite in the bottom of the can.
- Position the sample jar in the zip-loc bag so that the sample tags can be read through the plastic bag.
- Place the jar in the can and fill the remaining volume with vermiculite.
- Close the can and secure the lid with metal clips.
- Write the traffic report number on the lid.
- Place "This Side Up" and "Flammable Liquid N.O.S." or "Flammable Solid N.O.S." (as appropriate) labels on the can.
- Place the cans in the cooler.
- For medium concentration samples, ship samples with ice or "blue ice" inside the coolers. (Double bag ice in zip-lock plastic bags.)

III. Special Instructions for Shipping Medium and High Concentration Samples by Federal Express

A. Label cooler as hazardous shipment:

- Write shipper's address on outside of cooler. If address is stenciled on, just write "shipper" above it.
- Write or affix sticker saying "This Side Up" on two adjacent sides.
- Write or affix sticker saying "ORM-E" with box around it on two adjacent sides. Below ORM-E, write NA#9188.
- Label cooler with "Hazardous Substance, N.O.S." and "liquid" or "solid," as applicable.

B. Complete the special shipping bill for restricted articles.

- Under Proper Shipping Name, write "Hazardous Substance, N.O.S." and "liquid" or "solid," as applicable.
- Under Class, write "ORM-E.
- "Under Identification No., write NA No. 9188.

C. For high concentration samples, ship samples with "blue ice" only inside coolers.

Section B

Quality Assurance Project Plan

Quality Assurance Project Plan for Landfill 5 at the Former Griffiss Air Force Base Rome, New York

Contract No. DACA41-01-D-0004

Prepared for

U.S. Army Corps of Engineers–New York District
Fort Drum Resident Office
Building T-4895
Watertown, New York 13602-5200

Submitted by

Conti Environmental, Inc.
3001 South Clinton Avenue
South Plainfield, New Jersey 07080

Prepared in Association with

EA Engineering, P.C. and Its Affiliate
EA Engineering, Science, and Technology
3 Washington Center
Newburgh, New York 12550

July 2002
FINAL
30002.01

Quality Assurance Project Plan for Landfill 5 at the Former Griffiss Air Force Base Rome, New York

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30 July 2002
Date

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EA Engineering, Science, and Technology

30 July 2002
Date

July 2002
FINAL
30002.01

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1. PROJECT DESCRIPTION

The U.S. Army Corps of Engineers (USACE)–Kansas City District, issued Task Order No. 0001 under Contract No. DACA41-01-D-0004 to Conti Environmental, Inc. Under this Task Order, EA Engineering, P.C. and its affiliate EA Engineering, Science, and Technology are tasked as a subcontractor to conduct closure activities at Landfill 5 at the former Griffiss Air Force Base, Rome, New York.

This Quality Assurance Project Plan (QAPP) has been developed in accordance with Chapter 3, Chemistry Scope of Work, of the Scope of Work (USACE 2001a), USACE Engineer Manuals 200-1-3 (USACE 2001b) and 200-1-6 (USACE 1997), and the New York State Department of Environmental Conservation (NYSDEC) Part 360 Regulations to outline the sampling and analysis procedures to be conducted at Landfill 5 during landfill closure activities, including landfill cover improvements and potential landfill reclamation.

1.1 PURPOSE AND OBJECTIVES

This QAPP documents the quality assurance and quality control procedures for laboratory analysis of environmental samples collected during landfill cap activities at Landfill 5 at the former Griffiss Air Force Base, Rome, Oneida County, New York (Figure 1).

The main objective of this QAPP is to provide procedures for the collection and analysis of environmental samples collected during landfill cap activities. Activities anticipated to be conducted during this process include collection and analysis of surface soils from reclaimed areas of the landfill, collection and analysis of soils from offsite borrow sources, and collection and analysis of samples supporting offsite disposal of derived wastes.

The objective of sampling the soil beneath the reclaimed area is to determine if the area can be excluded from the landfill closure and post-closure criteria. The objective of the borrow source sampling is to determine if the proposed borrow source sample is acceptable to use as cover material. The objective of sampling the construction-derived wastes, if required, is to determine appropriate disposal options.

Constituents of potential concern include U.S. Environmental Protection Agency (EPA) Target Analyte List inorganics (plus cyanide), volatile organics, semivolatile organics, organochlorine pesticides, polycyclic aromatic hydrocarbons, total recoverable petroleum hydrocarbons (reclamation only), and polychlorinated biphenyls. Soil samples will be sent to a USACE-validated laboratory for these analyses. The analytical data will be received by the Contractor Chemical Quality Control Coordinator and evaluated to determine if the soil data are usable based on a precision, accuracy, representativeness, completeness, and comparability (PARCC) review. The PARCC review, along with the data, will be provided to the Air Force Base Conversion Agency, NYSDEC, and EPA who will review the chemical quality in comparison to NYSDEC Technical and Administrative Guidance Memorandum (TAGM) No. 4046

requirements and other applicable requirements to determine if the sample results are acceptable. The following exceptions for topsoil to the TAGM No. 4046 values will be used for comparison: lead ≤60 ppm, cadmium ≤1 ppm, and polychlorinated biphenyl non-detects.

2. ORGANIZATIONAL STRUCTURE AND RESPONSIBILITIES

The project organization and responsibilities of the Landfill 5 project team are provided in Section 2 of the Field Sampling Plan. Organization and responsibilities of the analytical laboratories are discussed within the following sections.

2.1 ANALYTICAL LABORATORY ORGANIZATION

The laboratory is a functional unit that has the responsibility for:

- Performance of specified analyses for projects at prescribed levels of quality
- Custody control and traceability from sample delivery to results reported to clients
- Implementation and maintenance of quality control procedures
- Documentation for those samples analyzed according to approved, written instructions and methods.

Laboratory Director

- Provides resources and staffing to ensure data quality
- Provides resources and staffing to ensure laboratory safety
- Maintains an independent Quality Assurance staff.

Director of Operations

- Responsible for operational and support activities
- Ensures staff are qualified and trained
- Ensures operations and support groups follow the Quality Assurance Program and work closely with the Quality Services Manager (QSM) to maintain compliance
- Coordinates Client Services Group activities to ensure quality of services provided to clients
- Establishes and maintains a documented communication mechanism between Client Services and the laboratory to ensure that contractual and operational reporting requirements are met.

Quality Services Manager

- Develops analytical laboratory's quality assurance program
- Manages state and federal laboratory certifications
- Maintains a document control system
- Reviews non-conformance reports and verifies corrective actions
- Exercises authority to shut down any process or procedure that impacts data quality
- Assesses effectiveness of the quality system through performance, systems, and data audits
- Ensures personnel qualifications and training are documented.

Laboratory Project Manager

- Serves as client liaison through project duration
- Identifies analytical requirements for each project
- Ensures coordination of production efforts, and on-time delivery of data packages that meet client specifications for parameters, methods, quality control, and report format.

Information Systems Manager

- Responsible for the site preparation, and onsite configuration of hardware and software for Laboratory Information Management System
- Identifies custom programming needs, and prepares protocols for system operation
- Responsible for user training and routine system maintenance.

Section Chief

- Responsible for the implementation of their respective analytical programs operating in the inorganics and organics laboratories
- Responsible for data review against project requirements and internal quality control criteria
- Initiates and coordinates quality control measures for the section

- Monitors and verifies the status and quality of analytical data within the section
- Responsible for coordinating and facilitating the section(s) interaction with the Quality Services and Client Services departments to ensure that clients' expectations and requirements are met and the section's performance meets and exceeds such criteria
- Reviews training documentation for section staff to ensure analysts have the qualifications and training to perform quality work and generate acceptable packages
- Ensures 100 percent technical review of data packages and preparation of the narrative
- Ensures section staff implementation of and compliance with applicable Standard Operating Procedures (SOPs) and Method SOPs.

Sample Management Officer

- Receives, logs, and assigns control numbers to incoming samples
- Inspects sample shipping containers for custody seals and container integrity
- Records condition of both shipping containers and sample containers
- Signs documents shipped with samples (i.e., air bills, chain-of-custody records, etc.)
- Verifies and records discrepancies in information on sample documents (i.e., sample tags, chain-of-custody records, traffic reports, air bills, etc.) in appropriate logbooks or on appropriate forms; notifies the Laboratory Project Manager for direction
- Controls samples in storage and assures that laboratory SOPs are followed when samples are removed from and returned to storage
- Monitors storage conditions for proper sample preservation such as refrigerator/freezer temperatures and checks for cross-contamination through maintenance and evaluation of volatile storage blanks.

Personnel qualifications will be supplied by the chosen laboratory after procurement has been completed.

3. QUALITY ASSURANCE OBJECTIVES FOR DATA MEASUREMENT

3.1 DATA USES

The purpose of this QAPP is to provide a standard for control and review of measurement data to ensure they are scientifically sound, defensible, and of known quality. The data will be used for control and review of measurement data to ensure they are scientifically sound, defensible, and of known quality. The data will be used to determine if borrow source materials are usable, reclaimed areas meet the clean criteria, and derived wastes meet disposal criteria for hazardous or non-hazardous disposal options. The project objective is to sample and test soil representative of the selected site with regard to bulk soil chemistry.

3.2 DATA QUALITY OBJECTIVES

3.2.1 Characteristics of Data Quality

The PARCC parameters are the characteristics of data quality. Table 1 lists the formulas used to calculate precision, accuracy, and completeness.

- *Precision* measures the reproducibility of measurements. It is defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under similar conditions. Analytical precision is the measurement of the variability associated with duplicate (two) or replicate (more than two) analyses. The laboratory control sample will be used to determine the precision of the analytical method. If the recoveries of analytes in the laboratory control sample are within established control limits, then precision is within limits. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch, rather the comparison is between the sample and samples analyzed in previous batches. Total precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations. Field duplicate samples and matrix duplicate spiked samples will be analyzed to assess field and analytical precision, and the precision measurement is determined using the relative percent difference between the duplicate sample results (Attachments B.1 and B.2). The formula for the calculation of precision is provided in Table 1 as relative percent difference. For replicate analyses, the relative standard deviation is determined. The formula for the calculation of relative standard deviation is provided in Table 1.

- *Accuracy* is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systemic error. It, therefore, reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. Analytical accuracy is measured by comparing the percent recovery of analytes spiked into a laboratory control sample to a control limit (Attachments B.1 and B.2).

For volatile and semivolatile organic compounds, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed.

- *Representativeness* is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a quantitative parameter that is most concerned with the proper design and implementation of the sampling program. The sampling program has been designed so that the samples collected are as representative as possible of the medium being sampled and that a sufficient number of samples will be collected. Representativeness is addressed by the description of the sampling techniques and the rationale used to select the sampling locations.

- *Completeness* for sample collection is defined as the percentage of specified samples listed in the Field Sampling Plan which were actually collected. The requirement for sample completeness is 95 percent. Completeness for acceptable data is defined as the percentage of acceptable data out of the total amount of data generated. Acceptable data will be data that may not pass all of the quality control criteria but which had appropriate corrective actions taken. Acceptable data also include data which passed all criteria. The requirement for analytical completeness is 98 percent. Quality data completeness is the percentage of quality data out of the total amount of data generated. Quality data are only those data that passed all quality control criteria as defined in the methods. The requirement for quality data completeness is 80 percent.

- *Comparability* is the confidence with which one data set can be compared to another data set. The objective for this quality assurance/quality control program is to produce data with the greatest possible degree of comparability. The number of matrices that are sampled and the range of field conditions encountered are considered in determining comparability. Comparability is achieved by using standard methods for sampling and analysis, reporting data in standard units, normalizing results to standard conditions, and using standard and comprehensive reporting formats. Complete field documentation using standardized data collection forms will support the assessment of comparability.

4. SAMPLE CUSTODY PROCEDURES

4.1 FIELD SAMPLING OPERATIONS

4.1.1 Sample Bottle Preparation

The chain-of-custody procedure begins with the preparation of the sample containers and preservatives to be used in sample collection. Unless superseded by specific project requirements, the laboratory purchases and distributes pre-cleaned sample containers. Vendors are required to provide documentation of analysis for each lot of containers, and the documentation is kept on file in the Sample Management Office. Contaminant levels in each lot are also evaluated by the laboratory through analysis of randomly selected containers in each vendor lot.

Tables 2 and 3 define the type of container required for specific analyses and matrix, preservation techniques, and holding times for soil samples. Preservatives are supplied with the sample containers to be added in the field.

Sample kits, which are coolers containing chain-of-custody forms, custody seals, sample containers, preservatives, and packing material, are prepared by the Sample Management Office and will be used for the bulk chemistry samples.

4.1.2 Sampling Activities

After the samples are put into containers with preservatives appropriate to the parameters to be determined, each container is provided with a sample label that is filled out at the time of sampling. At this time, a second chain-of-custody form (Figure 2) is initiated. The collected samples are cooled, if necessary, and returned to the laboratory by the most expedient means to ensure that holding times will be met. The chain-of-custody form is signed and dated as necessary as the samples pass from the collectors/compositers to those persons responsible for their transport.

4.1.3 Sample Labeling

The following information is **required** on each analytical sample label:

- Name of site
- Field station (sample identification) number
- Sample description
- Date and time of sample collection/compositing/homogenization
- Signature and printed name of the collector
- Sample preservation, if required
- Type of analysis.

After the label has been completed, it is affixed to the sample container.

4.2 LABORATORY OPERATIONS

The analytical laboratory has a designated Sample Management Officer who is responsible for receiving samples in the laboratory, opening the coolers and checking the sample integrity and the custody seal, logging samples into the laboratory system, and controlling the handling and storage of samples while in the laboratory.

4.2.1 Sample Custody

Samples are physical evidence and should be handled according to certain procedural safeguards. For the purposes of some types of legal proceedings, a showing to the court that the laboratory is a secure area may be all that is required for the analyzed evidence to be admitted. However, it is anticipated that in some cases, the court may require a showing of the hand-to-hand custody of the samples while they were at the laboratory. In the event that the court requires such a comprehensive chain-of-custody demonstration, the laboratory must be prepared to produce documentation that traces the in-house custody of the samples from the time of receipt to the completion of the analysis.

The National Enforcement Investigations Center of EPA defines "custody of evidence" in the following ways:

- It is in your actual possession
- It is in your view, after being in your physical possession
- It was in your possession and then you locked or sealed it up to prevent tampering
- It is in a secure area.

4.2.2 Sample Receipt and Logging

After samples have been labeled and the chain-of-custody forms initiated, the laboratory project manager completes the right side of the chain-of-custody form. This form provides sample-specific information and a listing of the parameters required on each sample, along with the required analytical sensitivity. The chain-of-custody and appropriate field data sheets are sealed in a water-tight plastic envelope and delivered with the samples to the laboratory.

The Sample Management Officer monitors custody of samples in the laboratory. Log-in procedures are documented in the laboratory's SOPs. Upon receipt at the laboratory, the Sample Management Officer or designated custodian inspects the samples for integrity and checks the shipment against the chain-of-custody/analytical task order form. Cooler temperatures are checked and documented on the chain-of-custody. The pH of preserved samples (except volatile organics) is measured and documented in the sample pH logsheet which is maintained in the Sample Management Office. The pH of sample vials submitted for volatile organics determinations is checked by the analyst during analysis, and the pH is recorded in the instrument run logbook.

Discrepancies are addressed at this point and documented on the chain-of-custody form, and must be resolved **before** samples are released to the laboratory for analysis. When the shipment and the chain-of-custody are in agreement, the custodian enters the samples into the analytical custody and preservation log and assigns each sample a unique laboratory number.

This number is affixed to each sample bottle. The custodian then enters the sample and analysis information into the laboratory computer system and samples are released for analysis by the Laboratory Project Manager after review and approval of all information. The original of the chain-of-custody form is maintained in the analytical data report file and returned to the client with the final report.

4.2.3 Sample Storage and Security

While in the laboratory, the samples and aliquots that require storage at approximately 4°C ± 2°C are maintained in a locked refrigerator unless they are being used for analysis. Samples for purgeable organics determinations are stored in a separate locked refrigerator from other samples, sample extracts, and standards. The refrigerators in the laboratory used for storage of samples are locked, numbered, and dedicated to specific types of samples, e.g., organic extractables, volatiles, inorganics. Similarly, there are refrigerators designated for extracts and standards which are located in the appropriate laboratory areas. The sample storage areas are within the laboratory to which access is limited to laboratory chemists and controlled by assigned passkeys. Specific requirements for sample storage are as follows:

- Samples are stored in a secure area
- Access to the laboratory is through a monitored area; other outside-access doors to the laboratory are kept locked
- Visitors sign a visitor's log and are escorted while in the laboratory
- Refrigerators, freezers, and other sample storage areas are securely maintained or locked; temperatures are monitored
- Only the designated sample custodian and supervisory personnel have keys to locked sample storage area(s)
- Samples remain in secure sample storage until removed for sample preparation or analysis
- All transfers of samples into and out of storage are documented on an internal chain-of-custody record, and the records are maintained in the Sample Management Office.

