

Contract No.: EP-W-09-002
WA #: 066-TSTS-0208

Region 2 RAC2 Remedial Action Contract

Final Quality Assurance Project Plan

Burnt Fly Bog Superfund Site
Treatability and Focused Feasibility
Study
Marlboro, New Jersey

January 22, 2018



605870

**CDM
Smith**

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Acronyms

%	percent
ANSETS	Analytical Services Tracking System
ASC	Analytical Services Coordinator
B.A.	Bachelor of Arts
bgs	below ground surface
B.S.	Bachelor of Science
°C	degrees Celsius
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygienist
CLP	Contract Laboratory Program
COC	chain of custody
CRQL	Contract-Required Quantitation Limit
CSM	conceptual site model
DESA	Division of Environmental Science and Assessment
DL	detection limit
DQI	data quality indicator
DQO	data quality objective
EDD	electronic data deliverable
EID	electronic internet database
EPA	United States Environmental Protection Agency
EQulS™	Environmental Quality Information System
ERT	Environmental Response Team
FAR	Federal Acquisition Regulation
FASTAC	Field and Analytical Services Teaming Advisory Committee
FCN	Field Change Notification
FS	feasibility study
FSTM	Feasibility Study Task Manager
FTL	field team leader
HASP	health and safety plan
H&S	health and safety
HSM	Health and Safety Manager
ID	identification
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigation-derived waste
L	liter
MCL	Maximum Contaminant Level
MDL	method detection limit
mg/kg	milligram per kilogram
MPC	measurement performance criteria
M.S.	Master of Science
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable/not available
NCP	National Contingency Plan

NJDEP	New Jersey Department of Environmental Conservation
NPL	National Priorities List
OSWER	Office of Solid Waste and Emergency Response
PAL	project action limit
P.E.	Professional Engineer
Ph.D.	Doctor of Philosophy
PPE	personal protective equipment
PQLG	project quantitation limit goal
PQM	Project Quality Management
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QL	quantitation limit
QMP	Quality Management Plan
QP	Quality Procedure
RA	remedial action
RAC	Remedial Action Contract
RAO	remedial action objective
RI	remedial investigation
ROD	Record of Decision
RPD	relative percent difference
RPM	Remedial Project Manager
RQAS	Regional Quality Assurance Specialist
RSCC	Regional Sample Control Center
SDG	sample delivery group
SM	Site Manager
SOP	standard operating procedure
SVOC	semi-volatile organic compound
SOW	Statement of Work
TAT	turnaround time
TBD	to be determined
TCL	Target Compound List
TCLP	toxicity characteristic leaching procedure
the Site	the Burnt Fly Bog Site
UFP	Uniform Federal Policy
VC	vinyl chloride
VOA	volatile organic analysis
VOC	volatile organic compound
XRF	x-ray fluorescence
µg/kg	microgram per kilogram

1.0 Introduction

CDM Federal Programs Corporation (CDM Smith) received Work Assignment 066-TSTS-0208 under United States Environmental Protection Agency (EPA) Region 2, Remedial Action Contract (RAC) 2 (Contract No. EPP-W-9-002), to conduct a Treatability and Focused Feasibility Study (FFS). Activities will be conducted to update the overall nature and extent of contamination and to develop additional remedial alternatives for Operable Unit (OU) 3 (Westerly Wetlands) of the Burnt Fly Bog Site (Site), located in Marlboro and Old Bridge Townships, New Jersey. The Site is shown in **Figure 1**. These actions will be completed pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended (CERCLA) and the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (EPA 540/G-89/004, October 1998).

This Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) has been prepared in accordance with the Intergovernmental Data Quality Task Force (IDQTF) Uniform Federal Policy for Quality Assurance Project Plans (IDQTF EPA 2005a/ EPA-505-B-04-900) and the Optimized worksheets (March 2012) and is compliant with the EPA QAPP guidance document, EPA QA/R-5 (EPA 2002). Please note that this QAPP primarily addresses the sample collection activities. Sample results will be used to discuss the application of amendments to reduce the mobility of contaminants. A separate addendum will be prepared at a later date to discuss specific details of the Treatability and Pilot Study. This QAPP includes associated field activities in accordance with the Work Plan, Volume 1 (CDM Smith 2016a) and Volume 2 (CDM Smith 2016b). This project will be implemented in accordance with the quality procedures (QPs) and processes detailed in CDM Smith's RAC 2 Quality Management Plan (QMP) (CDM Smith 2012) and this QAPP.

This QAPP describes the project objectives and organization, functional activities, and quality assurance (QA)/quality control (QC) protocols that will be used to achieve the data quality objectives (DQOs). The DQOs will, at a minimum, reflect use of analytical methods for identifying and addressing contamination consistent with the levels for remedial action objectives (RAOs) identified in the National Contingency Plan (NCP). All work will be performed in accordance with CDM Smith's RAC2 Quality Management Plan (QMP) (CDM Smith 2012).

CDM Smith will document any required changes in a letter, Field Change Notifications (FCNs), or QAPP Addenda to the EPA Remedial Project Manager (RPM). If there is no project-specific information for certain worksheets, a reference is made to CDM Smith's Region 2 RAC2 Contract Generic QAPP for Superfund Sites (CDM Smith 2013c).

1.1 Site Overview

Detailed information regarding site geology, hydrogeology, location, setting, history, and previous investigations is provided in the OU3 Record of Decision (ROD) Report (September 1998), the 2013 Baseline Ecological Risk Assessment (BERA), the 5-Year Review Report (June 2016) and CDM Smith Draft Work Plan Volumes I and II (2016). The site is comprised of three operable units including OU1, OU2 and OU3. OU1 encompasses the main source of the contamination in the Uplands Area; OU2 encompasses the Westerly Wetlands and sedimentation pond in the Downstream Area; and OU3 encompasses the Westerly Wetlands, Northerly Wetlands and Tar Patch Area.

1.1.1 Location and Description

The Site is located near the intersection of Texas and Spring Valley Roads in Marlboro Township, Monmouth County, New Jersey. The Site is in a semi-rural area in Marlboro Township, with a portion extending into Old Bridge Township, Middlesex County. The Site area includes approximately 60 acres affected by lead and polychlorinated biphenyl (PCB) contamination.

The Uplands Area of the Site was an abandoned oil recovery and storage facility originally owned and operated by the Imperial Oil Company and Champion Chemical whose base of operations was at a nearby facility located in Morganville, New Jersey. Contamination of the Site began during the 1950s and continued through the mid-1960s, with direct dumping and spreading of hazardous materials resulting from recycled waste oil operations. The areas contaminated by the results of these operations include storage lagoons, areas used for waste oil operations, and adjacent areas affected by downgradient movement of contaminants.

Most of the waste was originally deposited in a roughly 10-acre parcel located in the southeastern portion of the Site designated as the Uplands Area. Recycled waste oil operations were also carried out in this same portion of the Site. Treatment and disposal facilities for reprocessed waste oil were poorly built, improperly operated, and became a source of contamination. These facilities were allowed to degenerate under several different owners. The Uplands Area included several unlined waste oil lagoons containing residual oil sludges and aqueous wastes, contaminated waste piles, drummed wastes, and areas of contaminated soil resulting from associated waste oil reprocessing activities. Uncontrolled discharges from the Uplands Area resulted in surface water and soil contamination moving downgradient into adjoining undisturbed lands, including the Westerly Wetlands, Northerly Wetlands, the Tar Patch Area, and the Downstream Area.

1.1.2 Previous Investigations

An Environmental Information Document (EID) pertaining to the Site was prepared in 1982. Contamination of soil, groundwater, and surface water was found to exist from the improper disposal of hazardous substances. Onsite sampling during investigation of the Uplands Area and Westerly Wetlands indicated the presence of heavy metals, PCBs, and volatile organics. The Uplands Area is considered to be the source of contamination for the entire Site. As a result of the waste oil storage activities, the sludge lagoon liquid, surface soil, and shallow subsurface soil in the Uplands Area were found to be contaminated, primarily with PCBs and lead. Lead and PCBs were the two parameters driving the selection of the remedies in all three operable units. Based upon the results of the EID, EPA signed a Record of Decision (ROD) on November 16, 1983 for the selection of a remedy to clean up the sources of contamination in the Uplands Area. These areas of contamination were excavated and removed off-site for proper disposal.

EPA signed a second ROD (OU2 ROD) on September 29, 1988 for the selection of an interim remedy for the Westerly Wetlands and Downstream Area following a remedial investigation/feasibility study. The major components of the remedy selected in the OU2 ROD included the excavation and off-site disposal of the Downstream Area, installation of a sedimentation basin, installation of security fencing, and treatability studies to determine effective remedies for site contaminants (PCBs and lead).

EPA signed a third ROD (OU3 ROD) on September 28, 1998 for the selection of a final remedy for the Westerly Wetlands, Northerly Wetlands Area, and Tar Patch Area. The major components of the remedy selected in the OU3 ROD included the excavation and off-Site disposal from Tar Patch and Northerly Wetlands Areas, backfilling and restoration of both excavated area, installation of additional fencing around the Westerly Wetlands, ecological monitoring of the Westerly Wetlands and long-term monitoring plan for the Site.