4.3 HOLDING TIME COMPLIANCE

Sample preparation and analysis will be completed within the method required holding times (Tables 2, 3 and 4). The holding time for a sample begins at the time of sample collection. Some methods have more than one holding time requirement (e.g., Methods SW8081A, SW8270C, etc.). The preparation holding time is calculated from the time of sample collection to the time of completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup and/or volume reduction procedures. If no preparation (e.g., extraction) is required, the analysis holding time is calculated from the time of sample collection to the time of completion of all analytical runs, including dilutions, second column confirmations, and any required re-analyses. In methods requiring sample preparation prior to analysis, the analysis holding time is calculated from the time of preparation completion to the time of completion of all analytical runs, including dilutions, second column confirmations, and any required re-analyses.

5. CALIBRATION PROCEDURES AND FREQUENCY

Instruments and equipment used in the analytical laboratory are controlled by a formal calibration program. The program verifies that equipment is of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. Instruments and equipment that measure a quantity, or whose performance is expected at a stated level, are subject to calibration. Calibration is performed by laboratory personnel using reference standards or externally by calibration agencies or equipment manufacturers.

Implementation and documentation of the laboratory calibration program is the responsibility of the laboratory Section Chiefs. The QSM monitors the procedures through systems, performance, and data audits (Section 9). Two types of calibration are discussed in this section:

- *Operational Calibration* is routinely performed as part of an analytical procedure or test method, such as the development of a standard curve for use with determinations where an analytical system response is related to analyte concentration, e.g., spectrometric and chromatographic systems.

- *Periodic Calibration* is performed at prescribed intervals for measurement equipment, such as balances, automatic pipettes, and thermometers. In general, equipment that can be calibrated periodically is a distinct, singular purpose unit and is relatively stable in performance. Table 5 contains the requirements for equipment subject to periodic calibration.

5.1 CALIBRATION SYSTEM

The following sections contain a discussion of the elements comprising the calibration system.

5.1.1 Calibration Procedures

Written procedures are used by the analytical laboratory for analytical systems and equipment subject to calibration. Whenever possible, recognized procedures, such as those published by American Society for Testing and Materials or the EPA or procedures provided by manufacturers, are adopted. If established procedures are not available, a procedure is developed considering the type of equipment, stability characteristics of the equipment, required accuracy, and the effect of operational error on the quantities measured. As a minimum, the procedures include:

- Equipment to be calibrated
- Reference standards used for calibration
- Calibration technique and sequential actions
- Acceptable performance tolerances
- Frequency of calibration
- Calibration documentation format.

5.1.2 Equipment Identification

Equipment that is subject to calibration is identified by a unique number assigned by the laboratory, and calibration records reference the specific instrument identification.

5.1.3 Calibration Frequency

Instruments and equipment are calibrated at prescribed intervals and/or as part of the operational use of the equipment. Calibration frequency is based on the type of equipment, inherent stability, manufacturer's recommendations, values provided in recognized standards, intended data use, specified analytical methods, effect of error upon the measurement process, and prior experience.

5.1.4 Calibration Reference Standards

Two types of reference standards are used for calibration:

- *Physical standards,* such as weights for calibrating balances and certified thermometers for calibrating working thermometers, refrigerators and ovens, are generally used for periodic calibration. Whenever possible, physical reference standards have known relationships to nationally recognized standards (e.g., National Institute of Standards and Technology) or accepted values of natural physical constants. If national standards do not exist, the basis for the reference is documented. Physical reference standards are used only for calibration and are stored separately from equipment used in analyses. In general, physical reference standards are at least 4-10 times as accurate as the requirements for the equipment which they are used to calibrate. In general, physical standards are recalibrated annually by a certified external agency, and documentation is maintained by the Quality Assurance staff.

- *Chemical standards,* such as Standard Reference Materials provided by the National Institute of Standards and Technology or EPA. Whenever possible, chemical reference standards are directly traceable to National Institute of Standards and Technology Standard Reference Materials. If Standard Reference Materials are not available, compounds of vendor-certified high purity are used to prepare calibration standards. These are primarily used for operational calibration. Documentation, e.g., certificates of analysis or traceability, are required for chemical standards used for calibration and quality control. Chemical standards are verified prior to use.

5.1.5 Calibration Failure

Equipment or analytical systems that cannot be calibrated must be repaired and satisfactorily recalibrated before re-use. Analysis will not proceed until appropriate corrective action is taken and an acceptable calibration is achieved. This activity is documented in a Non-Conformance Record which is discussed in Section 12.

Scheduled calibration of equipment does not relieve the laboratory staff of the responsibility for using properly functioning equipment. If an equipment malfunction is suspected, the equipment is tagged and removed from service and recalibrated. If it fails recalibration, the above process will apply. The laboratory Section Chiefs are responsible for the development and implementation of a contingency plan for major equipment failure. The plan includes guidelines on waiting for repairs, use of other instrumentation, subcontracting analyses, and evaluating scheduled priorities.

5.1.6 Calibration Records

Records are prepared and maintained for each piece of equipment subject to calibration. Records demonstrating accuracy of preparation, stability, and proof of continuity of reference standards are also maintained.

Records for periodically calibrated equipment will include, as appropriate:

- Unique identification number of equipment and type of equipment
- Calibration frequency and acceptable tolerances
- Identification of calibration procedure used
- Date calibration was performed
- Identity of personnel and/or external agencies performing calibration
- Reference standards used for calibration
- Calibration data
- Certificates or statements of calibration provided by manufacturers and external agencies and traceability to national standards
- Information regarding calibration acceptance or failure and any repair of failed equipment.

Records for periodically calibrated equipment are maintained in the instrument logbooks, or in the equipment file maintained by the QSM. Physical reference standards are kept in a separate folder.

For instruments and equipment that are calibrated on an operational basis, calibration generally consists of determining instrumental response against compounds of known composition and concentration or the preparation of a standard response curve of the same compound at different concentrations. Records of these calibrations are maintained in the instrument logbook, which provides an ongoing record of the calibration undertaken for a specific instrument. Logbook

entries will be signed and dated by the chemist. Copies are placed in data packages as required, and checked in the data review process. Logbook entries are reviewed during internal audits by the Quality Services staff.

In addition to the instrument logbook, copies of the raw calibration data are kept with the analytical sample data. In this way, results can be readily processed and verified because the raw data package is complete as a unit. If samples from several projects are processed together, the calibration data are copied and included with each group of data.

5.2 OPERATIONAL CALIBRATION

Operational calibration is generally performed as part of the analytical procedure and refers to those operations in which instrument response (in its broadest interpretation) is related to analyte concentration. Included is the preparation of a standard response (calibration) curve and often the analysis of blanks. Formulas used for calibration are listed in Table 6.

5.2.1 Preparation of Calibration Curve

Preparation of a standard calibration curve is accomplished by using calibration standards. The process is summarized as:

- Preparation of a standard calibration curve is accomplished by the analysis of calibration standards that are prepared by adding the analyte(s) of interest to the solvent that is introduced into the instrument
- The concentrations of the calibration standards are chosen to cover the working range of the instrument or method
- Sample measurements are made within this working range
- The calibration curve is prepared by plotting or regressing the instrument responses versus the analyte concentrations, or by calculating a calibration/response factor for chromatographic methods
- The concentrations of the analyzed samples are calculated from system response using the calibration curve.

5.2.2 Instrument Calibration Procedures

Attachment B.3 contains the operational calibration procedures and criteria used by the various instrument groups to meet requirements for the analysis of soil samples for this project.

5.3 METHOD DETECTION LIMITS

The method detection limit is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The laboratory will establish method detection limits for each method, matrix, and analyte for each instrument the laboratory plans to use for the project. The laboratory will revalidate these method detection limits at least once per 12-month period.

5.4 RETENTION TIME WINDOWS

Retention time windows are used in gas chromatograph and high performance liquid chromatography analysis for qualitative identification of analytes. They are calculated from replicate analyses of a standard on multiple days. The procedure and calculation method are given in SW-846 Method 8000B.

When the retention time is outside of the acceptance limits, corrective action will be performed. After the system problems have been resolved and system control has been re-established, re-analyze all samples analyzed since the last acceptable retention time check. If corrective actions are not performed, the reason why will be noted in the laboratory narrative.

6. LABORATORY PROCEDURES

Analytical support will be provided by a laboratory validated approved by USACE.

6.1 ANALYTES AND ANALYTICAL METHODS

Constituents of concern for this project will be EPA Target Analyte List inorganics (plus cyanide), volatile organics, semivolatile organics, organochlorine pesticides (topsoil only) and polychlorinated biphenyls for borrow source soils; volatile organics, semivolatile organics, pesticides, polychlorinated biphenyls, polynuclear aromatic hydrocarbons, and Target Analyte List inorganics (plus cyanide) for the reclaimed area; and hazardous waste characterization of derived waste (by Toxicity Characteristic Leaching Procedure [TCLP] for volatile organic compounds, semivolatile organic compounds, total polychlorinated biphenyls, metals, pesticides, herbicides, ignitability, reactivity, and corrosivity).

Organic and inorganic analytes for this project are determined using the methods listed in Table 7. The analytical protocols are provided in laboratory method SOPs which document the implementation specifics of the standard reference methods. Methods will be followed as written with the following exceptions.

6.1.1 Volatile Organic Compounds

Analysis of the Target Compound List of volatile organic compounds will be performed using SW-846 Method 5030B/8260B, with the addition of the dichlorobenzenes. The dichlorobenzenes are included on the method list and, therefore, readily analyzed by this method.

Soil samples will be analyzed using SW-846 Methods 5030A/8260B.

6.1.2 Metals

Following appropriate digestion/preparation procedures, metal analytes, except mercury, arsenic, lead, selenium, silver, antimony, and thallium, will be determined utilizing inductively coupled plasma according to the methodology specified (SW-846 Method 6010B), including the use of TRACE inductively coupled plasma, with the following exceptions:

- If interferences are present that cannot be eliminated by dilution without impacting data quality objectives, samples will be analyzed by Graphite Furnace Atomic Absorption using SW-846 series 7000 methods.

For inductively coupled plasma analyses, spectral interferences are corrected through the use of interelement correction factors or by setting background correction points. The application of either depends upon the configuration of the instrument. Although interelement correction factors are determined and reported for inductively coupled plasma instruments, interelement correction factors are not applied for those instruments which allow the use of background correction.

6.1.3 Toxicity Characteristic Leaching Procedure

For samples designated for hazardous waste characterization, the TCLP extract (leachate) will be handled as follows:

- Upon completion of the extraction procedure, aqueous holding times apply.
- For semivolatile organic compound and pesticide analyses, 200 mL of TCLP leachate will be extracted for analysis in order to lessen the matrix effects engendered by the acid leachate solution.
- For herbicides, 100 mL of TCLP leachate will be extracted to lessen the matrix effects.

These modifications will maintain detection and reporting limits well below the TCLP regulatory threshold criteria.

6.2 QUALITY CONTROL SAMPLES

6.2.1 Equipment Rinsate Blanks

Rinsate blanks, consisting of reagent water collected from a final rinse of sampling equipment after the decontamination procedure, will be collected from each of the sets of sampling devices used for collection of samples. The results will be used to evaluate the completeness of the decontamination procedures during sampling.

6.2.2 Field Blanks

Field blanks will consist of reagent water from the laboratory and will be present on the site during sampling activities. The results will be used to confirm that the reagent water used for the equipment and process blanks was not contaminated prior to use.

6.2.3 Laboratory Quality Control Samples

For all methods, the laboratory quality control samples will be analyzed at the frequency consistent with EPA methods. Acceptance criteria are specified in the methods, and listed in Attachment B.3.

Quality Control Sample	Frequency
Method Blank	1 per analytical batch of 20 or fewer samples
Laboratory Control Sample	1 per analytical batch of 20 or fewer samples
Matrix Spike	1 per analytical batch of 20 or fewer samples
Matrix Spike Duplicate	1 per analytical batch of 20 or fewer samples

For the borrow source samples, 5 samples will be collected from a single borrow source for each material type and composited. The following samples will be generated from the composite material:

Borrow Source	Duplicate	Triplicate	Matrix Spike	Matrix Spike Duplicate
1	1	1	1	1

An aqueous trip blank will also be included with the above samples.

For each 20 samples collected from a reclamation area, 1 duplicate, 1 triplicate, 1 matrix spike, and 1 matrix spike duplicate will be collected. The following samples will be generated from the composite material:

Duplicate	Triplicate	Matrix Spike	Matrix Spike Duplicate
1	1	1	1

An aqueous trip blank will also be included with the above samples.

6.3 METHOD REPORTING LIMITS

The method reporting limits for borrow source material and excavation soil area were developed in accordance with Engineer Manual 200-1-3, and are based on one-half of the TAGM No. 4046 Contract Required Quantitation Limit (Tables 8 and 9). The method reporting limits for TCLP are based on TCLP regulatory criteria and leachate volumes. The method reporting limits are the minimum concentrations to be reported by the laboratory.

There may be instances where calibration ranges have been exceeded for a given analyte and dilution series set up to pull the concentration into an appropriate calibration range. In these situations, the results for all dilutions will be reported. Appropriate concentrations will be those reported pre-dilution, unless they are found to exceed the calibration range (E-qualified) and subsequent dilutions are acceptable (D-qualified). No E-qualified data will be considered, and only D-qualified data will be used for the assessment.

Parameter	Method	Soil
Volatile Organics	SW-8260B	Method Reporting Limit
Semivolatile Organics	SW-8270C	Method Reporting Limit
Polychlorinated Biphenyls	SW-8082	Method Reporting Limit
Pesticides	SW-8081A	Method Reporting Limit
Polynuclear Aromatic Hydrocarbons	SW-8310	Method Reporting Limit
Herbicides	SW-8151A	Method Reporting Limit
Metals	SW-6010B/7000 series	Method Reporting Limit
Cyanide	SW-9012A	Method Reporting Limit

6.4 STANDARD OPERATING PROCEDURES

An SOP is a written step-by-step description of laboratory operating procedures exclusive of analytical methods. The laboratory documents procedures in formal, approved SOPs, which are issued in a document-controlled manual. SOPs are submitted in draft to the QSM who is responsible for initiating the review and approval process and for distributing and controlling the final SOPs. The QSM maintains the original copies of SOPs, as well as an historical file of all versions. The SOPs address the following areas:

- Storage containers and sample preservatives
- Sample receipt and logging
- Sample custody
- Sample handling procedures
- Sample transportation
- Glassware cleaning
- Laboratory security
- Quality control procedures and criteria
- Equipment calibration and maintenance
- Documentation
- Safety
- Data handling procedures
- Document control
- Personnel training and documentation
- Sample and extract storage
- Preventing sample contamination
- Traceability of standards
- Data reduction and validation
- Maintaining instrument records and logbooks
- Non-conformance
- Corrective actions
- Records management.

Analytical procedures are documented in the laboratory Method SOPs. An example table of contents listing SOPs and Method SOPs is provided in Attachment B.4.

6.5 RECORDKEEPING

6.5.1 General Requirements

The laboratory maintains extensive records to ensure that all aspects of the analytical process are adequately documented because the keeping of laboratory records is a legal requirement. These records convey:

- What was done
- When it was done

- Who did it
- What was found.

The requirements for laboratory recordkeeping are given in the laboratory's SOPs. Data entries are made in indelible, water-resistant ink. The date of the entry and the observer is clear on each entry. The observer uses his/her full name or initials. An initial and signature log is maintained so that the recorder of every entry can be identified. Information is recorded in a notebook or on other records at the time the observations are made. Recording information on loose pieces of paper is not allowed.

When a mistake is made, the wrong entry is crossed out with a single line, initialed and dated by the person making the entry, and the correct information recorded. Obliteration of an incorrect entry or writing over it is not allowed; neither is the use of correction tape or fluid on any laboratory records.

6.5.2 Laboratory Records

The following records are used to document analytical activities in the laboratory. These are in addition to those discussed elsewhere in this QAPP, i.e., chain-of-custody forms, log-in sheets, maintenance records (Section 10), and non-conformance forms (Section 12).

Reagent and Titrant Preparation Records—The procedure for each analysis includes the procedures for reagent/titrant preparation, including concentration, storage, and discard information. After a reagent/titrant is prepared, the following information is entered on a label affixed to the storage bottle: (1) identity, (2) intended use, (3) titer/concentration, (4) preparation date, (5) storage requirement, (6) discard date, and (7) preparer. For titrimetric analyses, the procedure includes directions for standardizing the titrant; the laboratory data sheets include space for titrant standardization data.

Standards Preparation Logs—The preparation of stock, intermediate, and working standard solutions is recorded in standards preparation logbooks which are specific to the requirements of each operational group. Each standard is assigned a number that is used to trace the preparation from stock to working standards and to reference the analysis of the standards. The logbooks are completed by the appropriate analysts as they prepare the standards and are reviewed by the supervisor.

Sample Preparation Logs—Sample preparation operations, such as digestions and extractions, are documented in sample preparation logs which are specific to the operations involved. The information in these logs can include: date, analyst, sample identification, weight or volume of sample used, reagents used, and final volume. It can also include the volume of spiking, surrogate, or internal standard solution.

Bench Data Sheets—Laboratory bench data sheets are used for those analyses in which instrument responses are manually transcribed from instrument readout or from recorder tracings. The data sheets are preprinted to reflect the requirements of the analysis and are used to ensure that the information is recorded in a complete and organized manner.

Instrument Run Logs—The run log is used for recording data generation, instrument malfunctions, repairs, and maintenance activities. Data generation from an instrument requires that the sequence of the introduction of standards, field samples, and quality control samples be recorded in the instrument run log. The following information is recorded when applicable: instrument identification, date, time, analyst, sample identifications, dilutions, and filenames for disk storage.

Strip Chart Recordings/Chromatograms/Computer Output—Strip chart recordings, chromatograms, computer output, and other instrument-generated records are clearly labeled with the following information: instrument identification, date, analyst, and sample identifications. The operational conditions are also recorded if applicable.

7. DATA REDUCTION, VERIFICATION, VALIDATION, AND REPORTING

7.1 DATA REDUCTION

7.1.1 Laboratory Data Collection and Reduction

For inorganic and general organic analyses where the instruments are not directly coupled to computerized data systems, the raw data are instrument responses in the form of meter, recorder, or printer output. The chemist performing the analysis enters the bench-generated data into a bound laboratory workbook specific for each parameter. Entries are made in ink. These data consist of instrumental responses (absorbencies, percent transmittances, etc.), standard and spike concentrations, sample numbers, and any other pertinent information. The workbooks are under the control of the group supervisor who is responsible for their security. For computerized instruments, the output is in the form of printer output and files on magnetic disks which are filed by sample batch.

For chromatographic organic analyses, the raw data are instrument responses in the form of chromatograms, integrator outputs, or computer-generated data files. The chromatograms and printer output are stored in project-specific files. The data files are archived on magnetic tape or disks.

7.1.2 Data Reduction

Data reduction includes processes that change either the values or numbers of data items. The data reduction processes used in the laboratory include establishment of calibration curves, calculation of sample concentrations from instrument responses, and computation of quality control parameters (Table 1). Calibration is discussed in Section 5. Table 10 lists the formulas used to calculate sample concentrations.

7.1.3 Sample Calculations

The reduction of instrument responses to sample concentrations takes different forms for different types of methods. Non-chromatographic and chromatographic methods and solid sample calculations are discussed below.

For most spectrophotometric analyses, the sample concentrations are calculated from the measured instrument responses using a calibration curve. The sample concentrations can be back-calculated from a regression equation fitted to calibration data. For gravimetric and titrimetric analyses, the calculations are performed according to equations given in the method.

For chromatographic analyses, the unknown concentrations are determined using response factors with external standardization. Quantitation by the external standard technique for gas chromatograph analyses involves calculation of the concentrations of the target compound from the sample response and the response of a standard solution of the compound. These

calculations are generally performed by the associated computerized data systems. The data are transferred to summary tables, which are given to the Reports Group.

Reporting Conventions and Units—The number of conventions set forth in the figures for reported data will be consistent with the laboratory's SOP. Reporting units used are those commonly used for the analyses performed.

7.2 DATA VERIFICATION AND VALIDATION

The International Standard ISO 8402 defines the following terms:

- **Verification**—Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled.

- **Validation**—Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

EPA has also adopted this terminology (U.S. EPA 1996). With regard to environmental testing, these definitions apply to two distinct processes involving evaluation of analytical data.

Data Verification is a process of evaluation used by the laboratory or an independent party to determine compliance with the specific quality control requirements identified in this QAPP. The data are reviewed by the laboratory staff during sample analysis and data generation. The following are the parameters reviewed for technical compliance:

- Chain-of-custody
- Preservation
- Holding times
- Gas chromatograph/mass spectrometry tunes
- Initial and continuing calibration
- Calibration and method blanks
- Surrogate recoveries
- Matrix spikes and matrix spike duplicates for organics
- Matrix spikes and duplicates for inorganics.

Data qualifiers are added to provide additional information to the data user (Tables 11 and 12).

Data Validation is also a process of evaluation, performed exclusively by an independent third party on the same data set which the laboratory has reviewed and released. The purpose of this process is to determine the suitability of the data for its intended use. This is a different goal from that of verification, and the review must be performed by a validator who understands, not only the technical analytical requirements, but how the data will be used in the decision making process, which is stated in the project data quality objectives. The difference in the two processes is in the review criteria and in the resulting qualification of the data: Data evaluated

as unusable is flagged (R), and data judged usable but of a lesser quality than specified in the project data quality objectives is flagged (J) as estimated.

7.2.1 Laboratory Data Verification Process and Responsible Personnel

Data verification is performed by the laboratory prior to release of results, and to evaluate the data against acceptance criteria specified for quality control samples in this QAPP. The quality control data produced during analysis are reviewed by the analyst and an assigned Quality Control Chemist during the analytical process to evaluate data integrity during collection and reporting of analytical data.

Initial review of analytical and quality control data is the responsibility of the analyst. Data are checked for errors in transcription, calculations, and dilution factors and for compliance with quality control requirements. Failure to meet method performance quality control criteria results in reanalysis of the sample or lot if data usability is affected. After the initial review is completed, the data are collected from summary sheets, workbooks, or computer files and assembled into a data package. The analyst prepares the narrative.

The second level of data review is the prime responsibility of a Chemist, assigned by the Section Chief, who verifies the data are compliant with method and project requirements, and reviews the narrative for completeness and accuracy. After technical review, the Section Chief verifies that the data package is complete.

The third level of review is performed by the Laboratory Project Manager who certifies the data by signing the Analytical Narrative in the final report. The Laboratory Project Manager checks to ensure that analyses were performed as requested and that the invoice is accurate.

Finally, the Quality Services staff is responsible for a minimum 10 percent audit of final reports. The reports are chosen randomly for review.

7.2.2 Field Data Verification

Field data validation will consist of both quantitative measures (quality assurance/quality control samples) and qualitative evaluation. Qualitative evaluation will generally consist of reviewing documentation of field activities and how well collection procedures were followed.

Validation is the prime responsibility of the Project Manager who addresses the following areas:

- Proper chain-of-custody, sample handling, and decontamination procedures followed
- Samples collected according to specified methods
- Field instrumentation calibrated according to specified methods
- Quality control samples (e.g., blanks, replicates) collected as required

- Field data sheets and logbooks completed and in agreement with sample container labels and chain-of-custody forms.

7.2.3 Data Validation

No data validation is required, however, a data review will be performed to determine if the data are usable.

7.3 LABORATORY REPORTS

The laboratory data package will meet EPA's Quality Control Level 3 Data Package.

7.3.1 Hard Copy Reports

The Laboratory Reports Group receives the data package after the Section Chief has released it. The Laboratory Reports Group assembles the draft report by collecting and incorporating:

- Data packages for each analysis associated with the reported samples
- Analytical narratives
- Other report-related information, such as copies of chain-of-custody, communication records, and non-conformance forms
- All dilutions will be reported.

The laboratory's draft report (sample) contains the information specified in Attachment B.5. It is prepared and reviewed by the Reports staff, and released by the Reports Supervisor. The draft data report is then reviewed by the Laboratory Project Manager who signs the report narrative to certify that the report meets the Data Quality Objectives for precision, accuracy, and completeness specified for this project. A copy of the report is maintained in the laboratory files.

7.3.2 Electronic Data Deliverable

In addition to a hard copy data report, the laboratory will submit an electronic data deliverable for each data set. The standardized electronic data deliverable is in a Microsoft Access format and contains the results of field samples and blanks for target analytes. Results of laboratory quality control samples will not be included. Table 13 lists the fields included in the electronic data deliverable.

7.4 PROJECT REPORTS

A reviewer designated by the Project Manager examines the final project report for compliance with the project requirements for field and laboratory work. Final review is the responsibility of the Project Manager or designated senior technical reviewers.

8. INTERNAL QUALITY CONTROL CHECKS

A quality control program is a systematic process that controls the validity of analytical results by measuring the accuracy and precision of method and matrix, developing expected control limits, using these to detect anomalous events, and requiring corrective action techniques to prevent or minimize the recurrence of these events. Quality control measurements for analytical protocols are designed to evaluate laboratory performance, and measurement biases resulting from the sample matrix and field performance.

- **Laboratory Method Performance**—Quality control criteria for method performance must be met for target analytes for data to be reported. These criteria generally apply to instrument tune, calibration, method blanks, laboratory control samples, and Standard Reference Materials. In some instances where method criteria fail, useable data can be obtained and are reported with client approval. The narrative will then include a thorough discussion of the impact on data quality.

- **Sample Performance**—The accuracy and precision of sample analyses are influenced by both internal and external factors. Internal factors are those associated with sample preparation and analysis. Internal factors are monitored by the use of internal quality control samples. Quality control field samples are analyzed to determine any measurement bias due to the sample matrix based on evaluation of matrix spike, matrix spike duplicate, and laboratory duplicates. If acceptance criteria are not met, matrix interferences are confirmed either by reanalysis or by inspection of the laboratory control sample results to verify that laboratory method performance is in control. Data are reported with appropriate qualifiers or discussion.

- **Field Performance**—Quality control samples are used to evaluate the effectiveness of the sampling and processing program to obtain representative samples, eliminating any cross contamination.

The Contractor Chemical Quality Control Coordinator will evaluate the data to assure that method performance objectives and the project objectives have been met.

8.1 LABORATORY QUALITY CONTROL SAMPLES

8.1.1 Method (Reagent) Blank

The method (reagent) blank is used to monitor laboratory contamination. This is usually a sample of laboratory reagent water processed through the same analytical procedure as the sample (i.e., digested, extracted, distilled). One method blank is prepared and analyzed every day that samples are prepared.

8.1.2 Fortified Method Blank Spike (Laboratory Control Sample)

Normally, fortified method blank samples are analyzed with each batch of 20 or fewer samples. These samples generally consist of laboratory tissue or solid matrix fortified with the analytes of interest for single-analyte methods and selected analytes for multi-analyte methods according to the appropriate analytical method. They are prepared and analyzed with the associated sample batch. The analyte recovery from each is used to monitor analytical accuracy.

8.1.3 Fortified Sample (Matrix Spike)

A fortified sample (matrix spike) is an aliquot of a field sample which is fortified with the analyte(s) of interest and analyzed to monitor matrix effects associated with a particular sample. Samples to be spiked are chosen at random. Soil samples which are to be analyzed for metals will be spiked at a level of at least three times the estimated or known background concentrations. For organics, the spiking level will be near 10 times the quantification limit for all samples. All quality control limits, including guidance limits, which are not met will be followed by a corrective action whether or not it is required by the method. A duplicate fortified sample (matrix spike duplicate) will be performed for every batch of 20 or fewer samples for organic analyses.

8.1.4 Surrogates

Surrogates are organic compounds that are similar to analytes of interest in chemical composition, extraction, and chromatography, but are not normally found in environmental samples. These compounds are spiked into blank, standards, samples, and spiked samples prior to analysis for organic parameters. Generally, surrogates are not used for inorganic analyses. Percent recoveries are calculated for each surrogate. Surrogates will be spiked into samples according to the appropriate analytical method (Section 6). Surrogate spike recoveries will fall within the control limits set in accordance with procedures specified in the method. Surrogate recoveries will not be calculated if sample dilution causes the surrogate concentration to fall below the quantitation limit.

8.1.5 Internal Standards

Internal standards are measured amounts of certain compounds added after preparation or extraction of a sample.

They are used in an internal standard calibration method to correct sample results affected by column injection losses, purging losses, or viscosity effects.

When the internal standard results are outside of the acceptance limits, corrective actions will be performed. After the system problems have been resolved and system control has been re-established, all samples analyzed while the system was malfunctioning will be re-analyzed. If corrective actions are not performed or are ineffective, it will be noted in the laboratory narrative.

8.1.6 Interference Check Sample

The interference check sample, used in inductively coupled plasma analyses only, contains both interfering and analyte elements of known concentrations. The interference check sample is used to verify background and interelement correction factors. The interference check sample is run at the beginning and end of each run sequence.

When the interference check sample results are outside of the acceptance limits stated in the method, corrective action will be performed. After the system problems have been resolved and system control had been re-established, re-analyze the interference check sample. If the interference check sample result is acceptable, re-analyze all affected samples. If corrective action is not performed or the corrective action was ineffective, it will be noted in the laboratory narrative.

8.2 FIELD QUALITY CONTROL SAMPLES

These samples are not included specifically as laboratory quality control samples but are analyzed when submitted. Data for these quality control samples are reported with associated samples. Equipment rinsate blank, field, and trip quality control samples are discussed and will be collected as specified in Section 3 of the Field Sampling Plan.

8.2.1 Rinsate Blank

A rinsate blank is generated by pouring reagent water over the sampling equipment after it has been decontaminated and collecting the rinse. A rinsate blank will be taken within each sampling event.

8.2.2 Field Blank

A field blank is generated by pouring reagent water from the laboratory into the appropriate sample bottles that accompany the samples during the collection process. A field blank will be taken within each sampling event.

8.2.3 Trip Blank

Trip blanks will be collected by filling volatile organic analyte sample bottles with reagent-grade deionized water at the laboratory. The trip blanks will be kept with sample bottles and transported to the laboratory with the field sample volatile organic analyte containers.

8.3 APPLICATION OF CONTROLS

Analytical quality control results are calculated using the formulas in Table 14, and are compared with the control limits in Attachments B.1 and B.2 to determine if the data can be reported. If the limits are exceeded, appropriate corrective action must be taken as specified in Attachment B.3.

9. PERFORMANCE AND SYSTEMS AUDITS

9.1 PERFORMANCE AUDITS

Audits are performed routinely to review and evaluate the adequacy and effectiveness of laboratory performance and quality assurance program, ascertain if the QAPP is being completely and uniformly implemented, assess the effectiveness of the laboratory quality assurance program, identify non-conformances, and verify that identified deficiencies are corrected. The individual laboratory QSMs are responsible for such audits and will perform them according to a schedule planned to coincide with appropriate activities on the project schedule and sampling plans; however, no performance audits are planned due to the limited number of samples being taken.

10. PREVENTIVE MAINTENANCE

Periodic preventive maintenance is required for sensitive field and laboratory equipment. Instrument manuals will be kept on file for reference if equipment needs repair. The troubleshooting section of factory manuals may be used in assisting personnel in performing maintenance tasks. The frequency of preventive maintenance for field equipment is indicated in each operating instruction manual. Field equipment is checked by field personnel under the supervision of the field coordinators. It is the responsibility of Field Operations Manager and Field Team Leader to conduct preventive maintenance.

Major instruments in the laboratory are covered by annual service contracts with manufacturers. Under these agreements, regular preventive maintenance visits are made by trained service personnel. Maintenance is documented and maintained in permanent records by the individual responsible for each instrument.

The Laboratory Managers and Section Chiefs are responsible for preparation and documentation of the program. Supervisors implement the program, and the QSM reviews implementation to verify compliance. For each operational group, the preventive maintenance program includes the following:

- Listing of the instruments and equipment that are included in the program
- Frequency of maintenance considering manufacturer's recommendations and/or previous experience with equipment
- For each instrument in the program, a file is maintained for the following information
  - List of spare parts maintained by the laboratory
  - External service contracts
  - Items to be checked and/or serviced during maintenance and directions for performing maintenance (if external service is not provided or if not stated in manufacturer's instrument manuals).

Specific preventive maintenance practices, their frequency of performance, and available spare parts for laboratory equipment are described in Table 15.

11. DATA QUALITY ASSESSMENT

11.1 FIELD DATA ASSESSMENT

Assessment of the field data is the prime responsibility of the EA Project Manager and Field Team Leader who address the following areas:

- Proper chain-of-custody, sample handling, and decontamination procedures followed
- Samples collected according to specified methods
- Quality control samples (e.g., blanks, replicates) collected as required
- Field data sheets and logbooks completed and in agreement with sample container labels and chain-of-custody forms.