The remediation goals for sediment are based on EPA's risk-based Regional Screening Levels (EPA 2012), and were derived based on the more stringent of the protection of groundwater and direct contact risks to human health criteria. For this Site, the protection of groundwater values were lower, and are summarized as follows:

- PCB - 0.49 mg/kg
- Lead - 400 mg/kg

Current site risks are attributed to the presence of lead and PCBs in the soil, surface water, and sediments. As recorded in the surface water quality results of the June 2016 Five Year Review Report, no PCBs were detected within Burnt Fly Brook and the sedimentation pond, except one detection of 3.99 microgram per liter ($\mu\text{g/L}$) on-site. Surface water lead concentrations vary within the sediment basin and on-site in the Westerly Wetlands with the highest level being 1,110 $\mu\text{g/L}$.

Sediment PCB concentrations were below the 0.49 milligram per kilogram (mg/kg) New Jersey Soil Cleanup Criteria within Burnt Fly Brook and the sedimentation pond but PCB levels in sediment collected on-site were above criteria at five locations, with the highest level of 182.6 mg/kg. Sediment lead concentrations in Burnt Fly Brook and the sedimentation pond were below the lowest effect level sediment screening criteria (0.031 mg/kg) (Ontario Ministry of the Environment and Energy publication, "Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario," August 1993). Lead concentrations upgradient in the Westerly Wetlands sediments continue to remain elevated with the highest level being 10,900 mg/kg (EPA 2016). All sediment samples were collected during the 2013 BERA.

1.2 Path Forward

The remedy in the Westerly Wetlands has been effective and humification has been occurring. However, the overall process has been progressing at a slower rate than anticipated. Surface contamination has been identified throughout the wetland area. There is a possibility that contamination (lead) has been transported by surface water beyond the sedimentation pond. The RAO to preserve the Westerly Wetlands and avoid invasive remedial activities limits the remedies that can be implemented.

Sediments have the potential to act as a continuous source of contamination for groundwater and surface water through processes such as leaching. Therefore, this field investigation will include the collection of sediment over three separate rounds of sampling. These rounds are defined as baseline, interim and final. Ultimately, all data collected during each round will be used to support

the Treatability and FFS. A separate addendum to this QAPP will be prepared for the Treatability and FFS as necessary.

1.3 Sample Analyses for the Treatability and FFS Field Investigation

The environmental samples to be collected for the Treatability and FFS field investigation will be analyzed utilizing the analytical methods listed below.

Sediment

- Target Compound List (TCL) PCB – Method SOM02.4
- Lead – Method ISM02.4 and field screening using XRF (quick-cup method)
- TPH – Method EPA 8015 B/C
- Total Organic Carbon – Method Lloyd Kahn
- pH – Method 9045D
- Grain Size – Method ASTM D7928

1.4 Treatability and FFS Program Overview

The tasks discussed in this QAPP primarily focus on the collection of sediment samples in the Westerly Wetlands (OU3) to gather data pertaining to implementing the Treatability and FFS. Field activities will be conducted to determine an effective remedy to treat existing contamination. The main objectives of the Treatability and FFS field program include:

- Determine contaminant concentrations prior to, during and after application of amendment
- Minimize exposures to PCBs and lead in sediment at levels exceeding the remediation goals
- Minimizing extent of wetlands to be excavated
- Minimize contaminated soil from serving as a source of groundwater contamination
- Minimize both human and ecological exposure to contaminated sediments having concentrations exceeding the remediation goals
- Restore wetlands to a productive ecosystem

To achieve these objectives, sediment samples will be collected for the analyses listed above in Section 1.3. As stated above, an additional QAPP addendum will be issued to address the application of different types of amendments to provide a suitable remedy as necessary. The addendums will provide specific details of the Treatability and Pilot Study.

QAPP Worksheets #1 and 2
Title and Approval Page

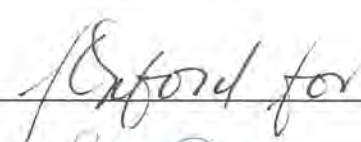
Project Identifying Information

Site/Project Name: Burnt Fly Bog Site, Operable Unit 3,
Treatability and Focused Feasibility Study
Site Location: Marlboro Township, New Jersey
Contract: Remedial Action Contract (RAC)2, EPA Region 2 EP-W-09-002
Work Assignment No./Operable Unit: 066-TSTS-0208/ OU-3
Document Control No.: 3323-066-03424

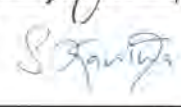
CDM Smith Site Manager:
Paul Hagerman, P.E.

Signature for 

CDM Smith QA Manager:
Jo Nell Mullins, ASQ CQA

Signature 

RAC 2 Program Manager:
Jeanne Litwin, REM

Signature 

EPA Project Manager:
Diane Salkie

Signature _____

EPA Region 2 QA Officer:
William Sy

Signature _____

State Regulatory Agency /Stakeholders:

EPA/New Jersey Department of Environmental Protection (NJDEP)

Dates and Titles of Plan and Reports Written for Previous Site Work:

OU3 Record of Decision – USEPA - September 1998
Baseline Ecological Risk Assessment – USEPA - June 2013
5-Year Review Report – USEPA - June 2016
Draft Work Plan Volume 1 and 2 – CDM Smith - 2016

In this QAPP, several updated worksheets are included to address changes to EPA analytical methods. In addition, the EPA-approved CDM Smith Generic QAPP is included as an attachment in Appendix D.

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QAPP CROSSWALK

QAPP Identifying Information

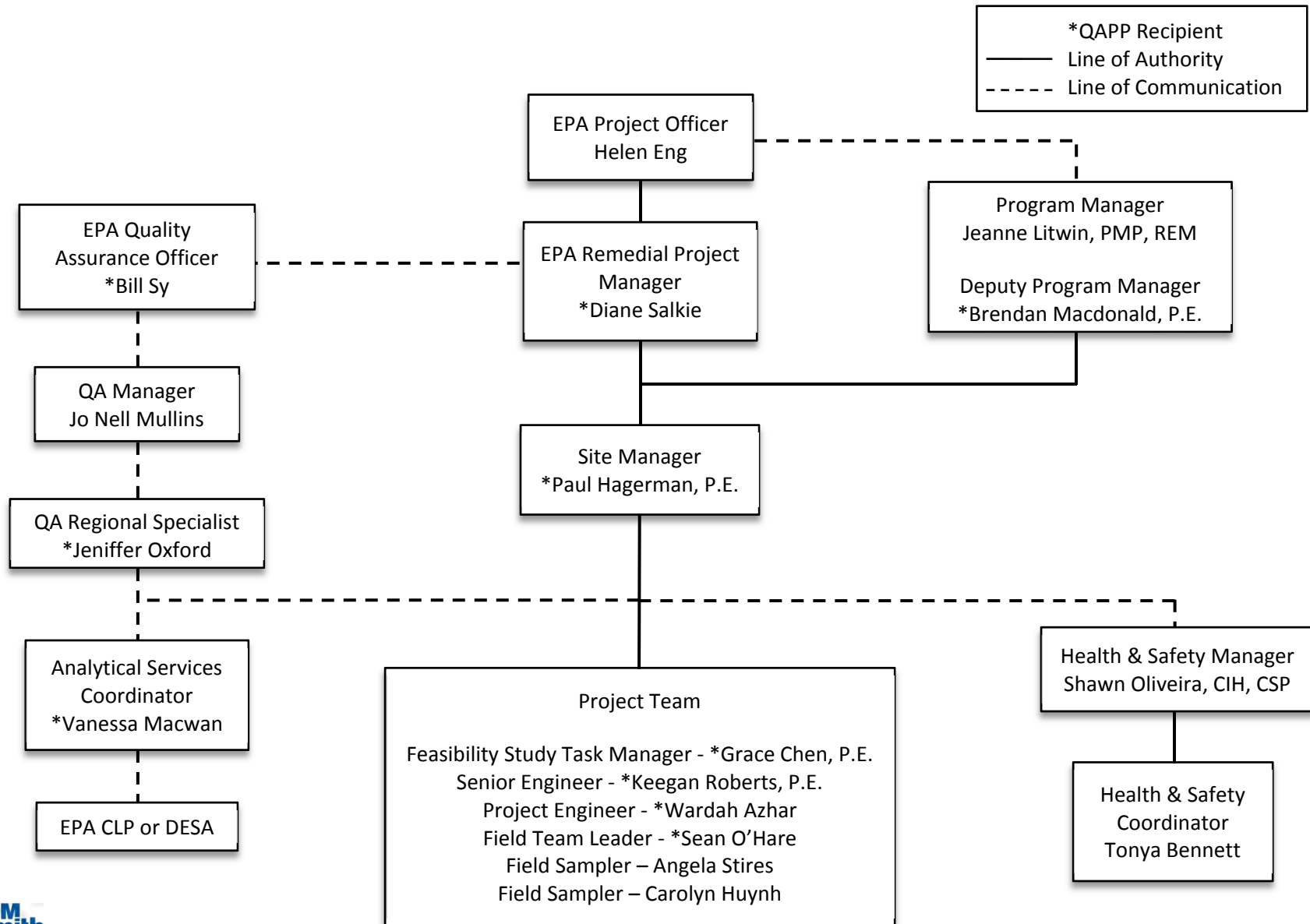
Optimized UFP-QAPP Worksheets		2016-G-05 QAPP Guidance Section	
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7 & 8	Project Qualifications and Sign-off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certification
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Format 2.2.2 Document Control	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP Elements for Evaluating Existing Data
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field QC	2.3.5	Quality Control Requirements
21	Field SOPs	2.3.2	Sampling Procedures and Requirements
22	Field Equipment Calibration, Maintenance, Testing and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables

QAPP CROSSWALK

QAPP Identifying Information

Optimized UFP-QAPP Worksheets		2016-G-05 QAPP Guidance Section	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements
29	Project Documents and Records	2.2.8	Documentation and Records Requirements
31, 32 & 33	Assessments and Corrective Action	2.4	Assessments and Data Reviews
		2.5.5	Reports to Management
34	Data Verification and Validation Inputs	2.5.5	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations and Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

QAPP Worksheet #3 & 5 Project Organization and QAPP Distribution



QAPP Worksheet #4, 7 & 8
Personnel Qualifications and Sign-off Sheet

EPA is the lead agency for the Treatability/Pilot Study and FFS Investigation. CDM Smith is the consulting engineering firm conducting the Treatability/Pilot Study and FFS investigation.