11.2 LABORATORY DATA ASSESSMENT

Data assessment is a systematic process of reviewing data against a set of criteria to identify outliers or errors. Laboratory data assessment is the ultimate responsibility of the Project Manager, who can designate a quality control person to perform a PARCC-type analysis to assess method performance and determine if the data are of sufficient quality to be used for the project. Laboratory data review is discussed in Section 7 of this QAPP. Each report narrative includes a discussion of the quality control samples and evaluates data usability based on the data.

12. CORRECTIVE ACTIONS

12.1 OBJECTIVES

The objectives of the corrective action procedures presented below are to ensure that recognized errors in performance of sample and data acquisition lead to effective remedial measures, and that those steps required to correct an existing condition are documented to provide assurance that any data quality deficiencies are recognized in later interpretation and are not recurrent in the course of the project.

12.2 RATIONALE

Many times corrective measures are undertaken by project staff in a timely and effective fashion but go undocumented. Such incidents may be of a recurrent type that might not be recognized by other staff performing the same activity. In other cases, corrective actions are of a complex nature and may require scheduled interactions between departmental groups. In either case, documentation in a formal or informal sense can reinforce the effectiveness and duration of the corrective measures taken.

12.3 CORRECTIVE ACTION METHODS

12.3.1 Immediate Corrective Actions

Immediate corrective actions are of a minor or routine nature such as correcting malfunctioning equipment, correction of data transcription errors, and other such activities routinely made in the field, laboratory or office by technicians, analysts, and other project staff. These should be documented as prescribed in the project quality control procedures, as required. Specific documentation should be limited to notations in logbooks, notebook, or on data sheets or other such forms. Such notations should be initiated and dated by the person performing the corrective action.

12.3.2 Long-Term Corrective Actions

Long-term corrective action will be used to identify and eliminate causes of non-conformances which are of a complex nature and that are formally reported between management groups. A formal system for reporting and recording these corrective actions will use the following procedure.

12.3.3 Corrective Action Steps

For either immediate or long-term corrective actions, steps comprising closed-loop corrective action system are as follows:

1. Define the problem
2. Assign responsibility for investigating the problem
3. Investigate and determine the cause of the problem
4. Determine a corrective action to eliminate the problem
5. Assign and accept responsibility for implementing the corrective action
6. Establish effectiveness of the corrective action and implement the correction
7. Verify that the corrective action has eliminated the problem.

Non-conformance events associated with analytical work are documented using non-conformance reports which are reviewed and approved by the QSM.

12.3.4 Audit-Based Non-Conformances

Following audits, corrective action is initiated by documenting the audit finding and recommended corrective action on an Audit Finding Report discussed in Section 9. The corrective action undertaken by the designated responsible party is documented with an implementation schedule and management approval. The implementation is verified by the auditor on the same form which is then made part of the project audit report record. Other means of documenting long-term corrective action are equally acceptable if the seven elements listed above are addressed.

12.4 CORRECTIVE ACTION REPORT REVIEW AND FILING

Immediate and long-term corrective actions require review to assure that, during the time of non-conformance, erroneous data were not generated or that, if possible, correct data were acquired instead. Such confirmation and review is the responsibility of the supervisor of the staff implementing the corrective action. Confirmation will be acknowledged by notation and dated signature on the affected data record or appropriate form or by memorandum to cognizant project management. Such corrective action forms and memorandum will be retained on file by responsible task leaders and filed centrally by the project manager.

12.5 CORRECTIVE ACTION REPORTS TO MANAGEMENT

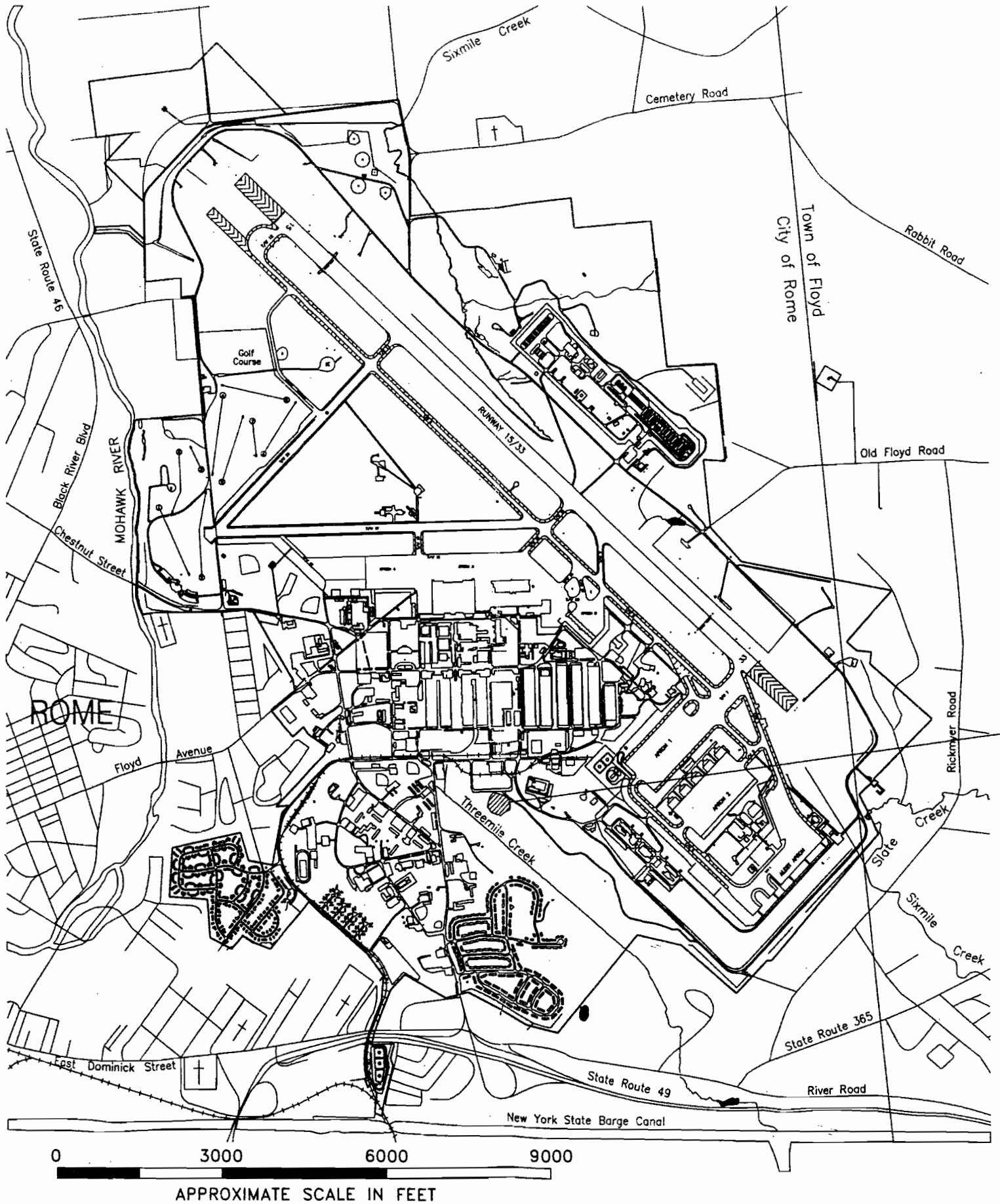
The Project Quality Assurance Officer will provide project management with corrective action reports. The Project Manager is informed verbally of analytical non-conformance events as soon as possible and decisions made after evaluation are documented in the non-conformance report. Copies of each non-conformance report are maintained in the report file, and addressed in the final data report.

13. QUALITY ASSURANCE REPORTS

Fundamental to the success of this project is the active participation of management through awareness of project activities, and during development, review, and operation of the project. Management will be informed of quality central activities through the receipt, review, and/or approval of:

- QAPP
- Audit reports
- Corrective action reports
- Analytical report narratives.

Figures



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LANDFILL COVER DESIGN – LANDFILL 5

FORMER GRIFFISS AIR FORCE BASE ROME, NEW YORK

LOCATION MAP

EA ENGINEERING, P.C.

FIGURE 1

SCALE: AS SHOWN | DATE: 6 NOVEMBER 2001 | 1 OF 2

CADD

CHAIN of CUSTODY

PLEASE PRINT IN PEN Page of ____

Client	Contact	Phone # ( )	Fax # ( )
Address	City	State	Zip Code
Purchase Order #	Proj. Name / No.		Katahdin Quote #
Bill (if different than above)	Address		
Sampler (Print / Sign)		Copies To:	

LAB USE ONLY

WORK ORDER #: _ *

KATAHDIN PROJECT MANAGER _____

REMARKS: _____

SHIPPING INFO: ☐ FED EX ☐ UPS ☐ CLIENT

AIRBILL NO: _____

TEMP °C _____ ☐ TEMP BLANK ☐ INTACT ☐ NOT INTACT

ANALYSIS AND CONTAINER TYPE PRESERVATIVES

*	Sample Description	Date / Time coll'd	Matrix	No. of Cntrs.	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N	Filt. ☐Y☐N
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COMMENTS

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ORIGINAL

Figure 2. Example Chain-of-Custody form.

Tables

TABLE 1 DATA QUALITY CHARACTERISTICS FORMULAS

Characteristic	Formula	Symbols
Precision (as relative percent difference)	$RPD = \frac{\lvert x_1 - x_2 \rvert}{(x_1 + x_2)/2} \times 100 = \frac{\lvert x_1 - x_2 \rvert}{(x_1 + x_2)} \times 200$	x1, x2 = Duplicate values.
Accuracy (as percent recovery for samples without a background level of the analyte, such as reference materials, laboratory control samples, and performance evaluation samples)	$\%R = \frac{X}{T} \times 100$	X = Found concentration T = True or assumed concentration
Accuracy (as percent recovery for measurements in which a known amount of analyte [a spike] is added to an environmental sample)	$\%R = \frac{X - B}{T} \times 100$	X = Found concentration B = Background concentration T = True or assumed concentration
Completeness	$C = (N/S) \times 100$	C = Completeness (%) N = Number of valid data S = Number of data scheduled for collection

TABLE 2 REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR FIELD BLANKS[a]

Parameter	Volume Required[b] (mL)	Container[c]	Preservative	Holding Time
METALS				
Mercury	100	P, G	HNO_3 to pH <2	28 days
Other Metals	500	P, G	HNO_3 to pH <2	6 months
INORGANICS, NON-METALLIC				
Cyanides	500	P, G	Cool, 4°C ± 2°C NaOH to pH >12	14 days
ORGANICS				
Volatile Organics	40	G, Teflon-lined septum	Cool, 4°C ± 2°C 4 drops conc. HCL to pH <2	14 days
Polychlorinated Biphenyls	1,000	G, amber, Teflon-lined cap	Cool, 4°C ± 2°C pH 5-9	7 days to extraction 40 days after extraction
Organochlorine Pesticides	1,000	G, Teflon-lined cap	Cool, 4°C ± 2°C	7 days to extraction 40 days after extraction
Polynuclear Aromatic Hydrocarbons	1,000	G, Teflon-lined cap	Cool, 4°C ± 2°C; store in dark, 0.008% $Na_2S_2O_3$	7 days to extraction 40 days after extraction
Semivolatile Organics	1,000	G, amber, Teflon-lined cap	Cool, 4°C ± 2°C	7 days to extraction 40 days after extraction

(a) From time of sample collection (40 CFR 261).
(b) If matrix spike/matrix spike duplicate analyses are required, the stated amount should be increased by a factor of three for the designated sample.
(c) P = polyethylene; G = glass. For metals in aqueous samples, polyethylene with a polypropylene cap (no lines) is preferred.
(d) Included with metals.

TABLE 3 CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR SOIL SAMPLES[a]

Parameter	Weight[b] Required (g)	Container[c]	Preservative	Holding Time
METALS				
Mercury	5	G	None required	28 days
Other Metals	5	G	None required	6 months
INORGANICS, NON-METALLIC				
Cyanides	50	G	Cool, 4°C ± 2°C	14 days
Total Organic Carbon	5	G	Cool, 4°C ± 2°C	28 days
ORGANICS[e]				
Volatile Organics	5	G, Teflon-lined septum	Cool, 4°C ± 2°C	14 days
Polychlorinated Biphenyls	30	G, Teflon-lined cap	Cool, 4°C ± 2°C	14 days to extraction 40 days after extraction
Organochlorine Pesticides	30	G, Teflon-lined cap	Cool, 4°C ± 2°C	14 days to extraction 40 days after extraction
Polynuclear Aromatic Hydrocarbons	30	G, Teflon-lined cap	Cool, 4°C ± 2°C	14 days to extraction 40 days after extraction
Semivolatile Organics	30	G, Teflon-lined cap	Cool, 4°C ± 2°C	14 days to extraction 40 days after extraction

(a) From time of sample collection (40 CFR Part 136.3, 40 CFR Part 261).
(b) If matrix spike/matrix spike duplicate analyses are required, the stated amount should be increased by a factor of three for the designated sample.
(c) Glass (G) only.
(d) Included with metals.
(e) Samples requiring the full suite of organics analyses can be collected in two 40-oz glass jars; one for volatile organics with a Teflon-lined septum and one additional jar for the balance of analyses.

TABLE 4 CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR INVESTIGATION-DERIVED WASTE [a]

Parameter	Weight[b] Required (g)	Container[c]	Preservative	Holding Time
METALS				
TCLP metals	100	G	None required	6 months from collection to TCLP extraction except Hg, which is 28 days 6 months from TCLP extraction to analysis except Hg, which is 28 days
INORGANICS, NON-METALLIC				
Corrosivity	10	G	Cool, 4°C ± 2°C	7 days
Ignitability	50	G	Cool, 4°C ± 2°C	7 days
Reactivity	50	G	Cool, 4°C ± 2°C	7 days for reactive sulfide 14 days for reactive cyanide
ORGANICS[d]				
TCLP volatile organic analytes	50	G, Teflon-lined septum	Cool, 4°C ± 2°C	14 days from collection to TCLP extraction 14 days for TCLP extraction to analysis
TCLP semivolatile organic analytes	100	G, Teflon-lined cap	Cool, 4°C ± 2°C	14 days from collection to TCLP extraction
Organochlorine pesticides	100	G, Teflon-lined cap	Cool, 4°C ± 2°C	7 days from TCLP extraction to method extraction
Herbicides	100	G, Teflon-lined cap	Cool, 4°C ± 2°C	40 days from method extraction to analysis

(a) From time of sample collection (40 CFR Part 136.3, 40 CFR Part 261).
(b) If matrix spike/matrix spike duplicate analyses are required, the stated amount should be increased by a factor of three for the designated sample.
(c) Glass (G) only.
(d) Samples requiring the full suite of organics analyses can be collected in two 40-oz glass jars; one for volatile organics with a Teflon-lined septum and one additional jar for the balance of analyses.

NOTE: TCLP = Toxicity Characteristic Leaching Procedure.

TABLE 5 SUMMARY OF PERIODIC CALIBRATION REQUIREMENTS

Instrument	Calibration Frequency		Acceptance Limits	Corrective Actions
Analytical Balances	Daily:	Sensitivity (with a Class P weight)	0.001 g	Adjust sensitivity
	Monthly:	Checked with Class S weights	Standard deviation <0.1 mg	Service balance
	Annually:	Calibrated by outside vendor against certified Class S weights		Service balance
Thermometers	Annually:	Calibrated against certified National Institute of Standards and Technology thermometers	±0.5°C	Tag and remove from service
Automatic Pipettors	Quarterly:	Gravimetric check	High volume (>100 mL): ≤1.0% relative error as relative standard deviation Low volume (<100 mL): ≤2.0% relative error as relative standard deviation	Service or replacement

TABLE 6 CALIBRATION FORMULAS

Application	Formula	Symbols
Linear regression calibration curves	$C = (R - a_0)/a_1$	C = Analytical concentration R = Instrument response a_0 = Intercept of regression curve (instrument response when concentration is zero) a_1 = Slope of regression curve (change in response per change in concentration)
Calibration factors[a]	$C = \frac{A_x V_f}{CF V_i}$	C = Concentration (µg/L) CF = Calibration factor A_x = Peak size of target compound in sample extract V_f = Final volume of extracted sample (mL) V_I = Initial volume of sample extracted (mL)
Response factors[b]	$C = \frac{C_{is} A_x V_f}{RF A_{is} V_i}$	C = Concentration (µg/L) RF = Internal standard response factor C_{is} = Concentration of the internal standard (µg/L) A_x = Area of the characteristic ion for the target compound V_f = Final volume of extracted sample (mL) A_{is} = Area of the characteristic ion for the internal standard V_I = Initial volume of sample extracted (mL)

(a) Used for quantitation by the internal standard technique.
(b) Used for quantitation by the external standard technique.

TABLE 7 ANALYTICAL METHODS

Parameter	Method	Reference Method	Matrix	Reference
SAMPLE PREPARATION				
Mercury	Atomic Absorption – Cold Vapor	7470A	W	U.S. EPA (1997)
Mercury	Atomic Absorption – Cold Vapor	7471A	S	U.S. EPA (1997)
Semivolatile Organics Extraction	Continuous Extraction	3520C	W	U.S. EPA (1997)
Semivolatile Organics Extraction	Soxhlet Extraction	3540C	S	U.S. EPA (1997)
Total Metals Digestion	Nitric Acid – Hydrogen Peroxide	3050B	S	U.S. EPA (1997)
Total Metals Digestion (FAA/ICP)	Nitric Acid – Hydrochloric Acid	3010A	W	U.S. EPA (1997)
Total Metals Digestion (GFAA)	Nitric Acid	3020A	W	U.S. EPA (1997)
Volatile Organics Preparation	Purge and trap	5030A	S	U.S. EPA (1995)
Volatile Organics Preparation	Purge and trap	5030B	W	U.S. EPA (1997)
Volatile Organics Preparation	Closed System Purge and trap	5035	W,S	U.S. EPA (1997)
Toxicity Characteristic Leaching Procedure	Liquid Extraction	1311	S	U.S. EPA (1997)
Acid Cleanup	Treatment with sulfuric acid	3665A	W,S	U.S. EPA (1997)
Alumina Column Cleanup	Adsorption Column Chromatography	3610	W,S	U.S. EPA (1997)
Florisil Column Cleanup	Adsorption Column Chromatography	3620B	W,S	U.S. EPA (1997)
Sulfur Cleanup	Treatment with Cu, Hg, or TBA-sulfite	3660	W,S	U.S. EPA (1997)
ORGANICS				
Volatile Organics	Gas Chromatography/Mass Spectrometry	8260B	W,S	U.S. EPA (1997)
Acid Extractable Organics	Gas Chromatography/Mass Spectrometry	8270C	W,S	U.S. EPA (1997)
Base-Neutral Extractable Organics	Gas Chromatography/Mass Spectrometry	8270C	W,S	U.S. EPA (1997)
Herbicides	Gas Chromatography – Electron Capture Device	8151A	S	U.S. EPA (1997)
Organochlorine Pesticides	Gas Chromatography – Electron Capture Device	8081A	W,S	U.S. EPA (1997)
Polynuclear Aromatic Hydrocarbons	Gas Chromatography – Ultraviolet/Fluorescent	8310	W,S	U.S. EPA (1997)
Polychlorinated biphenyls	Gas Chromatography – Electron Capture Device	8082	W,S	U.S. EPA (1997)
METALS				
Antimony	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Arsenic	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Beryllium	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Cadmium	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Chromium, Total	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
NOTE: **Matrix codes:** W = Field blanks; S = Soils.				

Parameter	Method	Reference Method	Matrix	Reference
METALS (Continued)				
Copper	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Lead	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Mercury	Atomic Absorption – Cold Vapor, Autoclave Digestion Procedure	7470A	W	U.S. EPA (1997)
Mercury	Atomic Emission – Inductively Coupled Plasma	7471A	S	U.S. EPA (1997)
Nickel	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Selenium	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Silver	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
Thallium	Atomic Emission – Inductively Coupled Plasma	7841	W,S	U.S. EPA (1997)
Zinc	Atomic Emission – Inductively Coupled Plasma	6010B	W,S	U.S. EPA (1997)
PHYSICAL PARAMETERS				
Percent Moisture	Gravimetric	D2216	S	ASTM (1995)
Ignitability (solid)	Regulatory Definition	Section 7.1	S	U.S. EPA (1997)
Corrosivity (solid)	pH Measurement	9045	S	U.S. EPA (1997)
Reactivity (solid)	Reaction Over pH Range 2-12	Section 7.3	S	U.S. EPA (1997)

References:

American Society for Testing and Materials (ASTM). 1995. Annual Book of ASTM Standards, Volume 11.01. ASTM, Philadelphia, Pennsylvania.
U.S. EPA. 1997. Test Methods for Evaluating Solid Waste. Physical/Chemical Methods. U.S. EPA SW-846, 3rd Edition, including UPDATE III. U.S. EPA, Washington, D.C. June.

TABLE 8 METHOD REPORTING LIMITS FOR BORROW SOURCE AND LANDFILL RECLAMATION SOIL SAMPLES

Parameter	Method Reporting Limit[a]	NYSDEC TAGM CRQL[b]
VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8260B (µg/kg)		
Acetone	5	10
Benzene	2.5	5
Bromodichloromethane	2.5	5
Bromoform	2.5	5
Bromomethane	2.5	5
2-Butanone	5	10
Carbon disulfide	2.5	5
Carbon tetrachloride	2.5	5
Chlorobenzene	2.5	5
Chloroethane	5	10
Chloroform	2.5	5
Dibromochloromethane	2.5	5
1,1-Dichloroethane	2.5	5
1,2-Dichloroethane	2.5	5
1,1-Dichloroethene	2.5	5
1,2-Dichloroethene (total)	2.5	5
1,2-Dichloropropane	2.5	5
cis-1,3-Dichloropropene	2.5	5
trans-1,3-Dichloropropene	2.5	5
Ethylbenzene	2.5	5
2-Hexanone	2.5	5
4-Methyl-2-pentanone (MIBK)	5	10
Methylene chloride	2.5	5
Styrene	2.5	5
1,1,2,2-Tetrachloroethane	2.5	5
Tetrachloroethene	2.5	5
Toluene	2.5	5
1,1,1-Trichloroethane	2.5	5
1,1,2-Trichloroethane	2.5	5
Trichloroethene	2.5	5
Vinyl chloride	5	10
Xylenes (total)	5	10

(a) Method Reporting Limit is determined according to U.S. Army Corps of Engineers Engineer Manual 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans (USACE 2001b).
(b) NYSDEC TAGM No. 4046. 24 January 1994. Revised.

NOTE: NYSDEC = New York State Department of Environmental Conservation.
TAGM = Technical and Administrative Guidance Memorandum.
CRQL = Contract Required Quantification Limit.
EPA = U.S. Environmental Protection Agency.

Parameter	Method Reporting Limit[a]	NYSDEC TAGM CRQL[b]
SEMIVOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8270C (µg/kg)		
Acenaphthene	165	330
Acephthylene	165	330
Anthracene	165	330
Benz(a)anthracene	165	330
Benzo(b)fluoranthene	165	330
Benzo(k)fluoranthene	165	330
Benzo(a)pyrene	165	330
Benzo(g,h,i)pyrene	165	330
Bis(2-chloroethyl) ether	165	330
Bis(2-chloroethoxy)methane	165	330
Bis(2-ethylhexyl)phthalate	165	330
4-Bromophenyl phenyl ether	165	330
Butylbenzylphthalate	165	330
Carbazole	165	330
4-Chloroaniline	165	330
4-Chloro-3-methylphenol	165	330
2-Chloronaphthalene	165	330
2-Chlorophenol	165	330
4-Chlorophenyl phenyl ether	165	330
Dibenzofuran	165	330
Di-n-butyl phthalate	165	330
1,2-Dichlorobenzene	165	330
1,3-Dichlorobenzene	165	330
1,4-Dichlorobenzene	165	330
3,3'-Dichlorobenzidine	165	330
2,4-Dichlorophenol	800	1,600
Diethyl phthalate	165	330
2,4-Dimethylphenol	165	330
Dimethyl phthalate	165	330
4,6-Dinitro-2-methylphenol	165	330
2,4-Dinitrophenol	165	330
2,4-Dinitrotoluene	165	330
2,6-Dinitrotoluene	165	330
Di-n-octyl phthalate	165	330
Hexachlorobutadiene	165	330
Hexachlorocyclopentadiene	165	330
Hexachloroethane	165	330
Indeno(1,2,3-cd)pyrene	165	330
Isophorone	165	330
2-Methylnaphthalene	165	330
2-Methylphenol	165	330
4-Methylphenol	165	330
Naphthalene	165	330
2-Nitroaniline	165	330
3-Nitroaniline	165	330
4-Nitroaniline	800	1,600
Nitrobenzene	165	330
2-Nitrophenol	800	1,600
4-Nitrophenol	800	1,600

Parameter	Method Reporting Limit[a]	NYSDEC TAGM CRQL[b]
SEMIVOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8270C (µg/kg) (Continued)		
N-Nitrosodiphenylamine	165	330
N-Nitroso-di-n-propylamine	165	330
2,2'-Oxybis (2-chloropropane)	165	330
Phenol	165	330
1,2,4-Trichlorobenzene	165	330
2,4,5-Trichlorophenol	165	330
2,4,6-Trichlorophenol	165	330
ORGANOCHLORINE PESTICIDES BY EPA METHOD 8081A (µg/kg)		
Aldrin	4	8
Alpha-BHC	4	8
Beta-BHC	4	8
Delta-BHC	4	8
Chlordane	40	80
4,4'-DDD	8	16
4,4'-DDE	8	16
4,4'-DDT	8	16
Dieldrin	8	16
Endosulfan I	8	16
Endosulfan II	8	16
Endosulfan Sulfate	8	16
Endrin	4	8
Endrin keytone	Not applicable	Not applicable
Gamma-BHC	4	8
Gamma-chlordane	40	80
Heptachlor	4	8
Heptachlor epoxide	4	8
Methoxychlor	40	80
Mitotane	Not applicable	Not applicable
POLYCHLORINATED BIPHENYLS BY EPA METHOD 8082 (µg/kg)		
Polychlorinated biphenyls	80	160
POLYNUCLEAR AROMATIC HYDROCARBONS BY EPA METHOD 8310 (µg/kg)		
Acenaphthene	165	330
Acenaphthylene	165	330
Benzo(a)anthracene	165	330
Benzo(a)pyrene	165	330
Benzo(b)fluoranthene	165	330
Benzo(g,h,i)perylene	165	330
Benzo(k)fluoranthene	165	330
Chrysene	165	330
Dibenzo(a,h)anthracene	165	330
Fluoranthene	165	330
Fluorene	165	330
Indeno(1,2,3-cd)pyrene	165	330
Naphthalene	165	330
Pyrene	165	330

Parameter	Method Reporting Limit[a]	NYSDEC TAGM CRQL[b]
TARGET ANALYTE LIST METALS BY EPA METHOD 6010B/7000 (mg/kg)		
Aluminum	1.0	2.0
Antimony	0.3	0.6
Arsenic	0.05	0.1
Barium	1	2
Beryllium	0.025	0.05
Cadmium	0.025	0.05
Calcium	25	50
Total Chromium[c]	0.05	0.1
Cobalt	0.25	0.5
Copper	0.125	0.25
Iron	0.5	1
Lead	0.015	0.03
Magnesium	25	50
Manganese	0.075	0.15
Mercury	0.001	0.002
Nickel	0.2	0.4
Potassium	25	50
Selenium	0.025	0.05
Silver	0.05	0.1
Sodium	25	50
Thallium	0.05	0.1
Vanadium	0.25	0.5
Zinc	0.1	0.2
(c) Total chromium includes hexavalent chromium.		

TABLE 9 METHOD REPORTING LIMITS FOR TOXICITY CHARACTERISTIC LEACHING PROCEDURE HAZARDOUS TOXICANTS

Parameter	Method Reporting Limit	TCLP Regulatory Criteria[a]
VOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8260B (µg/L)		
Benzene	5	500
2-Butanone	10	200,000
Carbon tetrachloride	5	500
Chlorobenzene	5	100,000
Chloroform	5	6,000
1,2-Dichloroethane	5	500
1,1-Dichloroethene	5	700
Tetrachloroethene	5	700
Trichloroethene	5	500
Vinyl chloride	5	200
SEMIVOLATILE ORGANIC COMPOUNDS BY EPA METHOD 8270C (µg/L)		
1,4-Dichlorobenzene	50	7,500
2,4-Dinitrotoluene	50	130
Hexachlorobenzene	6.5	13
Hexachlorobutadiene	50	500
Hexachloroethane	50	3,000
2-Methylphenol	50	200,000
3+4-Methylphenol	50	200,000
Nitrobenzene	50	2,000
Pentachlorophenol	250	100,000
Pyridine	50	5,000
2,4,5-Trichlorophenol	250	400,000
2,4,6-Trichlorophenol	50	2,000
ORGANOCHLORINE PESTICIDES BY EPA METHOD 8081A (µg/L)		
Lindane	0.25	400
Chlordane	5.0	30
Endrin	0.50	20
Heptachlor (and its oxides)	0.25	8
Methoxychlor	2.5	10,000
Toxaphene	25	500
HERBICIDES BY EPA METHOD 8151A (µg/L)		
2,4-D	120	10,000
2,4,5-TP	17	1,000
TARGET ANALYTE LIST METALS BY EPA METHOD 6010B/7000 (µg/L)		
Arsenic	100	5,000
Barium	200	100,000
Cadmium	5.0	1,000
Chromium	10.0	5,000
Lead	100	5,000
Selenium	100	1,000
Silver	10.0	5,000
METALS – COLD VAPOR BY EPA METHOD 7470A (µg/L)		
Mercury	0.20	200

(a) Regulatory criteria indicate a minimum concentration in the leachate above which a sample is considered a hazardous waste (40 CFR 261).

NOTE: TCLP = Toxicity Characteristic Leaching Procedure.

TABLE 10 SAMPLE CONCENTRATION FORMULAS

Application	Formula	Symbols
Linear regression calibration curves	$C = (R = a_0)/a_1$	C = Analytical concentration R = Instrument response a_0 = Intercept of regression curve (instrument response when concentration is zero) a_1 = Slope of regression curve (change in response per change in concentration)
Calibration factors[a]	$C = \frac{A_x\ V_f}{CF\ V_i}$	C = Concentration (µg/L) CF = Calibration factor A_x = Peak size of target compound in sample extract V_f = Final volume of extracted sample (mL) v_i = Initial volume of sample extracted (mL)
Response factors[b]	$C = \frac{C_{is}\ A_x\ V_f}{RF\ A_{is}\ V_i}$	C = Concentration (µg/L) RF = Internal standard response factor C_{is} = Concentration of the internal standard (µg/L) A_x = Area of the characteristic ion for the target compound V_f = Final volume of extracted sample (mL) A_{is} = Area of the characteristic ion for the internal standard V_1 = Initial volume of sample extracted (mL)
Residues[c]	$R = \frac{W - T \times 1{,}000{,}000}{V}$	R = Residue concentration (mg/L) W = Weight of dried residue + container (g) T = Tare weight of container (g) V = Volume of sample used (mL)
Solid samples[d]	$K = \frac{C\ V\ D}{W\ (\%S/100)}$	K = Dry-weight concentration (mg/kg) C = Analytical concentration (mg/L) V = Final volume (mL) of processed sample solution D = Dilution factor W = Wet-weight (g) of as-received sample taken for analysis %S = Percent solids of as-received sample

(a) Used for quantitation by the external standard technique.
(b) Used for quantitation by the internal standard technique.
(c) Conversion factor to convert g/mL to mg/L.
(d) Used to calculate the dry-weight concentration of a solid sample from the analytical concentration of the processed sample.

$$\frac{mg}{L} = \frac{g}{mL} \times \frac{10^3\ mL}{L} \times \frac{10^3\ mg}{g}$$

TABLE 11 LABORATORY ORGANIC ANALYSIS DATA QUALIFIERS[(a)]

Qualifiers other than those listed below may be required to properly define the results. If used, they are given an alphabetic designation not already specified in this table or in a project/program document such as a Quality Assurance Project Plan or a contract Statement of Work. Each additional qualifier is fully described in the Analytical Narrative section of the laboratory report.

U Indicates a target compound was analyzed for but not detected. The sample Reporting Limit is corrected for dilution and, if a soil sample, for percent moisture, if reported on a dry weight basis.

J Indicates an estimated value. This qualifier is used under the following circumstances:

(1) When estimating a concentration for tentatively identified compounds (TICs) in gas chromatograph/mass spectrometry (GC/MS) analyses, where a 1:1 response is assumed

(2) When the mass spectral and retention time data indicate the presence of a compound that meets the volatile and semivolatile GC/MS identification criteria, and the result is less than the Reporting Limit but greater than the method detection limit.

B This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action. For GC/MS analyses, this qualifier is used for a TIC, as well as, for a positively identified target compound.

E This qualifier identifies compounds whose concentrations exceed the calibration range of the instrument for that specific analysis.

D When applied, this qualifier identifies all compound concentrations reported from a secondary dilution analysis.

A This qualifier indicates that a TIC is a suspected aldol-condensation product.

N Indicates presumptive evidence of a compound. This qualifier is only used for GC/MS TICs, where the identification is based on a mass spectral library search. For generic characterization of a TIC, such as chlorinated hydrocarbon, the N qualifier is not used.

P When applied, this qualifier indicates a reported value from a GC analysis when there is greater than 25 percent difference for detected concentrations between the two GC columns.