ORGANIZATION: CDM Smith

Name	Project Title/Role	Responsibilities	Education and Experience/Training/Certifications	Signature /Date
Paul Hagerman	SM	Oversee project and respond to EPA RPM. Manage subcontractors.	Bachelor of Science (B.S.), Mechanical Engineering; Master of Science (M.S.), Mechanical Engineering, Business Administration; Professional Engineer (P.E.)	
Grace Chen	Feasibility Study Task Manager	Provide guidance for and oversee the FFS and respond to the CDM Smith SM.	B.S., Environmental Engineering; M.S., Environmental Engineering; P.E.	
Keegan Roberts	Senior Engineer	Provide guidance on the design.	B.S., Civil Engineering; M.S. Civil Engineering; PhD, Civil Engineering; P.E.	
Wardah Azhar	Project Engineer	Conduct the remedial design.	B.S., Civil Engineering; M.S.E., Civil and Environmental Engineering; PhD, Civil Engineering	
Sean O'Hare	FTL	Coordinate and oversee the Treatability/Pilot Study and FFS field activities.	B.S., Biological Sciences	
Vanessa Macwan	ASC	Communicate with EPA RSCC, DESA laboratory, and subcontract laboratories; validation, and data packages.	B.S., Environmental Science; B.S., Environmental Engineering Technologies	
Shawn Oliveira	HSM	Oversee adherence to H&S requirements.	B.S., Chemistry; M.S., Environmental Engineering; Certified Safety Professional (#18988); Certified Industrial Hygienist (CIH) from the American Board of Industrial Hygiene	
Jeniffer Oxford	RQAS	Oversee adherence to QA requirements.	B.S., Natural Sciences, Certified Hazardous Materials Manager (CHMM)	
Angela Stires	Field Sampler	Assist with sampling activities	B.S., Environmental Engineering; Engineer in Training (EIT)	
Carolyn Huynh	Field Sampler	Assist with sampling activities	B.A., Biological Sciences; M.S., Environmental Sciences and Forestry	

**QAPP Worksheet #4, 7 & 8:
Personnel Qualifications and Sign-off Sheet**

ORGANIZATION: Laboratories

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date²
EPA CLP Laboratory (to be determined [TBD])	QA Officer	TBD (Experience vetted by accreditation body)	National Environmental Laboratory Accreditation Program (NELAP)/CLP	
DESA – Sumy Cherukara	QA Officer	TBD (Experience vetted by accreditation body)	NELAP/Trained in EPA and standard analytical methods	
CDM Smith Subcontract Laboratory (if required) – TBD	QA Officer	TBD		

Notes:

1. An individual can fill as many roles as he or she is qualified.
2. Other tasks requiring specialized skills and training will be performed by appropriate subcontractors. Training, certification, and permit requirements will be outlined in separate scopes of work for each task and project.
3. CPR/First Aid- Red Cross or CINAS- periodically as required.
4. Signatures indicate personnel have read and agree to implement this QAPP as written.

QAPP Worksheet #6 Communication Pathways

Communication Driver	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, Documentation, etc.)
Point of contact with EPA	SM	Paul Hagerman	(732) 590-4663	All information about the project will be sent to the EPA Remedial Project Manager (RPM) by the CDM Smith SM. Field changes will be discussed with the EPA RPM prior to implementation.
Manage Treatability/Pilot Study and FFS field tasks	SM	Paul Hagerman	(732) 590-4663	Daily communication with project team and Feasibility Study Task Manager (FSTM). Communicate implementation issues to field team leader (FTL).
QAPP changes	FTL	Sean O'Hare	(732) 590-4719	Notify Site Manager (SM) immediately and complete a field change notification form and/or corrected QAPP worksheets. Send FCN forms to the regional quality assurance specialist (RQAS).
	SM	Paul Hagerman	(732) 590-4663	Notify EPA RPM and the analytical services coordinator (ASC) of delays or changes to field work.
	FSTM	Grace Chen	(732) 590-4626	Prepare QAPP addenda or revisions in consultation with the SM.
Field corrective actions	FTL	Sean O'Hare	(732) 590-4719	Oversee implementation of corrective action and notify auditor, SM, and FSTM by email. SM will complete the corrective action report form.
Field progress reports	FTL	Sean O'Hare	(732) 590-4719	Complete on a daily basis and submit to FSTM and SM. SM will forward to EPA RPM upon request.
Booking of analytical services	FSTM	Grace Chen	(732) 590-4626	Submit request to ASC within the timeframe below.
	ASC	Vanessa Macwan	(732) 590-4706	Review request and send email to Regional Sample Control Center (RSCC) 3 weeks prior to sampling (6 weeks for special requests). If needed, EPA or CDM Smith will prepare a modified analytical Statement on Work (SOW) upon the clients request and submit for review. If a subcontract laboratory is required, the FTL will initiate a kick-off call with and email agenda.
Facilitate database setup and data management planning	FTL	Sean O'Hare	(732) 590-4719	Provide sample and analytical information prior to sample collection. Provide information on sample and analytical reporting groups and types of report tables required for project.

QAPP Worksheet #6
Communication Pathways

Communication Driver	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, Documentation, etc.)
Facilitate data management	FTL	Sean O'Hare	(732) 590-4719	Provide electronic survey data, sample identification (ID), locations, and analyses. Transmit completed sample tracking information to data specialist and data manager by the completion of each sampling case.
Incomplete electronic data deliverables (EDDs) or other EDD issues	ASC	Vanessa Macwan	(732) 590-4706	Request resubmittal of corrected EDD by email.
Data verification issues (e.g., incomplete records)	ASC	Vanessa Macwan	(732) 590-4706	Send an email to the FTL when an issue is found. FTL will address questions or any discrepancies.
Field corrective action	RQAS FTL	Jeniffer Oxford Sean O'Hare	(212) 377-4536 (732) 590-4719	Corrective actions may also be identified by the field team. FTL initiates corrective action on identified field issues immediately or within timeframe recommended by the Quality Assurance Manager (QAM).
Analytical services support	ASC	Vanessa Macwan	(732) 590-4706	Act as liaison with RSCC for CLP laboratories, with Ness Tirol for Division of Environmental Science and Assessment (DESA), and with subcontract laboratories (if needed).
Laboratory QC variances and analytical corrective actions	FSTM	Grace Chen	(732) 590-4626	Communicate daily with laboratory staff and regularly with CDM Smith ASC, RQAS, or designee. Provide oversight and direction on technical issues as needed.
Notification of analytical issues; sample receipt variances	ASC	Vanessa Macwan	(732) 590-4706	Notify FTL of any sample collection/shipment issues. Notify subcontract laboratory to initiate corrective action.

QAPP Worksheet #6 Communication Pathways

Communication Driver	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, Documentation, etc.)
Data validation issues (e.g., non-compliance with procedures; data review corrective actions)	Data Validator or Data Assessor	To be determined (TBD)	TBD	Submit a list of questions or issues to project team, EPA or the subcontract laboratory as appropriate for correction or other appropriate response. Notify team of data issues by email.
Reporting of issues relating to analytical data quality (including ability to meet reporting limits and usability of data)	ASC	Vanessa Macwan	(732) 590-4706	Communicate results of field sampling and data quality assessment to SM and project teams by email.
	Data Assessor	TBD	TBD	Communicate findings to SM as appropriate. Document situation and impact in a data quality report.
Release of analytical data	ASC and Data Coordinator	Vanessa Macwan	(732) 590-4706	Receive and review data packages before data are used. Initiate validation of subcontract laboratory data. Inform data manager of status by updating data tracking.
Site health and safety (H&S) issues; stop work due to safety issues	Site Health and Safety Officer	Sean O'Hare	(732) 590-4719	Conduct daily H&S meetings; make decisions regarding H&S issues and upgrading personal protective equipment (PPE). Communicate to SM, Health and Safety Manager (HSM), and field staff as appropriate.

Note: The Field and Analytical Services Teaming Advisory Committee (FASTAC) Policy for obtaining analytical services will be followed. Analytical requests will be submitted to the RSCC by the CDM Smith ASC.