(a) These Data Qualifiers are added by the laboratory to provide additional information for the reported results. ***They should not be confused with the qualifiers applied to the reported data as a result of a data validation process performed independently of the laboratory reporting procedure.***

TABLE 12 LABORATORY INORGANIC ANALYSIS DATA QUALIFIERS[a]

C	***(Concentration) Qualifiers:***
B	Reported value is less than the project-specified Reporting Limit, but greater than the method-specified Instrument Detection Limit or Method Detection Limit.
U	Analyte analyzed for but not detected (concentration is less than the method-specified Instrument Detection Limit or Method Detection Limit).
Q	***(Quality Control) Qualifiers:***
E	Reported value is estimated because of presence of interference.
M	Duplicate injection precision not met.
N	Spiked sample recovery is not within control limits.
S	Reported value is determined by the method of standard additions.
W	Post-digestion spike for furnace Atomic Absorption Spectrophotometric (AAS) analysis is out of control limits (85-115 percent) and sample absorbency is less than 50 percent of spike absorbency.
	* Duplicate analyses is not within control limits.
	+ Correlation coefficient for method of standard addition is less than 0.995.
M	***(Method) Qualifiers:***
P	Inductively Coupled Plasma
A	Flame AAS
F	Furnace AAS
CV	Cold Vapor AAS
AV	Automated Cold Vapor AAS
AS	Semi-Automated Spectrophotometric
C	Manual Spectrophotometric
T	Titrimetric
NR	Analyte is not required to be determined.

(a) These Data Qualifiers are added by the laboratory to provide additional information for the reported results. ***They should not be confused with the qualifiers applied to the reported data as a result of a data validation process performed independently of the laboratory reporting procedure.***

TABLE 13 ELECTRONIC DATA DELIVERABLE FIELDS

*	Field	Data Type	Length	Description	Valid Values
1	Sys_Sample_Code	Text	20	Unique identifier. Concatenation of sys_loc code* sample type and matrix* sample date.	
2	Sample_Type_Code	Text	10	Code which distinguished between different type of sample.	"N" for normal sample, "FD" for field duplicate sample, "MB" for method blank, "TB" for trip blank, "RB" for rinsate blank, "AB" for ambient or field blank, "MS" for matrix spike, "MD" for matrix spike duplicate.
3	Lab_method	Text	35	Laboratory analytic method name or description.	
4	Sample_date	Date		Date sample was collected (in MM/DD/YY format for electronic data deliverable).	
5	Analysis_Date	Date		Date of sample analysis (in MM/DD/YY format for electronic data deliverable).	
6	Total_or_Dissolved	Text	1	Identifies whether water samples were submitted for total or dissolved (inorganic) analysis.	"T" for total concentration, "D" for dissolved or filtered concentration.
7	Test_Type	Text	10	Type of analytical test.	"Initial" for first run. "Reanalysis" for subsequent runs. "Re-extraction" for re-extracted samples.
8	Sample_Matrix_Code	Text	10	Code which distinguishes between different type of sample matrix.	"GW" for ground water, "SW" for surface water, "SO" for soil, "SD" for sediment, "W" for lab and field quality control blanks (method blanks, trip blanks, field blanks, rinsate blanks).
9	Basis	Text	10	"Wet" for wet-weight basis reporting, "Dry" for dry-weight basis reporting.	
10	Dilution_Factor	Single		Test dilution factor.	
11	Lab_Prep_Method_Name	Text	35	Laboratory sample preparation method name or description.	
12	Ext_date	Date		Extraction date.	
13	Percent_Moisture	Text	5	Percent moisture of the sample portion used in this test.	
14	Lab_Sample_Id	Text	20	Laboratory LIMS sample identifier.	
15	Batch_Id	Text	255	Sample batch id.	
16	Cas_Rn	Text	15	Chemical Abstract Registry number.	
17	Chemical_Name	Text	75	Analyte name.	
18	Organic_YN	Boolean		Indicates whether analyte is organic or inorganic.	-1 for organic, 0 for inorganic.
19	Result_Value	Text	20	Analytical result value.	
20	Result_Type_Code	Text	10	Type of analytical result.	"TRG" for target results, "TIC" for tentatively identified compounds, "SUR" for surrogates, "IS" for internal standards, "SC" for spiked compounds.

*	Field	Data Type	Length	Description	Valid Values
21	Detect_Flag	Text	2	Indicates whether or not an analyte was detected.	"Y" for detected result; "N" for non-detected results.
22	Lab_Qualifiers	Text	7	Qualifier flags assigned by the laboratory.	
23	Method_detection_Limit	Text	20	Method detection limit.	
24	Reporting_Detection_Limit	Text	20	Detection limit used for reporting.	
25	Result_Unit	Text	15	Units of measurement for the result.	
26	Validator_qualifiers	Text	7	Validator qualifiers.	
27	Interpreted_Qualifiers	Text	7	Most appropriate qualifiers. Validator's qualifier if they exist, otherwise lab qualifier.	
28	Sys_loc_code	Text	20	Unique location name.	
29	Parent_sample_code	Text	20	Sys_sample code of parent sample of field duplicate.	
30	Site_Code	Text	20	Unique code for site or area.	
31	Sample_name	Text	30	Chain-of-custody field identification.	
32	Location_name	Text	30	Location name.	
33	Location_description	Text	70	Description of location.	
34	Start_Depth	Double		Top depth of sample.	
35	End_Depth	Double		Bottom depth of sample.	
36	Depth_unit	Text	15	Depth unit.	
37	Source	Text	50	Name of source file.	Electronic data deliverable file name.
38	Lab Name	Text	10	Lab Name.	
39	Task code	Text	10	Task Code.	

TABLE 14 ANALYTICAL QUALITY CONTROL FORMULAS

Sample	Formula	Symbols
Spikes (as %R from the concentrations of the analyte in the spiked and unspiked samples)	$\text{Percent recovery} = \frac{A - B}{C} \times 100$	A = Sample concentration of the spiked sample (ppm). B = Sample concentration of the unspiked sample (ppm). C = Concentration of the spike (ppm).
Duplicates (as the mean and relative percent difference of the duplicates)	$\text{Mean} = \frac{X_1 + X_2}{2}$ $\text{RPD} = \frac{\lvert X_1 - X_2 \rvert}{\text{Mean}} \times 100$	X_1 = Concentration of first replicate. X_2 = Concentration of second replicate.

TABLE 15 PREVENTIVE MAINTENANCE REQUIREMENTS FOR LABORATORY EQUIPMENT

Instrument	Item Checked/Serviced	Frequency
Gas Chromatograph	EC (Ni-63) wipe test	Semi-annually
	Clean detectors: Electron Capture Device	As needed
	Change column	As needed
	Change gas wool plug	As needed
	Clean insert	As needed
	Replace septum	As needed
	Change fuses	As needed
	Reactivate external carrier gas filler dryers	As needed
	Clean and silanize or replace glass liners or injectors	As needed
Gas Chromatograph/ Mass Spectrometry	Gas Chromatograph/Mass Spectrometry maintenance is the same as Gas Chromatograph with the following additions:	Quarterly
	Mechanical pump oil	Semi-annually
	Vacuum chaff filter	Annually
	Turbo pump oil	Semi-annually
	Computer air filter	Semi-annually
	Card cage air filter	As needed
	Source-clean ceramics, polish lenses	As needed
	Clean poles and ceramics	As needed
	Clean contacts on the component boards	As needed
	Vacuum the component boards	As needed
	Replace quartz injection port insert	As needed
	Replace septum	Daily
	Injection port liner checked	As needed
	Column maintenance	Semi-annually or as
	Disk drive	needed
	Printer	Quarterly
Atomic Absorption-Furnace Spectrometer	Lamps	Each run
	Optics	Quarterly
	Clean furnace windows	Daily
	Replace graphite tube	As needed
	Replace contact rings	As needed
	Replace quartz windows	As needed
	Clean optics	Daily
	Align background lamp	Quarterly
	Check wave length	Quarterly
Inductively Coupled Plasma Spectrometer	Sample introduction system	Daily
	Check pumps	Daily
	Clean, realign torch	Monthly or as needed
	Replace nebulizer	Monthly or as needed
	Clean mixing chamber	Monthly or as needed
	Replace pump tubing	Daily, or as needed
Refrigerators/Freezers	Temperature checked and logged	Daily on each work day
	Compartment cleaned	Quarterly
Walk-In Coolers	Temperature checked and logged	Daily on each work day
	Unit cleaned	Quarterly
Balances	Service representative calibration	Annually
	Internal weight train, gears, electronics	Annual service

Instrument	Item Checked/Serviced	Frequency
Thermometers	Calibrated	Annually
Class S Weights	Calibrated	Annually
Deionized/Organopure Water	Conductivity check Ion-exchange bed changed Replace filters	Weekly Weekly As needed
Vacuum Pumps and Air Compressor	Check performance Lubrication, belts, etc.	Weekly As needed
Water Baths	Water Level Bath cleaned	Added as needed 6 Months

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Attachment B.1

Quality Control Criteria for Precision and Accuracy for Matrix Spikes, Surrogate Spikes, and Laboratory Control Samples

ATTACHMENT B.1

QUALITY CONTROL CRITERIA FOR PRECISION AND ACCURACY FOR MATRIX SPIKES, SURROGATE SPIKES, AND LABORATORY CONTROL SAMPLES[a]

Quality Control Parameter	Spiking Compounds	Accuracy (%R)		Precision (%RPD)[b]	
		Water	Soil	Water	Soil
SW-3010A/3050A/6010B Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy					
MS	Aluminum	75-125	75-125	<20	<20
	Antimony	75-125	75-125	<20	<20
	Barium	75-125	75-125	<20	<20
	Beryllium	75-125	75-125	<20	<20
	Cadmium	75-125	75-125	<20	<20
	Chromium	75-125	75-125	<20	<20
	Cobalt	75-125	75-125	<20	<20
	Copper	75-125	75-125	<20	<20
	Iron	75-125	75-125	<20	<20
	Manganese	75-125	75-125	<20	<20
	Nickel	75-125	75-125	<20	<20
	Silver	75-125	75-125	<20	<20
	Vanadium	75-125	75-125	<20	<20
	Zinc	75-125	75-125	<20	<20
LCS	Aluminum	80-120	53-147[c]	≤20	<25
	Antimony	80-120	9-190[c]	≤20	<82
	Barium	80-120	76-124[c]	≤20	<9
	Beryllium	80-120	70-128[c]	≤20	<19
	Cadmium	80-120	60-140[c]	≤20	<8
	Calcium	80-120	73-127[c]	≤20	<11
	Chromium	80-120	77-124[c]	≤20	<19
	Cobalt	80-120	79-120[c]	≤20	<13
	Copper	80-120	82-118[c]	≤20	<15
	Iron	80-120	40-160[c]	≤20	<53
	Magnesium	80-120	72-128[c]	≤20	<20
	Manganese	80-120	73-127[c]	≤20	<22
	Nickel	80-120	78-123[c]	≤20	<10
	Potassium	80-120	76-124[c]	≤20	<23
	Silver	80-120	51-149[c]	≤20	<18
	Sodium	80-120	60-140[c]	≤20	<14
	Vanadium	80-120	68-132[c]	≤20	<22
	Zinc	80-120	77-123[c]	≤20	<18

(a) LCS limits are based on historical performance data and are updated annually.
(b) Precision for LCS is calculated as the moving range for successive LCS recoveries; precision for matrix spikes is listed as relative percent difference.
(c) Solid LCS concentrations are manufacturer provided; absolute concentrations vary with purchased lots.

NOTE: MS = Matrix spike.
LCS = Laboratory control sample.

Quality Control Parameter	Spiking Compounds	Accuracy (%R)		Precision (%RPD)[b]	
		Water	Soil	Water	Soil
SW-3010A/3050A/6010B Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy – TRACE Instrumentation					
MS	Antimony	75-125	75-125	<20	<20
	Arsenic	75-125	75-125	<20	<20
	Cadmium	75-125	75-125	<20	<20
	Lead	75-125	75-125	<20	<20
	Selenium	75-125	75-125	<20	<20
LCS	Antimony	80-120	9-190[c]	≤20	<85
	Arsenic	80-120	74-126[c]	≤20	<16
	Cadmium	80-120	68-140[c]	≤20	<11
	Lead	80-120	76-124[c]	≤20	<15
	Selenium	80-120	63-137[c]	≤20	<32
SW-7470A/7471A Mercury by Cold Vapor Atomic Absorption					
MS	Mercury	75-125	75-125	<20	<20
LCS	Mercury	80-120	68-133[c]	≤20	<25
SW-3020/3050/7841 Thallium by Graphite Furnace Atomic Absorption					
MS	Thallium	75-125	75-125	<20	<20
LCS	Thallium	80-120	57-143[c]	≤20	<25
SW-5030A/5035/8260B Volatile Organic Compounds by Gas Chromatograph/Mass Spectrometry					
Surrogate Spike	1,2-Dichloroethane-d4	---	70-121	---	---
	4-Bromofluorobenzene (BFB)	---	74-121	---	---
	Dibromofluoromethane	---	80-120	---	---
	Toluene-d8	---	81-117	---	---
LCS/MS/MSD	Benzene	---	78-119	---	<25
	Toluene	---	73-130	---	<35
	Chlorobenzene	---	69-139	---	<43
	1,1-Dichloroethene	---	74-128	---	<33
	Trichloroethene	---	72-122	---	<31
SW-5030B/8260B Volatile Organic Compounds by Gas Chromatograph/Mass Spectrometry (25-mL purge for aqueous samples)					
Surrogate Spike	1,2-Dichloroethane-d4	76-114	---	---	---
	4-Bromofluorobenzene (BFB)	86-115	---	---	---
	Dibromofluoromethane	86-118	---	---	---
	Toluene-d8	88-110	---	---	---
LCS/MS/MSD	Benzene	78-123	---	<28	---
	Toluene	77-122	---	<27	---
	Chlorobenzene	79-123	---	<27	---
	1,1-Dichloroethene	75-118	---	<27	---
	Trichloroethene	73-122	---	<30	---
NOTE: MSD = Matrix spike duplicate.					

Quality Control Parameter	Spiking Compounds	Accuracy (%R)		Precision (%RPD)[b]	
		Water	Soil	Water	Soil
SW-3540C/3520C/8270C Semivolatile Organics by Gas Chromatograph/Mass Spectrometry					
Surrogate Spike	Nitrobenzene d5	35-114	23-120	---	---
	2-Fluorobiphenyl	43-116	30-115	---	---
	Terphenyl-d14	33-141	18-137	---	---
	2-Fluorophenol	21-100	25-121	---	---
	Phenol-d5	10-94	24-113	---	---
	2,4,6-Tribromophenol	10-123	19-122	---	---
LCS/MS/MSD	Phenol	38-91	35-97	<33	<38
	2-Chlorophenol	42-94	39-98	<32	<36
	1,4-Dichlorobenzene	28-90	39-102	<38	<39
	N-Nitroso-di-n-propylamine	53-115	51-115	<38	<39
	1,2,4-Trichlorobenzene	33-94	50-104	<38	<33
	4-Chloro-3-methylphenol	45-97	51-96	<32	<28
	Acenaphthene	49-103	51-109	<33	<36
	4-Nitrophenol	52-117	50-120	<40	<43
	2,4-Dinitrotoluene	57-115	54-126	<35	<45
	Pentachlorophenol	38-119	16-119	<50	<63
	Pyrene	45-114	44-119	<43	<46
SW-9012A Total and Amenable Cyanide by Automated Colorimetry					
LCS/MS/MSD	Cyanide	49-136	49-136	<54	<54
SW-9060 Total Organic Carbon					
LCS/MS/MSD	Total organic carbon	---	82-110	---	≤17
SW-3520C/3540A/8081A/8082 Polychlorinated Biphenyls by Gas Chromatograph/Electron Capture Device					
Surrogate Spike	DCB	30-150	30-150	---	---
	TCX	30-150	30-150	---	---
LCS/MS/MSD	gamma-BHC (Lindane)	56-125	59-103	<42	<27
	Heptachlor	25-128	69-118	<63	<30
	Aldrin	25-136	68-129	<68	<37
	Dieldrin	63-113	67-111	<31	<27
	Endrin	69-125	71-129	<34	<35
	4,4'-DDT	56-139	66-127	<51	<37
SW-3510/8081A Organochlorine Pesticides by Gas Chromatograph/Electron Capture Device					
Surrogate Spike	DCBP	34-133	25-143	---	---
	TCMX	45-125	35-135	---	---
LCS/MS/MSD	α-BHC	75-125	65-135	<30	<50
	β-BHC	51-125	41-133	<30	<50
	δ-BHC	75-126	65-136	<30	<50
	γ-BHC (Lindane)	73-125	63-130	<30	<50
	α-Chlordane	41-125	31-135	<30	<50
	γ-Chlordane	41-125	31-133	<30	<50
	4,4-DDD	48-136	38-146	<30	<50
	4,4-DDE	45-139	35-149	<30	<50
	4,4-DDT	34-143	25-153	<30	<50
	Aldrin	47-125	37-126	<30	<50
	Dieldrin	42-132	32-142	<30	<50
	Endosulfan I	49-143	39-153	<30	<50
	Endosulfan II	75-159	65-169	<30	<50

Quality Control Parameter	Spiking Compounds	Accuracy (%R)		Precision (%RPD)[b]	
		Water	Soil	Water	Soil
SW-3510/8081A Organochlorine Pesticides by Gas Chromatograph/Electron Capture Device (Continued)					
	Endosulfan Sulfate	46-141	36-151	<30	<50
	Endrin	43-134	33-144	<30	<50
	Endrin Aldehyde	75-150	65-160	<30	<50
	Heptachlor	45-128	35-138	<30	<50
	Heptachlor Epoxide	53-134	43-144	<30	<50
	Methoxychlor	73-142	63-152	<30	<50
	Toxaphene	41-126	31-136	<30	<50
SW-8310 Polynuclear Aromatic Hydrocarbons by High Performance Liquid Chromatographic – Ultraviolet/Fluorescent					
Surrogate	Terphenyl-D14	25-157	22-167	---	---
LCS/MS/MSD	Acenaphthene	43-130	33-140	<30	<50
	Acenaphthylene	49-125	39-135	<30	<50
	Anthracene	54-125	44-135	<30	<50
	Benzo(a)Anthracene	39-135	29-145	<30	<50
	Benzo(a)Pyrene	52-125	42-135	<30	<50
	Benzo(b)Fluoranthene	31-137	25-147	<30	<50
	Benzo(g,h,i)Perylene	53-125	43-135	<30	<50
	Benzo(k)Fluoranthene	60-129	50-139	<30	<50
	Chrysene	59-134	49-144	<30	<50
	Dibenzo(a,h)Anthracene	51-125	41-135	<30	<50
	Fluoranthene	42-125	32-135	<30	<50
	Fluorene	53-125	43-135	<30	<50
	Indeno(1,2,3-c,d)Pyrene	55-125	45-135	<30	<50
	Naphthalene	43-125	33-135	<30	<50
	Phenathrene	52-129	42-139	<30	<50
	Pyrene	55-125	45-135	<30	<50

Attachment B.2

Quality Control Criteria for Precision and Accuracy for Matrix Spikes, Surrogate Spikes, and Laboratory Control Samples for Toxicity Characteristic Leaching Procedure Leachates

ATTACHMENT B.2

QUALITY CONTROL CRITERIA FOR PRECISION AND ACCURACY FOR MATRIX SPIKES, SURROGATE SPIKES, AND LABORATORY CONTROL SAMPLES FOR TOXICITY CHARACTERISTIC LEACHING PROCEDURE LEACHATES[a]

Quality Control Parameter	Spiking Compounds	Accuracy (%R) Water	Precision[b] Water
SW3010A/3050A/6010B Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy			
TCLP Matrix Spike	Arsenic	75-125	<20
	Barium	75-125	<20
	Cadmium	75-125	<20
	Chromium	75-125	<20
	Lead	75-125	<20
	Selenium	75-125	<20
	Silver	75-125	<20
LCS	Arsenic	80-120	<20
	Barium	80-120	<20
	Cadmium	80-120	<20
	Chromium	80-120	<20
	Lead	80-120	<20
	Selenium	80-120	<20
	Silver	80-120	<20
SW7470A/7471A Mercury by Cold Vapor Atomic Absorption			
TCLP Matrix Spike	Mercury	75-125	<20
LCS	Mercury	80-120	<18
SW8151A Herbicides by Gas Chromatograph/Electron Capture Device			
TCLP Matrix Spike, LCS	2,4-D	51-116	<40
	2,4,5-TP (Silvex)	56-111	<34
Surrogate Spike	DCAA	50-130	NA
SW3520A/8081A Organochlorine Pesticides by Gas Chromatograph/Electron Capture Device			
TCLP Matrix Spike, LCS	gamma-BHC (Lindane)	56-123	<15
	Heptachlor	40-131	<20
	Heptachlor Epoxide	15-150	<25
	Endrin	56-121	<21
	Methoxychlor	15-150	<25
	gamma-Chlordane	20-150	<25
	alpha-Chlordane	20-150	<25
Surrogate Spike	DCB	30-150	NA
	TCX	30-150	NA

(a) LCS limits are based on historical performance data and are updated annually.
(b) Precision for LCS is calculated as the moving range for successive LCS recoveries; precision for matrix spikes is listed as relative percent difference (RPD).

NOTE: TCLP = Toxicity Characteristic Leaching Procedure.
LCS = Laboratory control sample.
NA = Not applicable.

Quality Control Parameter	Spiking Compounds	Accuracy (%R) Water	Precision[(b)] Water
SW5030B/8260B Volatile Organic Compounds by Gas Chromatograph/Mass Spectrometry			
TCLP Matrix Spike, LCS	Benzene	50-150	<20
	2-Butanone	50-150	<20
	Carbon Tetrachloride	50-150	<20
	Chloroform	50-150	<20
	Chlorobenzene	50-150	<20
	1,1-Dichloroethene	50-150	<20
	1,2-Dichloroethane	50-150	<20
	Tetrachloroethene	50-150	<20
	Trichloroethene	50-150	<20
	Vinyl Chloride	50-150	<20
Surrogate Spike	1,2-Dichloroethane-d4	76-114	NA
	Dibromofluoromethane	86-118	NA
	4-Bromofluorobenzene (BFB)	86-115	NA
	Toluene-d8	88-110	NA
SW3520C/8270C Semivolatile Organics by GC/MS			
TCLP Matrix Spike, LCS	2-Methylphenol	15-150	<25
	3&4-Methylphenol	15-150	<25
	2,4,6-Trichlorophenol	15-150	<25
	2,4,5-Trichlorophenol	15-150	<25
	Pentachlorophenol	38-119	<50
	Pyridine	15-150	<25
	1,4-Dichlorobenzene	28-90	<28
	Hexachloroethane	15-150	<25
	Nitrobenzene	15-150	<25
	Hexachlorobutadiene	15-150	<25
	2,4-Dinitrotoluene	57-115	<38
	Hexachlorobenzene	40-150	<25
Surrogate Spike	Nitrobenzene-d5	35-114	NA
	2-Fluorobiphenyl	43-116	NA
	Terphenyl-d14	33-141	NA
	2-Fluorophenol	21-100	NA
	Phenol-d5	10-94	NA
	2,4,6-Tribromophenol	10-123	NA

Attachment B.3

Summary of Laboratory Quality Control Requirements and Corrective Action Procedures

ATTACHMENT B.3

SUMMARY OF LABORATORY QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTION PROCEDURES[a]

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Metals by Inductively coupled plasma: SW-3010A/6010B in Water, SW-3050A/6010B in Sediment and Soil			
Holding time	6 months from sampling	Digestion/analysis and any re-analysis performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Initial Calibration	Established daily; verified immediately with second source high standard after initial calibration	Initial calibration with blank and one standard; correlation coefficient, r ≥0.995	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Document actions taken.
Highest Standard	Re-analyze immediately after initial calibration	%R = 95%-105%	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Document actions taken.
Calibration Blank	After initial calibration and thereafter at a frequency of 10%	Concentration of any analyte is less than the project specified RL	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Document actions taken.
RL Verification Standard	Immediately following initial calibration	%R for all analytes 50%-150%	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Document actions taken.
Calibration Verification	Analyze a mid-level second source calibration standard immediately after initial calibration	%R = 90%-110%	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Document actions taken.
Calibration Verification	Analyze a midrange standard every 10 samples	%R = 90%-110%	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Re-analyze all associated QC and field samples. 3. Document actions taken.
Interference Check Standard	Analyze at the beginning and end of an analytical run or twice during every 8-hour work shift, whichever is more frequent	For ICSAB, the spiking concentration will be 10X the method detection limit for all analytes not included in the ICSA solution, %R = 80% - 120%	1. Re-analyze using analytical and background correction wavelengths free from interferences. 2. Re-calibrate, verify the calibration, and re-analyze all digestates since the last successful ICSA/ICSAB. 3. Re-analyze associated samples using another testing procedure.

(a) Summary of general quality control requirements and corrective action procedures; actual requirements and procedures may differ upon laboratory selection.

NOTE: QC = Quality control.
RL = Reporting limit.
ICSAB = Interference check standard.
ICSA = Interference check standard.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Metals by Inductively coupled plasma: SW-3010A/6010B in Water, SW-3050A/6010B in Sediment and Soil (Continued)			
Interference Check Standard	Analyze at the beginning and end of an analytical run or twice during every 8-hour work shift, whichever is more frequent.	For the ICSA all analytes, with an RL ≤10 µg/L, must have apparent concentrations within ± 2X the RL.	1. Re-analyze using analytical and background correction wavelengths free from interferences. 2. Re-calibrate, verify the calibration, and re-analyze all digestates since the last successful ICSA/ICSAB. 3. Re-analyze associated samples using another testing procedure
Method Blank	1 per analytical batch	Concentration of any analyte is less than the project specified RL	1. If the applicable criteria are not met re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples. 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.
LCS	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits.	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.
MS/MSD	1 set per analytical batch	%R, RPD within LCS limits	1. If analyte recovery is outside control limits in LCS and data are judged unusable, re-prepare and re-analyze the analytical batch. 2. If LCS is acceptable but recovery is outside control limits in MS/MSD, check preparation of samples. 3. If no errors or problems are discovered for sample preparation, data are reported with discussion in analytical narrative.
Serial Dilution	1+4 dilution for one sample per analytical batch	%D ≤ 10%	1. If the dilution analysis for one or more analytes is not within ± 10%, no further action is required. 2. A chemical or physical interference effect must be suspected, and the data for all affected analytes in the sample associated with the serial dilution are qualified.

NOTE: LCS = Laboratory control sample.
MS/MSD = Matrix spike/matrix spike duplicate.
RPD = Relative percent difference.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Metals by AA: SW-3020A/7000 Series in Water, SW-3050A/7000 Series in Sediment and Soil - Mercury/Cold Vapor Atomic Absorption, Thallium/Graphite Furnace Atomic Absorption			
Holding time	Mercury: 28 days from sampling Thallium: 6 months from sampling	Digestion/analysis and any re-analysis performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Initial Calibration	Established daily	1. Initial calibration with blank and three standards covering the linear range of instrument. 2. Initial calibration correlation coefficient, r, ≥0.995.	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Document actions taken.
Calibration Blank	After initial calibration and thereafter at a frequency of 10%	Concentration of any analyte is less than the project specified RL.	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Document actions taken.
Calibration Verification	Analyze a mid-level second source standard immediately after initial calibration	Metals, 90%-110%; mercury, 80%-120%	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Document actions taken.
Calibration Verification	Mid-range calibration standard; every 10 samples	Metals, 90%-110%; mercury, 80%-120%	1. If the applicable criteria are not met, re-calibrate the instrument. 2. Re-analyze ass samples since last acceptable calibration verification. 3. Document actions taken.
Method Blank	1 per analytical batch	Concentration of any analyte is less than the project specified RL.	1. If the applicable criteria are not met re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples. 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.
LCS	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits.	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Metals by AA: SW-3020A/7000 Series in Water, SW-3050A/7000 Series in Sediment and Soil - Mercury/Cold Vapor Atomic Absorption, Thallium/Graphite Furnace Atomic Absorption (Continued)			
MS/MSD	1 set per analytical batch	%R, RPD within LCS limits	1. If analyte recovery is outside control limits in LCS and data are judged unusable, re-prepare and re-analyze the analytical batch. 2. If LCS is acceptable but recovery is outside control limits in MS/MSD, check preparation of samples. 3. If no errors or problems are discovered for sample preparation, data are reported with discussion in analytical narrative.
Analytical Spike	1 per sample for all metals analyzed by furnace AA	%R = 85% -115%.	1. If spike recovery is <40%, dilute the sample and rerun with another spike. If after dilution, spike recovery is still <40%, report data with "E" qualifier. 2. If the spike recovery is <40% and the sample absorbency or concentration is <50% of the spike, report results. 3. If the sample absorbency or concentration is ≥50% of the spike, and the spike recovery is between 85%-115%, report results. 4. If the sample absorbency or concentration is ≥50% of the spike, and the spike recovery is outside 85%-115%, quantitate the sample by the method of standard additions.
Recovery Test (Method of Standard Additions)	Perform for all samples which fail the Analytical Spike criteria	Correlation coefficient, r, ≥ 0.995	1. Re-analyze, report results with the greater correlation coefficient, r. 2. Qualify data.
Dilution Test	1+4 dilution for one sample per analytical batch	1. %D within ± 10% for sample concentrations >10X method detection limit. 2. Criterion applies only to analytes where the original concentration is ≥50X RL	1. If the dilution analysis for one or more analytes is not within ± 10%. No further action is required. 2. A chemical or physical interference effect must be suspected, and the data for all affected analytes in the sample associated with the serial dilution are qualified.
Volatile Organic Compounds by Gas Chromatograph/Mass Spectrometry: SW-5030B/8260B in Water; SW-5030A/8260B in Sediment; SW-5035/8260B in Soil			
Holding time	14 days from sampling	Analysis is performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Tuning	Every 12 hours	Within limits of method	Adjust instrument parameters.
Calibration curve	Established initially at 5 concentration levels, verified every 12 hours at mid level	1. Initial calibration %RSD for all CCCs is less than 30 percent; RF for SPCCs is >method specified minimum 2. Continuing calibration %D for CCCs from initial calibration is less than 20 percent; RF for SPCCs is method specified minimum	1. Re-calibrate instrument. 2. Re-analyze samples since last criteria met. 3. Document actions taken.