QAPP Worksheet #9

Project Planning Session Summary

Projected Date(s) of Sampling: 3/24/17 to 12/12/17 Site Manager: Paul Hagerman Meeting Location: Conference Call			Site Name: Burnt Fly Bog Site Site Location: Marlboro Township, New Jersey Operable Unit: OU3	
Date of Session: August 2, 2016 Scoping Session Purpose: The purpose of the Project Quality Management (PQM)/Scoping Meeting was for CDM Smith to propose a technical approach to meet the objectives of the Treatability and FFS scope of work. The group discussed the scope of work as well as data collection and decision making strategies. EPA agreed with CDM Smith's approach for the proposed field activities.				
Participants:				
Name	Affiliation	Phone #	Email Address	Project Role
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Notes/Comments:

Consensus decisions made:

Discussion Items:

- EPA's primary goal for the work assignment is to identify a way to optimize the selected remedy for the Western Wetland area, which currently requires minimal disturbance of the existing ecosystem.
- CDM Smith should review site history and investigations and applicable literature to identify viable technologies. If there is no technology or approach that would provide a more efficient and effective remedy, CDM Smith should inform EPA as early in the process as possible.
- CDM Smith will use existing data available through EPA's website, and provide EPA a list of other site historical documents and information that may be available through other sources, such as hard copies filed at EPA and NJDEP. EPA will contact NJDEP to determine whether they have any of these reports and data and initiate CDM Smith's coordination with NJDEP to obtain the documents.
- The week of September 12, 2016, CDM Smith will hold a Technical Scoping Meeting with EPA to discuss early findings of the literature review and how they support the approach to be proposed in the work plan.
- The submittal of the Draft Work Plan & Budget has been scheduled for September 30, 2016.

QAPP Worksheet #10: Conceptual Site Model

Background

Background information can be found in the Introduction section of this QAPP. Additional details regarding the Site history, geology, hydrology, topography, and climate can be found in the Work Plan (CDM Smith 2016), Five-Year Review Report (EPA 2016) and the ROD (NJDEP 1998).

Problem Summary

Approximately 60 acres of the Site property have been affected by lead and PCB contamination. The majority of the wastes were deposited on a 10-acre parcel located in the southeastern portion of the Site, designated as the Uplands area. The Uplands area contained several unlined waste oil lagoons, waste piles and drummed wastes. In addition, uncontrolled discharges from the Uplands Area resulted in surface water and soil contamination moving downgradient into the formerly undisturbed lands including the Westerly Wetlands, Northern Wetlands, Tar Patch Area and downstream area. The 1998 ROD addressed OU3 area of the Site and included the excavation and off-site disposal of both the Northerly Wetlands and Tar Patch Area located upgradient of the Westerly Wetlands. Due to the high diversity and overall thriving habitat, excavation was not conducted in the Westerly Wetlands. Instead, periodic monitoring, installation of a security fence and sediment buildup through humification were used as controls.

High levels of Site-related contaminants were found in the surface water and sediment within the Westerly Wetlands. There were no PCBs detected in Burnt Fly Brook. However, there was one detection of 3.99 µg/L on Site within the northeastern corner of the Westerly Wetlands. Surface water lead concentrations varied within the sedimentation basin and Westerly Wetlands. Similar to the PCB detection, the highest lead concentration (1,110 µg/L) was detected in the northeastern corner of the Westerly Wetlands, just downgradient of the former Tar Patch Area. Sediment PCB levels were below criteria (0.49 mg/kg) in Burnt Fly Brook and sedimentation pond. However, exceedances were observed at 5 locations within the Westerly Wetlands. The highest exceedance was 182.6 mg/kg. Sediment lead concentrations remain elevated in the Westerly Wetlands with the highest concentration at 10,900 mg/kg.

The suggested remedy of the Westerly Wetland has been effective. However, humification has been occurring at a much slower rate than anticipated. Surface water and storm water during periods of high precipitation travel through the Westerly Wetlands into the sedimentation basin and eventually into Burnt Fly Brook. Therefore, the contaminated sediment currently in the Westerly Wetlands has the potential to act as a source of continuous contamination due to mechanisms such as leaching. A pilot study will be conducted to evaluate the application of a variety of amendments to the surface sediment with intentions to reduce the mobility of the contaminants, primarily PCBs, TPH and lead. These technologies will be further examined through a Treatability/Pilot Study and FFS to identify the best alternative to address these concerns.

Land Use

The land use near the Site is semi-rural. Two auto salvage yards, a few scattered residences, a rehabilitation facility, and a horse farm are located near the Site.

QAPP Worksheet #11: Project Data Quality Objectives

Problem Statement

PCB, TPH and lead concentrations have been detected in sediment and surface water within the Westerly Wetlands at levels exceeding criteria. A ROD was signed in September 1998 for OU3 to address the final remedy for the Westerly Wetlands, Northerly Wetlands Area and Tar Patch Area. The OU3 ROD confirmed PCB, TPH and lead as the primary Site-related contaminants of concern. These contaminants may pose risks to human health through ingestion and dermal contact. Currently, the remedy in the Westerly Wetlands has been effective and humification has been occurring. However, the overall process has been progressing at a slower rate than anticipated. Surface contamination has been identified throughout the wetland area. There is a possibility that contamination (lead) has been transported by surface water beyond the sedimentation pond. The RAO to preserve the Westerly Wetlands and avoid invasive remedial activities limits the remedies that can be implemented.

A Treatability and FFS study will be conducted to collect the necessary data required to determine the most effective treatment for reducing the mobility of currently existing contaminants within the sediment in the Westerly Wetlands.

Goals of the Studies

Conduct a Treatability Study and FFS to determine an effective remedy to treat the existing sediment contamination
Prevent contaminated sediment from serving as a source of groundwater / surface water contamination
Prevent human exposure to contaminated sediment exceeding soil cleanup criteria
Conduct a hydrogeological evaluation
Conduct an ecological characterization

Information Inputs

This QAPP identifies sample collection activities, analyses, media types, and sample locations to meet the needs and scope of the investigation. Additional details are included in Worksheet #17 and the Draft Work Plan, Volumes 1 and 2 (CDM Smith 2016). Sources of secondary project data are identified on Worksheet #13.

The information inputs needed for the Treatability and FFS include:

- Sediment PCB, TPH, lead concentrations
- Sediment total organic carbon (TOC), pH, and grain size concentrations

The ecological and hydrogeological inputs are qualitative and include:

- Existing monitoring wells assessment
- Water levels
- Surface water reconnaissance following a rain event
- Topographic maps to aid in the evaluation of surface water flow in the Westerly Wetlands
- Ecological evaluation to characterize Site flora and fauna

QAPP Worksheet #11: Project Data Quality Objectives

Boundaries of the Study

The Treatability and FFS focuses on remediating the sediment contamination identified in the Westerly Wetlands during the 2013 and 2014 sampling events and as described on Worksheet #10 (PCB, TPH and lead).

Analytic Approach

Sampling and analysis tasks are outlined in Worksheet #14. CDM Smith will perform technical review and evaluation of the analytical data and reports to conduct a data quality assessment for the Treatability and FFS. Sample results will be evaluated against the project action limits (PALs) provided on Worksheet #15 using the data quality indicators (DQIs) listed on Worksheets #12 and #28. If treatability test results prove to lower contaminant concentrations, this remedy may have potential to treat the entire Westerly Wetlands.

Performance and Acceptance Criteria

Sample results will be compared to the measurement performance criteria (MPCs) of each DQI, outlined in Worksheet #12, to determine data quality and whether sample results are acceptable based on the established DQOs. EPA's FASTAC policy for obtaining laboratory resources will be utilized for all sampling events. Definitive-level data are required for full validation. The PALs and quantitation limits (QLs) are specified on Worksheet #15. Analytical data will be compared to these limits. Data must meet the DQOs specified for the Site. Refer to Worksheets #12, #18, and #28. Laboratory reporting limits must be less than or equal to the project quantitation limit goals (PQLGs) or the PALs.

To verify that MPCs are met, all data will be subject to validation and the outputs used to perform a data usability assessment.

Detailed Plan for Obtaining Data

Field sampling procedures are described in CDM Smith's Technical Standard Operating Procedures (Technical SOPs), which are listed on Worksheet #21 and included in **Appendix A** (only included in field copies). CDM Smith will be responsible for all sample collection, shipment, and management. CDM Smith will prepare, package, and ship the samples to the assigned laboratories. Either EPA's contract laboratory or CDM Smith's subcontract laboratory will generate the data. EPA's RSCC will communicate laboratory assignments to CDM Smith.

This QAPP primarily focuses on the sample collection phase of the project. Three rounds of sampling will be conducted to collect data prior to amendment distribution, during amendment distribution and several months after completing the application of different amendment. The sample plots are shown in Figure 2. Additional sediment will be collected for the Treatability Study. A separate addendum will be prepared for the Treatability Study to discuss the application of amendments to the surface to reduce the mobility of contaminants. Refer to Worksheets #17, 20, 26, 27 for further detail. Additional information will be collected during a hydrogeological and ecological characterization. Specific details are listed in Worksheet 17.

For the hydrogeologic investigation, this will include an assessment of all existing monitoring wells and evaluation of their suitability, both conceptually and technically. One round of water level data will be collected from the 7 existing monitoring wells; surface water reconnaissance and evaluation after a rain event; and an evaluation of topographical data (existing maps or NJDEP topographic databases to evaluated surface water flows in the Westerly Wetlands.