NOTE: RSD = Relative standard deviation.
CCC = Calibration check compound.
RF = Response factor.
SPCC = System performance check compound.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Volatile Organic Compounds by Gas Chromatograph/Mass Spectrometry: SW-5030B/8260B in Water; SW-5030A/8260B in Sediment; SW-5035/8260B in Soil (Continued)			
Method Blank	1 per analytical batch	Concentration of any analyte is less than the project specified RL.	1. If the applicable criteria are not met re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples. 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.
LCS	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits.	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.
Surrogate Spike	All laboratory QC and field samples.	Recoveries of surrogate spiking compounds are within project-specific control limits.	1. Examine all QC (including but not limited to LCS, MB). 2. If surrogate in LCS and/or MB is out-of-control, investigate, correct problem, and re-prepare and re-analyze the analytical batch. 3. If samples cannot be re-prepared, qualify data. 4. If surrogate recoveries in LCS and MB are acceptable but below the lower control limit for any sample, check sample preparation. Correct any problem then re-extract and re-analyze the sample. If no problem is found, data are reported with discussion in the analytical narrative. 5. If surrogate recoveries in LCS and MB are acceptable but above the upper control limit for any sample and no target analytes are detected, data are reported with discussion in the analytical narrative.
Internal Standard Responses and Retention Times	The internal standard responses and retention times in the calibration verification standard must be evaluated immediately after or during data acquisition.	• The retention times of the internal standards in the calibration verification standard must be within 30 seconds from that in the mid-point standard level of the initial calibration. • The EICP area for any of the internal standards in the calibration verification standard must be within a factor of two (from -50% to +100%) from that in the mid-point standard level of the initial calibration.	1. Inspect the mass spectrometric system for malfunction and correct. 2. Re-analyze affected samples. If the areas meet criteria, report data from the compliant analysis. 3. If re-analysis of the sample does not solve the problem, submit data from both runs, and document all inspection and corrective actions taken in the analytical narrative.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Volatile Organic Compounds by Gas Chromatograph/Mass Spectrometry: SW-5030B/8260B in Water; SW-5030A/8260B in Sediment; SW-5035/8260B in Soil (Continued)			
MS/MSD	1 set per analytical batch	%R, RPD within LCS limits.	1. If analyte recovery is outside control limits in LCS and data are judged unusable, re-prepare and re-analyze the analytical batch. 2. If LCS is acceptable but recovery is outside control limits in MS/MSD, check preparation of samples. 3. If no errors or problems are discovered for sample preparation, data are reported with discussion in analytical narrative.
SW-3520C/3540C/8270C – Semivolatile Organics by Gas Chromatograph/Mass Spectrometry in Water, Sediment, and Soil			
Holding time	Waters: extract within 7 days of sampling; analyze within 40 days of extraction. Soil and sediment: extract within 14 days of sampling; analyze within 40 days of extraction.	Extraction and analysis are performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Tuning	Every 12 hours	Within limits of method.	Adjust instrument parameters.
Calibration curve	Established initially at 5 concentration levels, verified every 12 hours at mid level	1. Initial calibration %RSD for all CCCs is less than 30 percent; RF for SPCCs is >0.05. 2. Continuing calibration %D for CCCs from initial calibration is less than 20 percent; RF for SPCCs is >0.05.	1. Re-analyze check standard. 2. If similar results are obtained re-calibrate instrument. 3. Re-analyze all samples analyzed since last criteria were met. 4. Document actions taken.
Method Blank	1 per analytical batch	Concentration of any analyte is less than the project specified RL.	1. If the applicable criteria are not met re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
SW-3520C/3540C/8270C – Semivolatile Organics by Gas Chromatograph/Mass Spectrometry in Water, Sediment, and Soil (Continued)			
LCS	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits.	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.
Surrogate Spike	All laboratory QC and field samples.	Recoveries of surrogate spiking compounds are within project-specific control limits.	1. Examine all QC (including but not limited to LCS, MB). 2. If surrogate in LCS and/or MB is out-of-control, investigate, correct problem, and re-prepare and re-analyze the analytical batch. 3. If samples cannot be re-prepared, qualify data. 4. If surrogate recoveries in LCS and MB are acceptable but below the lower control limit for any sample, check sample preparation. Correct any problem then re-extract and re-analyze the sample. If no problem is found, data are reported with discussion in the analytical narrative. 5. If surrogate recoveries in LCS and MB are acceptable but above the upper control limit for any sample and no target analytes are detected, data are reported with discussion in the analytical narrative.
Internal Standard Responses and Retention Times	The internal standard responses and retention times in the calibration verification standard must be evaluated immediately after or during data acquisition.	• The retention times of the internal standards in the calibration verification standard must be within 30 seconds from that in the mid-point standard level of the initial calibration. • The EICP area for any of the internal standards in the calibration verification standard must be within a factor of two (-50% to +100%) from that in the mid-point standard level of the initial calibration.	1. Inspect the mass spectrometric system for malfunction and correct. 2. Re-analyze affected samples. If the areas meet criteria, report data from the compliant analysis. 3. If re-analysis of the sample does not solve the problem, submit data from both runs, and document all inspection and corrective actions taken in the analytical narrative.
MS/MSD	1 set per analytical batch	%R, RPD within LCS limits.	1. If analyte recovery is outside control limits in LCS and data are judged unusable, re-prepare and re-analyze the analytical batch. 2. If LCS is acceptable but recovery is outside control limits in MS/MSD, check preparation of samples. 3. If no errors or problems are discovered for sample preparation, data are reported with discussion in analytical narrative.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Total Cyanide SW-9012A			
Holding time	14 days from sampling	Preparation and analysis are performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Calibration curve	Established daily with 5 concentration levels plus blank, verified every 10 samples	Correlation coefficient $\geq$ 0.995. Calibration verification standard recovery is 80%-120%.	1. Validate standard. If standard still exceeds acceptance criteria, obtain fresh, certified standards. 2. Re-calibrate instrument. 3. Document actions taken.
Method Blank	1 per analytical batch	Concentration of target analyte is less than the project specified RL.	1. If the applicable criteria are not met re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.
LCS	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits.	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.
MS/MSD	1 set per analytical batch	%R, RPD within LCS limits.	1. If analyte recovery is outside control limits in LCS and data are judged unusable, re-prepare and re-analyze the analytical batch. 2. If LCS is acceptable but recovery is outside control limits in MS/MSD, check preparation of samples. 3. If no errors or problems are discovered for sample preparation, data are reported with discussion in analytical narrative.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Releasable Sulfide SW 7.3			
Holding time	No requirement; analyze immediately after releasing	Preparation and analysis are performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Method Blank	1 per analytical batch	Concentration of any analyte is less than the project specified RL.	1. If the applicable criteria are not met, re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples. 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.
LCS	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits.	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.
Polychlorinated Biphenyls by Gas Chromatograph/Electron Capture Device (SW-3520A/3540C/8082)			
Holding time	Aqueous: extract within 7 days of sampling; analyze within 40 days of extraction. Solid: extract within 14 days of sampling; analyze within 40 days of extraction.	Extraction and analysis are performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Initial Calibration	Initial 5 point calibration, verified daily at mid level and every 10 samples.	1. Initial calibration %RSD for all target analytes is less than 20 percent, or use calibration curve ($r \geq 0.990$) if %RSD >20%. 2. Continuing calibration %D from initial calibration no greater than ±15 percent.	1. If initial calibration fails, verify standard preparation. Re-calibrate. 2. If continuing calibration standard fails, re-analyze the standard. 3. If similar results are obtained, re-calibrate instrument. 4. Re-analyze all sample extracts not preceded by an acceptable standard. 5. Evaluate data usability. Re-analyze if data usability is impacted. 6. Document actions taken.
Method Blank	1 per analytical batch	Concentration of any analyte is less than the project specified RL.	1. If the applicable criteria are not met re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples. 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Polychlorinated Biphenyls by Gas Chromatograph/Electron Capture Device (SW-3520A/3540C/8082) (Continued)			
LCS	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits.	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.
Surrogate Spike	All laboratory QC and field samples.	Recoveries of surrogate spiking compounds are within project-specific control limits.	1. Examine all QC (including but not limited to LCS, MB). 2. If surrogate in LCS and/or MB is out-of-control, investigate, correct problem, and re-prepare and re-analyze the analytical batch. 3. If samples cannot be re-prepared, qualify data. 4. If surrogate recoveries in LCS and MB are acceptable but below the lower control limit for any sample, check sample preparation. Correct any problem then re-extract and re-analyze the sample. If no problem is found, data are reported with discussion in the analytical narrative. 5. If surrogate recoveries in LCS and MB are acceptable but above the upper control limit for any sample and no target analytes are detected, data are reported with discussion in the analytical narrative.
MS/MSD	1 set per analytical batch	%R, RPD within LCS limits	1. If analyte recovery is outside control limits in LCS and data are judged unusable, re-prepare and re-analyze the analytical batch. 2. If LCS is acceptable but recovery is outside control limits in MS/MSD, check preparation of samples. 3. If no errors or problems are discovered for sample preparation, data are reported with discussion in analytical narrative.
Breakdown Check Standard	Verify daily	DDT and Endrin breakdown products each are less than 20%.	1. Verify calculations and standard preparation. 2. If standard is valid and percent breakdown exceeds criteria, evaluate instrument parameters, correct the problem, and re-analyze. 3. No samples shall be analyzed until a valid breakdown check standard is obtained.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Releasable Cyanide SW 7.3			
Holding Time	No requirement: analyze immediately after releasing	Preparation and analysis are performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Calibration Curve	Establish daily with 5 concentration levels plus blank, verified every 10 samples	Correlation coefficient, r >0.995. Calibration verification standard recovery is 80%-120%.	1. Validate standard. If standard still exceeds acceptance criteria, obtain fresh, certified standards. 2. Re-calibrate instrument. 3. Document actions taken.
Method Blank	1 per analytical batch	Concentration of any analyte is less than the project specified RL.	1. If the applicable criteria are not met, re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples. 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.
Laboratory Control Samples	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.
Releasable Sulfide SW 7.3			
Holding Time	No requirement: analyze immediately after releasing	Preparation and analysis are performed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
Method Blank	1 per analytical batch	Concentration of any analyte is less than the project specified RL.	1. If the applicable criteria are not met, re-analyze the blank. 2. If the re-analysis does not meet criteria, re-prepare and re-analyze all associated QC and field samples. 3. If re-preparation of samples is not possible, qualify data. 4. Document all actions taken in a Non-Conformance Record and in the report narrative.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Releasable Sulfide SW 7.3 (Continued)			
Laboratory Control Samples	1 per analytical batch	Recoveries of all spiked analytes are within project-specific control limits	1. If any LCS analyte recovery is above the upper control limit and the analyte is not detected, no further action is required, and data are reported with discussion in the analytical narrative. 2. If any LCS analyte recovery is above the upper control limit and the analyte is detected, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 3. If any LCS analyte recovery is below the lower control limit, re-analyze the LCS. If similar results are obtained, investigate and correct any problems. Re-prepare and re-analyze the analytical batch. 4. If re-preparation of samples is not possible, qualify data, and note in the report narrative. 5. Document all actions taken in a Non-Conformance Report and in the report narrative.
SW-846 3510C/8081A Organochlorine Pesticides by Gas Chromatograph/Electron Capture Device			
Holding Time	Aqueous: Extract within 7 days, analyze within 40 days of extraction.	Extraction/analysis completed within holding time.	Notify client, determine if laboratory to proceed or if client will resample.
Calibration curve	Established initially at 5 concentration levels, verified at mid level every 12 hours.	1. Initial calibration: If percent RSD for all compounds is ≤20 percent, then assume linearity and use average response factor. If percent RSD >20 percent for any compound, then utilize linear regression for that compound (R ≥0.990). 2. Continuing calibration (CCV): percent difference ≤15 percent.	1. If CCV is outside criteria, check instrument for problems. 2. If the next subsequent CCV is not within criteria, then perform new initial calibration. 3. Re-analyze all samples analyzed since the last acceptable CCV.
Method Blank	1 per batch[a]	No targets <MRL	1. Re-extract and reanalyze samples associated with the unacceptable method blank. Any samples that were non-detects can be reported. Any samples that were 20 times greater than the method blank may be reported. 2. If re-extraction is not possible, data will be B-flagged.
LCS	1 per batch[a]	70-130 percent	1. If the LCS exhibited high bias, then any samples that were non-detects may be reported. 2. Re-extract and reanalyze samples. 3. If re-analysis is not possible, unacceptable LCS results will be noted in the project narrative.

(a) Sample batch is up to 20 samples.

NOTE: CCV = Continuing calibration verification.
MRL = Method reporting limit.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
SW-846 3510C/8081A Organochlorine Pesticides by Gas Chromatograph/Electron Capture Device (Continued)			
Laboratory Matrix Spike/Matrix Spike Duplicate	1 per batch[a]	70-130 percent recovery 30 percent RPD	1. If the LCS and method blank were within criteria, then examine sample preparation. If no errors are found in sample prep, a matrix affect is assumed and noted in the project narrative. 2. If LCS and method blank are not in criteria, then re-prep and re-analyze affected samples. 3. If sample cannot be re-prepped, then notify client in the project narrative.
Surrogate	All laboratory QC and field samples.	70-130 percent (only one surrogate needs to be within criteria)	1. If the surrogate results are not within criteria, then the sample(s) must be re-analyzed. 2. If sample(s) cannot be re-extracted and reanalyzed, then inform client in project narrative.
Breakdown Check Standard	Verify every 12 hours	DDT and Endrin breakdown products must each be <15 percent	1. Verify calculations and standard preparation. 2. If standard is valid and percent breakdown exceeds criteria, evaluate instrument parameters, correct the problem, and re-analyze. 3. No samples shall be analyzed until a valid breakdown check standard is obtained.
Metals by SW-1311/3050A/6010B/7000 Series in Soil			
Holding Time	6 months from sampling for TCLP, 6 months from TCLP for digestions and analysis.	TCLP, digestion, and analysis are completed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
TCLP Blank	1 per each TCLP preparation batch.	Concentration does not exceed the TCLP regulatory level of the analyte.	1. Determine if concentration levels exceed the TCLP regulatory levels. 2. If not, proceed with analysis. 3. If regulatory levels are exceeded, re-prepare blank, QC samples, and affected samples. 4. Document actions taken.
TCLP MS	1 per each TCLP preparation batch.	MS recovery must be greater than 50%.	The method of standard additions is used if the TCLP MS recovery is <50% and the sample concentration is less than the regulatory level or of the contaminant concentration in the sample is within 20% of the regulatory limit.
Calibration Curve Interelement Check Sample Method Blank LCS MS/MSD	Requirements for frequency, acceptance criteria, and corrective actions are the same as for metals.		

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Herbicides SW-1311/8151A in Soils			
Holding Time	TCLP leachate: 14 days from sampling for TCLP, 7 days from TCLP to extraction, 40 days from extraction to analysis	TCLP extraction and analysis are completed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
TCLP Blank	1 per TCLP preparation batch.	Concentration does not exceed the TCLP regulatory level of the analyte.	1. Determine if concentration levels exceed the TCLP regulatory levels. 2. If not, proceed with analysis. 3. If regulatory levels are exceeded, re-prepare blank, QC samples, and affected samples. 4. Document actions taken.
TCLP MS	1 per each TCLP preparation batch.	MS recovery must be greater than 50%.	The method of standard additions is used if the TCLP MS recovery is <50% and the sample concentration is less than the regulatory level or of the contaminant concentration in the sample is within 20% of the regulatory limit.
Calibration Curve Method Blank LCS Surrogate Spike MS/MSD	Requirements for frequency, acceptance criteria, and corrective actions are the same as for Method 8150 herbicides.		
Volatile Organic Compounds by Gas Chromatograph/Mass Spectrometry: SW-1311/5035/8260B in Soil			
Holding Time	TCLP leachate: 14 days from sampling for TCLP, 14 days from TCLP to analysis	TCLP and analysis are completed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
TCLP Blank	1 per each TCLP preparation batch.	Concentration does not exceed the TCLP regulatory level of the analyte.	1. Determine if concentration levels exceed the TCLP regulatory levels. 2. If not, proceed with analysis. 3. If regulatory levels are exceeded, re-prepare blank, QC samples, and affected samples. 4. Document actions taken.
TCLP MS	1 per each TCLP preparation batch.	Acceptance criteria are specified in Table 10.	1. Verify that the spike concentration is at the regulatory concentration, and at least 5 times the MDL. 2. Verify that correct spiking solutions and amounts were used. 3. Check method blanks and LCS recovery. 4. Re-analyze samples if laboratory error is suspected. 5. Document actions taken.
Tuning Calibration Curve Method Blank LCS Surrogate Spike MS/MSD	Requirements for frequency, acceptance criteria, and corrective actions are the same as for Method 8260B volatiles.		

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Semivolatile Organics by Gas Chromatograph/Mass Spectrometry: SW-1311/3520C/3540C/8270C in Soil			
Holding Time	TCLP Leachate: 14 days from sampling for TCLP, 7 days from TCLP to extraction, 40 days from extraction to analysis	TCLP and analysis are completed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
TCLP Blank	1 per each TCLP preparation batch.	Concentration does not exceed the TCLP regulatory level of the analyte.	1. Determine if concentration levels exceed the TCLP regulatory levels. 2. If not, proceed with analysis. 3. If regulatory levels are exceeded, re-prepare blank, QC samples, and affected samples. 4. Document actions taken.
TCLP MS	1 per each TCLP preparation batch.	Acceptance criteria are specified in Table 10.	1. Verify that the spike concentration is at the regulatory concentration, and at least 5 times the MDL. 2. Verify that correct spiking solutions and amounts were used. 3. Check method blanks and LCS recovery. 4. Re-analyze samples if laboratory error is suspected. 5. Document actions taken.
Tuning Calibration Curve Method Blank LCS Surrogate Spike MS/MSD	Requirements for frequency, acceptance criteria, and corrective actions are the same as for Method 8270C semivolatile organics.		
Organochlorine Pesticides by Gas Chromatograph/Electron Capture Device: SW-1311/3510/8081			
Holding Time	TCLP Leachate: 14 days from sampling for TCLP, 7 days from TCLP to extraction, 40 days from extraction to analysis	TCLP and analysis are completed within holding time.	Notify client, determine if laboratory to proceed or if client will re-sample.
TCLP Blank	1 per each TCLP preparation batch.	Concentration does not exceed the TCLP regulatory level of the analyte.	1. Determine if concentration levels exceed the TCLP regulatory levels. 2. If not, proceed with analysis. 3. If regulatory levels are exceeded, re-prepare blank, QC samples, and affected samples. 4. Document actions taken.

QC Check	Frequency	Acceptance Criteria	Laboratory Corrective Action
Organochlorine Pesticides by Gas Chromatograph/Electron Capture Device: SW-1311/3510/8081 (Continued)			
TCLP MS	1 per each TCLP preparation batch.	Acceptance criteria are specified in Table 10.	1. Verify that the spike concentration is at the regulatory concentration, and at least 5 times the MDL. 2. Verify that correct spiking solutions and amounts were used. 3. Check method blanks and LCS recovery. 4. Re-analyze samples if laboratory error is suspected. 5. Document actions taken.
Calibration Curve Method Blank LCS Surrogate Spike MS/MSD	Requirements for frequency, acceptance criteria, and corrective actions are the same as for Method 8081 pesticides.		

Attachment B.4

Example Table of Contents Listing Standard Operating Procedures and Method Standard Operating Procedures

ATTACHMENT B.4

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