QAPP Worksheet #11

Project Data Quality Objectives

CDM Smith will perform an ecological characterization of the Westerly Wetlands area of the site. CDM Smith will verify the conditions relative to the most recent 5-year report and collect more detailed information of biota in the areas most likely to be accessed during the pilot study.

No sampling will be conducted during this initial evaluation. The work will include habitat characterization, identification of threatened and endangered species, and a written summary of the results.

Data Reporting

Sampling data will be emailed to CDM Smith from DESA, EPA, or CDM Smith's subcontractor laboratory.

Final validated data will be submitted to CDM Smith in electronic format.

Following completion of laboratory analyses and receipt of all data, CDM Smith will conduct a data usability assessment, which will be performed to evaluate achievement of the project DQOs. The results of the data usability assessment including a discussion of the data quality will be included in the Treatability and FFS report. The assessment will be performed on the site-related contaminants of concern: PCB, TPH, and lead, unless any other unanticipated parameters are detected. A decision will be made at that time whether additional parameters will be included in the assessment. Data generated will be reported to the client through the Treatability Study report and later a FFS report. Samples analyzed by CLP will be validated by a contractor of the EPA or by EPA staff; EPA DESA staff will validate samples analyzed by the DESA laboratory; and CDM Smith will validate sample analyzed by its subcontract laboratories. DESA, CLP and subcontract validated analytical data will be forwarded to CDM Smith in electronic and hard copy. Analytical data will be uploaded to the Environmental Quality Information Systems (EQuIS) database. The database query and reporting tools will be used to create a project data management system as specified by the project team for use in the Treatability and Feasibility Report. The memorandums and remedial design will be submitted to EPA for review. CDM will use AutoCAD and 3-D Modeling software to facilitate spatial analysis of data and to generate figures for reports and presentations. Following completion of all laboratory analysis and receipt of all electronic and hard-copy data, a Treatability Study Report will be prepared by CDM and submitted to EPA and NJDEP.

Data archiving

Electronic data will be input into the project's Environmental Quality Information System (EQuIS™) database.

EPA will archive laboratory raw data in its document control system.

Hard copies of field data, including field logs, will be archived in the project files.

Electronic copies of analytical data will be archived in the project files and maintained for the period specified in the contract.

QAPP Worksheet #12

Measurement Performance Criteria

The following worksheets have been updated and are included in this QAPP:

Worksheet #12a – Lead in sediment samples by XRF (quick-cup method)

Worksheet #12b – TCL PCBs in sediment samples by SOM02.4

Worksheet #12c – Lead in sediment samples by ISM02.4

Worksheet #12d – TCL PCBs in aqueous samples by SOM02.4

Worksheet #12e – Lead in aqueous samples by ISM02.4

Worksheet #12f – Grain size in sediment samples by ASTM D7928

The following worksheets from CDM Smith's Generic QAPP (CDM Smith 2013) are applicable to this project and are provided in Appendix D:

Worksheet #12bk – TPH – DRO and GRO in sediment samples by EPA Method 8015 B/C

Worksheet #12bu – pH in sediment samples by SW-846 EPA Method 9045D

Worksheet #12bm – TOC in sediment samples by Lloyd Kahn

Worksheet #12ab – TPH – DRO and GRO in aqueous samples by EPA Method 8015 B/C

QAPP Worksheet #12a
Lead in sediment by XRF (quick-cup method)
Measurement Performance Criteria

Matrix: Sediment
Analytical Method: XRF (quick-cup method)
Concentration Level: Low to High

DQI	QC Sample or Measurement Performance Activity	MPC
Precision	Field duplicate ¹	RPD ≤ 50%
Comparability	Assessed during DQA	Comparable units and methods
Completeness	Assessed during DQA	≥70% collection and analysis
Sensitivity/accuracy	Preparation blank/ QC sample (field assessment) ²	80% to 120% R ³

¹ – Duplicate samples will be collected at a rate of 5%. The field duplicate sample will be collected and prepared following being oven-dried. A separate sample will be collected for each duplicate and field prep sample. A replicate XRF reading will be taken of each field duplicate to confirm accuracy of XRF instrument. If results differ significantly, the instrument will be re-calibrated per manufacturer's specifications.

² - QC samples will be collected at a rate of 1 per 20 samples and will include a prepared NIST blank standard and NIST Lead standard of known concentrations to accurately re-calibrate the XRF instrument. The measured analyte value should be +/- 20% of the standard value.

³ - The MPC was determined to be within 80% to 120% based on the measured analyte values being within +/- 20% of the standard reference material value. Further detail is included in Technical SOP.

QAPP Worksheet #12b: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Sediment
Analytical Group TCL PCBs/Aroclors/SOM02.4
Concentration Level Low/Medium (µg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field duplicates	$\leq 100\% \text{RPD}$ $\text{ABS} \leq 2 * \text{CRQL}$ when either result is $\leq 5 * \text{CRQL}$
Precision	MS/MSD**	See list of compound-specific RPDs and %Rs on Worksheet #28
Accuracy	LCS***	
	MS/MSD**	
	Surrogates	
Comparability	Assessed during DQA	Comparable units and methods
Completeness	Assessed during DQA	≥ 90 percent collection and analysis
Sensitivity/Accuracy	Method blanks assessed during DV and DQA	$\leq \text{CRQLs}$ (WS#15 and laboratory SOP)

*Reference EPA Region 2 Low/Medium Aroclors (PCBs) Data Validation SOP shown on Worksheet #36 or most recent revision (<https://www.epa.gov/quality/managing-quality-environmental-data-epa-region-2>)

**MS/MSD – Reference CLP SOM02.4, Exhibit D, Aroclors Section Table 7 for Criteria – Not typically required for Region 2

***LCS – Reference CLP SOM02.4, Exhibit D, Aroclors Section Table 8 for Criteria

QAPP Worksheet #12c: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Sediment
Analytical Group Lead/ISM02.4
Concentration Level ICP-AES (milligram per kilogram [mg/kg])

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field duplicates *	$\leq 100\% \text{RPD}$ when both results $\geq 5 * \text{CRQL}$ $\text{ABS} \leq 2 * \text{CRQL}$ when either result $\leq 5 * \text{CRQL}$ (¹Important Note. The validation SOP requires qualification of results $\leq 50\% \text{RPD}$. For the purpose of data use the 100% RPD criterion is satisfactory for most projects)
Precision	Laboratory duplicate sample **	$\leq 35\% \text{RPD}^*$ (DV action based on this value)
Accuracy	Field rinsate blank*	No analyte > CRQL
Accuracy	Matrix spike***; LCS****	75-125 %R 70-130 %R
Comparability	Assessed during DQA	Comparable units and methods
Completeness	Assessed during DQA	≥ 90 percent collection and analysis
Sensitivity/Accuracy	Method blanks assessed during DV and DQA	$\leq \text{CRQLs}$ (WS#15 and laboratory SOP)

* Reference EPA ICP-MS Data Validation SOP or most recent revision (https://www.epa.gov/quality/managing-quality-environmental-data-epa-region-2).

More detailed QA/QC procedures for this analytical service are provided in Exhibit E of the SOW, which can be accessed at: https://www.epa.gov/clp/epa-contract-laboratory-program-statement-work-inorganic-superfund-methods-multi-media-multi-1

**Reference EPA CLP ISM02.4, Exhibit D of ICP-AES for Duplicate Sample Analysis, includes absolute difference criteria

***Reference EPA CLP ISM02.4, Exhibit D of ICP-AES for Spike Sample Analysis

****Reference EPA CLP ISM02.4, Exhibit D of ICP-AES for LCS Sample Criteria

QAPP Worksheet #12d: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TCL PCBs/Aroclors/SOM02.4
Concentration Level Low/Medium (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicates	≤50%RPD when PCBs in both samples ≥ 5*CRQL, otherwise ABS ≤ 2*CRQL
Analytical accuracy/bias (contamination)	Method blank	No analyte > CRQL No target analyte concentrations ≥ ½ CRQL
Precision	MS/MSD**	See Worksheet #28 for compound specific values
Accuracy	***Laboratory control sample (LCS); MS/MSD** Surrogates (Table 6 of method)	See Worksheet #28 for the list of compound-specific values
Sensitivity	Method blank	Results ≤ CRQL
	Data assessment	CRQLs meet PQLGs or PALs at a minimum
Completeness	Data assessment Also see Worksheet #34	≥90 percent valid data versus total data collected and ≥90 percent planned data versus data collected Also see Worksheet #34

*Reference EPA Region Low/Medium Aroclor (PCBs) Data Validation SOP on Worksheet # 36 or most recent revision (<https://www.epa.gov/quality/managing-quality-environmental-data-epa-region-2>)

**MS/MSD – Reference CLP SOM02.4, Exhibit D, Aroclors Section Table 7 for Criteria – Not typically required for Region 2

***LCS – Reference CLP SOM02.4, Exhibit D, Aroclors Section Table 8 for Criteria

QAPP Worksheet #12e: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Lead /ISM02.4 - Inductively coupled plasma atomic emission spectroscopy (ICP-AES) (µg/L)
Concentration Level Low/Medium (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field duplicates *	$\leq 50\%RPD^1$ when both results $\geq 5*CRQL$ otherwise, $ABS \leq 2*CRQL$ The validation SOP requires qualification of results $\leq 20\%RPD$. For project purposes and data use the 50%RPD criterion is satisfactory.
Precision	Laboratory duplicate sample **	$\leq 20\%RPD^{**}$
Accuracy	Matrix spike ***; LCSW ****	75-125%R; 70-130%R (except Ag and Sb)
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90 percent collection and analysis
Sensitivity/Accuracy	Field rinsate/method blanks assessed during DV and DQA	$\leq CRQLs$ (WS#15 and laboratory SOP)

* Reference EPA ICP-MS Data Validation SOP or most recent revision (https://www.epa.gov/quality/managing-quality-environmental-data-epa-region-2). More detailed QA/QC procedures for this analytical service are provided in Exhibit E of the SOW, which can be accessed at: https://www.epa.gov/clp/superfund-clp-analytical-statements-work-sows

**Reference EPA CLP ISM02.4, Exhibit D of ICP-AES for Duplicate Sample Analysis, includes absolute difference criteria

***Reference EPA CLP ISM02.4, Exhibit D of ICP-AES for Spike Sample Analysis

****Reference EPA CLP ISM02.4, Exhibit D of ICP-AES for LCS Sample Criteria

QAPP Worksheet #12f: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Sediment
Analytical Group Grain Size/ASTM D7928
Concentration Level NA (percent particle size)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Field Duplicates	≤100% RPD

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Data Type	Data Source	Data Use Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
Topography, background and contaminant levels of Site	Record of Decision, 1998	Data used for site history planning purposes during work plan preparation	Data used for background information and to study potential amendments to limit migration of contaminated sediment
Ecological risk assessment, nature and extent of contamination in Westerly Wetlands, and collection of samples at former NJDEP sample locations	Baseline Ecological Risk Assessment, Emergency Response Team (ERT), October 2014 ERT collected samples from September 2012 through June 2013	Data used for planning purposes during work plan preparation Data collected from previous BERAs conducted in 1992 and 2008 was evaluated	Data used for determination of range of sediment contamination Data used for planning purposes during work plan preparation
Comparison and evaluation of contaminant levels over time	Fourth 5-Year Review Report, June 2016, USEPA This report follows up on the previous 5-Year Report conducted in 2011 to evaluate existing Site conditions and contaminant levels.	Evaluate the effectiveness of remedy to determine if it will continue to protect human health and the environment	Data used to compare initial contaminant concentrations to existing concentrations The comparison will determine how to effectively conduct the long-term monitoring and maintenance of the Westerly Wetlands

QAPP Worksheet #14 and #16 Project, Tasks & Schedules

Refer to **Figure 3** for project tasks and schedule.

QAPP Worksheet #15

Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

The following worksheets are included in this QAPP:

Worksheet #15a – TPH – DRO and GRO in sediment samples by EPA Method 8015 B/C

Worksheet #15b – TCL PCBs in sediment samples by SOM02.4

Worksheet #15c – Lead in sediment samples by ISM02.4

Worksheet #15d – TOC in sediment samples by Lloyd Kahn

Worksheet #15e – Grain size in sediment samples by ASTM D7928

Worksheet #15f – pH of sediment samples by SW-846 EPA Method 9045D

Worksheet #15g – Lead in sediment samples by XRF (quick cup method)

* Aqueous samples are field rinsate blanks and the reporting limits will be equivalent to the sediment methods including TPH, PCBs and lead.

QAPP Worksheet #15a:
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Sediment
Analytical Method: EPA Method 8015 B/C
Concentration Level: Low to Medium

Analyte	PAL (mg/kg) ¹	PQLG (mg/kg)	CRQL (mg/kg) ²	Laboratory-Specific QL	Laboratory-Specific DL
TPH - GRO	NL	NA	0.1	NA	NA
TPH - DRO	NL	NA	10	NA	NA

mg/kg – milligram per kilogram

¹ Per the 1998 ROD, PALs for TPH were not listed in the New Jersey Department of Protection and Energy's Soil Cleanup Criteria, for residential direct contact (NJDEP 1999).

² CRQL values obtained from modified analyses for GRO/DRO according to SW-846 EPA Method 8015D.

PAL – Project Action Limit

PQLG – Project Quantitation Limit Goal

CRQL – Contract Required Quantitation Limit

MDL – method detection limit

QL – quantitation limit

DL – detection limit

NA – not applicable

NL – not listed

QAPP Worksheet #15b
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Sediment

Analytical Method: SOM02.4

Concentration Level: Low to High

Analyte	PAL (mg/kg) ¹	PQLG (mg/kg)	CRQL (mg/kg)	Laboratory-Specific DESA RL ²	Laboratory-Specific DESA MDL ²
Aroclor -1016	0.49	0.163	0.033	0.031	NA
Aroclor -1221	0.49	0.163	0.033	0.062	NA
Aroclor -1232	0.49	0.163	0.033	0.031	NA
Aroclor -1242	0.49	0.163	0.033	0.031	0.0299
Aroclor -1248	0.49	0.163	0.033	0.031	NA
Aroclor -1254	0.49	0.163	0.033	0.031	NA
Aroclor -1260	0.49	0.163	0.033	0.031	NA
Aroclor -1262	0.49	0.163	0.033	0.031	NA
Aroclor -1268	0.49	0.163	0.033	0.031	NA

mg/kg – milligram per kilogram

¹ Per the 1998 ROD, PALs are based on the New Jersey Department of Protection and Energy's Soil Cleanup Criteria, for residential direct contact (NJDEP 2005).

² DESA achievable laboratory limits are included in the DESA QAPP worksheets.

QAPP Worksheet #15c
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Sediment
Analytical Method: ISM02.4 – ICP-AES
Concentration Level: Low to High

Analyte	PAL (mg/kg) ¹	PQLG (mg/kg)	CRQL (mg/kg)	Laboratory-Specific DESA RL ²	Laboratory-Specific DESA MDL ²
Lead	400	80	1	0.8	0.23

mg/kg – milligram per kilogram

¹ Per the 1998 ROD, PALs are based on the New Jersey Department of Protection and Energy's Soil Cleanup Criteria, for residential direct contact (NJDEP 2005).

² DESA achievable laboratory limits are included in the DESA QAPP worksheets.

QAPP Worksheet #15d
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Sediment
Analytical Method: Lloyd Kahn
Concentration Level: Low

Analyte	PAL (mg/kg) ¹	PQLG (mg/kg)	CRQL (mg/kg)	Laboratory-Specific DESA RL ²	Laboratory-Specific DESA MDL ²
TOC	NA	NA	NA	1,000	NA

mg/kg – milligram per kilogram

¹ Per the 1998 ROD, PALs for TOC were not listed in the New Jersey Department of Protection and Energy's Soil Cleanup Criteria, for residential direct contact (NJDEP 1999).

² DESA achievable laboratory limits are included in the DESA QAPP worksheets.

QAPP Worksheet #15e
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Sediment
Analytical Method: ASTM D7928
Concentration Level: NA

Analyte	PAL (mg/kg) ¹	PQLG (mg/kg)	CRQL (mg/kg)	Laboratory-Specific QL	Laboratory-Specific DL
Grain Size	NA	NA	NA	NA	NA

mg/kg – milligram per kilogram

¹ Per the 1998 ROD, PALs for grain size were not listed in the New Jersey Department of Protection and Energy's Soil Cleanup Criteria, for residential direct contact (NJDEP 1999).

QAPP Worksheet #15f
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Sediment
Analytical Method: SW-846 EPA Method 9045D
Concentration Level: Medium

Analyte	PAL (mg/kg) ¹	PQLG (mg/kg)	CRQL (mg/kg)	Laboratory-Specific QL ²	Laboratory-Specific DL ²
pH	NA	NA	NA	NA	NA

mg/kg – milligram per kilogram

¹ Per the 1998 ROD, PALs for pH were not listed in the New Jersey Department of Protection and Energy's Soil Cleanup Criteria, for residential direct contact (NJDEP 1999).

² DESA achievable laboratory limits are included in the DESA QAPP worksheets.

QAPP Worksheet #15g
Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Sediment
Analytical Method: XRF – (quick cup method)
Concentration Level: Low to high

Analyte	PAL (mg/kg) ¹	PQLG (mg/kg)	Laboratory-Specific QL ²	Laboratory-Specific DL ²
Lead	400	80	TBD	TBD

mg/kg – milligram per kilogram

¹ Per the 1998 ROD, PALs are based on the New Jersey Department of Protection and Energy's Soil Cleanup Criteria, for residential direct contact (NJDEP 2005).

² Values derived from the XRF user's manual.

QAPP Worksheet #17

Sampling Design and Rationale

The following worksheets are included to address field tasks:

- Mobilization/Demobilization – Worksheet #17a
- Decontamination Procedures – Worksheet #17b

The design and rationale of the field approach are described in detail in the following worksheets:

- Manual Hand Augering, Lithologic Logging, and Sediment Sampling – Worksheet #17c
- Hydrogeological Assessment – Worksheet #17d
- Ecological Characterization – Worksheet #17e

QAPP Worksheet #17a
Sampling Design and Rationale
Mobilization/Demobilization

Site Reconnaissance

Site reconnaissance activities will be performed to support mobilization and to prepare for sampling activities. Sample locations will be identified using a hand-held global positioning system (GPS) unit. The field team will assess potential logistical issues and physical access constraints for sampling. The field team will coordinate access issues with EPA prior to starting field activities. Potential problem locations will be documented. If any of the sample locations need to be adjusted, the FTL will contact the SM prior to relocation. Photographs will be taken prior to the start of activities to document existing conditions.

Sample Location Mark-Out

CDM Smith will locate each sediment sample location using a hand-held Trimble GPS unit. Each location will be marked and labeled using a wooden stake or piece rebar and flagging tape. CDM Smith intends on marking all locations in early Spring prior to the budding of trees. Limited tree coverage during this time of year will enable for better GPS accuracy.

Site Preparation and Restoration

Health and safety (H&S) work zones, including personnel decontamination areas, will be established in accordance with the Site-specific health and safety plan (HASP). Local authorities, including the police and fire departments, will be notified prior to the start of field activities. Equipment will be demobilized at the completion of each field event, as necessary. Demobilized equipment will include sampling equipment, H&S equipment, and decontamination equipment.

If properties are impacted by field activities, the properties will be restored as near as practicable. CDM Smith will maintain photographic documentation of Site conditions prior to and after completion of field activities.

Access Support

EPA will be responsible for obtaining Site access and CDM Smith will provide technical support. Once access has been granted, field work can begin. CDM Smith will provide a tentative field schedule prior to the start of activities and update EPA with a daily quality control report (Appendix B) and sample tracking sheet (**Tables 1 and 2**). These documents will provide the daily progress along with upcoming activities to the EPA.

QAPP Worksheet #17a
Sampling Design and Rationale – Mobilization/Demobilization

Field Planning Meetings

Prior to field activities, each field team member will review all project plans and participate in a field planning meeting, conducted by the CDM Smith FTL, to become familiar with the history of the Site, H&S requirements, field procedures, and related QC requirements. The required field data electronic data deliverables (EDDs) will be identified and responsibility for preparation will be assigned. The analytical method codes being used in Scribe will be reviewed to ensure that they are consistent with the EQUIS™ database. CDM Smith field personnel will also attend an onsite tailgate kick-off meeting immediately prior to the commencement of each stage of field activities. All new field personnel will receive a comparable briefing if they do not attend the initial field planning meeting and/or the tailgate kick-off meeting. Supplemental meetings may be conducted as required due to changes in Site conditions.

Field Equipment and Supplies

Equipment and field supply mobilization includes ordering, renting, and purchasing all equipment and supplies needed for each part of the field investigation. This will also include staging and transferring all equipment and supplies to and from the Site. Measurement and Test Equipment forms will be completed for rental or purchase of equipment (instruments) that will be utilized to collect field measurements. The field equipment will be inspected for acceptability, and instruments calibrated as required prior to use. This task also involves the construction of a decontamination area for sampling equipment and personnel.

Investigation-Derived Waste

CDM Smith will procure a subcontractor to remove and dispose of drums containing field-generated waste liquids, solids, PPE, and other investigation derived waste (IDW). Representative waste samples will be collected and analyzed for toxicity characteristic leaching procedure TCLP volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and RCRA characteristics by a laboratory. CDM Smith will conduct field oversight and H&S monitoring during all waste disposal field activities. All IDW will be disposed of properly at facilities approved by EPA under the Off-Site Disposal Rule. In accordance with the RAC2 Contract, CDM Smith will review and sign the required waste transportation documents on behalf of EPA.

Field Procedures for these Activities are detailed in:

Technical SOP 1-3	Drum Sampling
Technical SOP 2-2	Guide to Handling Investigation-Derived Waste
Technical SOP 5-1	Control of Measurement and Test Equipment

QAPP Worksheet #17b

Sampling Design and Rationale – Decontamination Procedures

Field decontamination will be performed on all personnel and equipment that enters the exclusion zone. Personnel decontamination procedures will be implemented to prevent worker exposure to Site contaminants. Equipment decontamination procedures will be implemented to prevent cross-contamination of environmental samples and prevent off-site migration of contaminants resulting from site investigation activities.

Personal Protective Equipment

Non-residual detergent (Alconox) and tap water rinse

Thorough rinse with potable water

Air dry

Field Monitoring Equipment

Instruments should be cleaned per manufacturer's instructions.

Sampling Apparatus, General Considerations

Sampling devices such as stainless steel augers must be decontaminated, after each use between sampling locations by the procedure listed below to prevent cross-contamination. In addition, disposable dedicated sampling apparatus will be used for each sample location. Therefore, decontamination will not be necessary for any dedicated sampling equipment. It is assumed that enough equipment (plastic scoops and aluminum pans) will be available for all sample locations. Decontamination will be performed in an area outside the contamination zone.

QAPP Worksheet #17b

Sampling Design and Rationale – Decontamination Procedures

Decontamination Procedure:

The required decontamination procedure for all non-dedicated sampling equipment is:

- * a. wash and scrub with low phosphate detergent
- b. tap water rinse
- c. 10 percent nitric acid rinse (for metals only) laboratory grade, (1% solution for carbon steel equipment such as split-spoons)
- d. demonstrated analyte-free water rinse
- ** e. isopropanol rinse (all solvents must be pesticide-grade or better)
- *** f. analyte-free water rinse (amount of water must be at least five times that of the solvents used)
- g. air dry
- h. wrap in aluminum foil, shiny side out, for transport

Definitions –

- * Tap water must be from a municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.
- ** Solvent rinse required only when sampling for organics.
- *** A sample of the demonstrated analyte-free water will be collected and submitted for chemical analysis. Analytical results will be kept on-site.

While performing decontamination activities, phthalate-free gloves should be used to prevent phthalate contamination of the sampling equipment that could result from the interaction of the gloves with the organic solvents.

QAPP Worksheet #17b
Sampling Design and Rationale – Decontamination Procedures

Decontamination Equipment

Distilled/deionized water
Potable water
Deep basins
Brush
Acetone or isopropanol (pesticide-grade)
Personnel protective equipment
10% nitric acid (1% when needed), ultra pure grade

Demonstrated analyte-free water
Polyethylene sheeting
Utility knife
Non-phosphate detergent (i.e., Alconox)
Aluminum foil
Air monitoring equipment and calibration gas

Field Procedures for these Activities are detailed in:

Technical SOP 4-5 Field Equipment Decontamination at Nonradioactive Sites

**QAPP Worksheet #17c:
Sampling Design and Rationale
Manual Hand Augering, Lithologic Logging, and Sediment Sampling**

Manual Hand Augering

Sediment borings will be advanced manually using a stainless-steel hand auger to define the limits of PCB, TPH and lead contamination in the surface and subsurface sediment. The proposed sediment plot locations were selected by concentrations determined from the 2014 BERA sampling events and are shown on **Figure 2**. These boring locations were selected to define the horizontal and vertical limits of the sediment contamination in each plot within the Westerly Wetlands. Each soil sample will be composited and collected into the appropriate container and shipped to the laboratory on the day of collection. Discarded soil will be placed into 55-gallon drums stored in a central staging area. Due to the shallow target depth of 18 inches, sediment borings will be filled in with surrounding sediment. The sample program includes:

- 12 plots (roughly 15 feet by 15 feet) will be scattered throughout the Westerly Wetlands. Plots are located among low, medium and high concentration areas based on sampling results from the 2014 BERA.
- Six plots will be selected to evaluate the Lead amendment while the other six plots will be selected to evaluate the PCB/TPH amendment for 3 rounds of sampling. pH and TOC will be evaluated from all 12 plots for 3 rounds of sampling. Grain size will be analyzed from all 12 plots for only the first round of sampling. Plots for both amendments will be representative of low, medium and high concentration areas along the stream channel and upland areas. The proposed sampling plots are provided on Figure 2.
- A total of 4 borings will be advanced in each of the 12 plots (Total of 48 borings). Each boring will be placed randomly in one quartile of each plot.
- Two samples will be collected from each boring including a surface sample collected from 0 to 6 inches below ground surface (bgs) and a subsurface sample collected from 12 to 18 inches bgs.
 - Samples from each interval will be collected and field screened for lead by XRF using a Thermo Niton XRF Analyzer XL3T600. Procedures listed in the equipment manual along with technical SOP 1-15 will be used to prepare and perform lead XRF analysis. Approximately 10 percent of the field screened samples will be sent to a CLP laboratory for lead analysis. Laboratory samples will be collected so that a range of concentrations (low, medium, high level concentration) are measured to develop an order of magnitude comparison between the XRF results and the wet laboratory results. Please note that a quick-cup sample will not be sent to the laboratory since additional volume is required to follow CLP procedures. Therefore, an 8-ounce jar will be filled, packed on ice and shipped to the designated laboratory for analysis.
- Three rounds of sampling will be conducted (baseline, interim and final). The details relative to the timing of collection of the interim and final round were determined and documented in the treatability study work plan and subsequent QAPP addendum.
- Additional soil samples will be collected from select areas in OU3 based upon analytical results from the baseline sampling event. A total of four samples will be collected and used for a bench scale treatability study. Further details will be included in a QAPP Addendum.

All borings will be advanced to the target depth of 18 inches. Based on previous investigation work performed at this property along with a shallow target depth of 18 inches, refusal is not expected. If refusal is encountered, the boring will be off-set a few feet to reach target depth.

QAPP Worksheet #17c
Sampling Design and Rationale
Manual Hand Augering, Lithologic Logging, and Sediment Sampling

Lithologic Logging

CDM Smith will characterize the lithology in accordance with Technical SOP 3-5 of each sample prior to collection for laboratory analysis.

Borehole Abandonment

Upon completion of sampling, each borehole will be backfilled with surrounding sediment.

Sampling Waste Management

Hand-auger cuttings and water from decontamination operations will be containerized at each sampling location and transported by the individual sampler to a central waste storage area for subsequent sampling, characterization, and disposal by CDM Smith's IDW subcontractor.

Field Procedures for these activities are detailed in:

- Technical SOP 1-2 Sample Custody
- Technical SOP 1-3 Surface Soil Sampling (Section 4.2, Manual (Hand) Augering)
- Technical SOP 1-4 Subsurface Soil Sampling
- Technical SOP 1-11 Sediment or Sludge Sampling
- Technical SOP 2-1 Packaging and Shipping Environmental Samples
- Technical SOP 2-2 Guide to Handling Investigation-Derived Waste
- Technical SOP 3-5 Lithologic Logging
- Technical SOP 4-1 Field Logbook Content and Control, with a RAC2 clarification
- Technical SOP 4-2 Photographic Documentation of Field Activities
- Technical SOP 15-1 Photographic Documentation of Field Activities
- Worksheet #17b Decontamination Procedures
- Worksheet #18 Sampling Locations and Methods/SOP Requirements

QAPP Worksheet #17d
Sampling Design and Rationale
Hydrogeological Assessment

A hydrogeological assessment will be conducted to assist in evaluating the surface water flow in the Westerly Wetlands. The following activities will be conducted as follows:

- An evaluation will be conducted to determine the conceptual and technical suitability of each of the existing monitoring wells
- Groundwater elevations will be recorded from all existing monitoring wells
- A surface water reconnaissance and evaluation will be conducted after a rain event
- Review of data collection along with topographical maps will be used in surface water flow evaluation

Each monitoring well will be examined for external damage and missing components that could potentially compromise the full functionality of the well. Measurements including depth to water and total depth will be recorded and checked against any existing well records. All observations will be recorded onto well-specific assessment checklist forms (sample form is provided in Appendix B).

The surface water reconnaissance includes the evaluation of the overall presence and flow of water within the Westerly Wetlands after a rain event. This rain event would require receiving over 1 inch of rain within a 24-hour period. CDM Smith would ideally conduct the surface water reconnaissance within 1 to 2 days following the rain event.

Field Procedures for these activities are detailed in:

- Technical SOP 1-6 Groundwater Level Measurement
- Technical SOP 4-1 Field Logbook Content and Control
- Technical SOP 4-2 Photographic Documentation of Field Activities
- Worksheet #17b Decontamination Procedures

QAPP Worksheet #17e

Sampling Design and Rationale – Ecological Characterization

Ecological Characterization

An ecological characterization will be conducted in the Westerly wetlands to collect additional biota data, habitat characterization and identification of potential threatened and endangered species. Data collected will be used to confirm the results from the latest 5-Year report (2016). A summary of the ecological characterization will be included in the Treatability and FFS report. Ecological characterization forms are included in **Appendix B**.

Field Procedures for these activities are detailed in:

- Technical SOP 4-1 Field Logbook Content and Control
- Technical SOP 4-2 Photographic Documentation of Field Activities

QAPP Worksheet #18
Sampling Locations and Methods

Sampling ID Number	Matrix	Depth (inches bgs)	Analytical Group	Type	Sampling Standard Operating Procedure (SOP) Reference	Comments ¹
Surface Sediment Samples – 0 to 6 inches bgs						
SS-Plot-01 ² -01 ³ -R1 ⁴ through SS-Plot-06 ² -01 ³ -R1 ⁴	Sediment	0 to 6	Lead*, pH, TOC	Hand Auger	CDM Smith Technical SOP 1-3	72 (6 plots X 4 sample locations X 3 rounds)
SS-Plot-07 ² -01 ³ -R1 ⁴ through SS-Plot-12 ² -01 ³ -R1 ⁴	Sediment	0 to 6	TCL PCBs, TPH, pH, TOC	Hand Auger	CDM Smith Technical SOP 1-3	72 (6 plots X 4 sample locations x 3 rounds)
SS-Plot-01 ² -01 ³ -R1 ⁴ through SS-Plot-12 ² -01 ³ -R1 ⁴	Sediment	0 to 6	Grain Size	Hand Auger	CDM Smith Technical SOP 1-3	48 (12 plots X 4 sample locations X 1 round)

QAPP Worksheet #18
Sampling Locations and Methods

Sampling ID Number	Matrix	Depth (inches bgs)	Analytical Group	Type	Sampling Standard Operating Procedure (SOP) Reference	Comments ¹
Subsurface Sediment Samples – 12 to 18 inches bgs						
SB-Plot-01 ² -01 ³ -R1 ⁴ through SB-Plot-06 ² -01 ³ -R1 ⁴	Sediment	12 to 18	Lead*, pH, TOC	Hand Auger	CDM Smith Technical SOP 1-4	72 (6 plots X 4 sample locations X 3 round)
SB-Plot-07 ² -01 ³ -R1 ⁴ through SB-Plot-12 ² -01 ³ -R1 ⁴	Sediment	12 to 18	TCL PCBs, TPH, pH, TOC	Hand Auger	CDM Smith Technical SOP 1-4	72 (6 plots X 4 sample locations X 3 rounds)
SB-Plot-01 ² -01 ³ -R1 ⁴ through SB-Plot-12 ² -01 ³ -R1 ⁴	Sediment	12 to 18	Grain Size	Hand Auger	CDM Smith Technical SOP 1-4	48 (12 plots X 4 sample locations X 1 round)

¹Number of samples does not include QC samples, which are listed in Worksheet #20.

²01 indicates the plot #

³01 indicates the boring number in each plot. There will be 4 borings in each plot.

⁴R1 indicates the round of sampling. There will be 3 rounds of sampling, baseline, interim, and final, for simplicity labeled Round 1, Round 2 and Round 3.

*Lead will be analyzed in the field using the Niton XRF instrument. In addition, confirmation samples will be collected from 10% of locations and shipped off-site for laboratory analysis of lead.

QAPP Worksheet #19 & 30
Sample Containers, Preservation, and Hold Times

Laboratory: DESA or CLP laboratory

Required accreditations/certifications: TBD

Back-up laboratory: Subcontract laboratory

Sample delivery method: FedEx Priority Overnight

Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
TCL PCBs	Sediment	SOM02.4	TBD	(1) 8 oz. glass jar w/Teflon lined cap	Cool 0 to 6 degrees Celsius (°C); but not frozen, immediately after collection	48 hours if cooled only; 14 days if frozen or	14 days	21 days for analysis/21 days for validation
Lead	Sediment	ISM02.4	TBD	(1) 8 oz. glass jar w/Teflon lined cap	Cool 0 to 6 degrees Celsius (°C); but not frozen, immediately after collection	6 months	None	21 days for analysis/21 days for validation
TPH - GRO	Sediment	EPA 8015 B/C	TBD	(3) 40 ml VOA vials w/Teflon lined septum	Cool to 0 to 6°C	14 days		21 days for analysis/21 days for validation
TPH - DRO	Sediment	EPA 8015 B/C	TBD	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 0 to 6°C	14 days		21 days for analysis/21 days for validation
pH	Sediment	SW-846, 9045D	TBD	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 0 to 6°C	As soon as possible		21 days for analysis/21 days for validation
TOC	Sediment	Lloyd Kahn	TBD	(1) 4 oz. jar w/Teflon lined cap	Cool to 0 to 6°C	14 days		21 days for analysis/21 days for validation
Grain Size	Sediment	ASTM D7928	TBD	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 0 to 6°C	None		21 days for analysis/21 days for validation

QAPP Worksheet #19 & 30
Sample Containers, Preservation, and Hold Times

Laboratory: DESA or CLP laboratory

Required accreditations/certifications: TBD

Back-up laboratory: Subcontract laboratory

Sample delivery method: FedEx Priority Overnight

Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
TCL PCBs	Aqueous	SOM02.4	TBD	(2) 1-L amber glass bottle w/Teflon lined cap	Cool to 0 to 6°C	7 days	40 days	21 days for analysis/21 days for validation
Lead	Aqueous	ISM02.4	TBD	(1) 1-L high density polyethylene (HDPE)	HNO3 to pH <2; Cool to 0 to 6°C	None	6 months	21 days for analysis/21 days for validation
TPH - GRO	Aqueous	EPA 8015 B/C	TBD	(3) 40-milliliter (ml) vials	HCL to pH <2; Cool to 0 to 6°C	14 days	14 days	21 days for analysis/21 days for validation
TPH - DRO	Aqueous	EPA 8015 B/C	TBD	(2) 1-L amber glass bottle w/Teflon lined cap	Cool to 0 to 6°C	14 days	40 days	21 days for analysis/21 days for validation

QAPP Worksheet #20
Field Quality Control Summary

Matrix	Analytical Group	No. of Field Samples	No. of Field Duplicates	Matrix Spikes	Matrix Spike Duplicates	No. of Rinsate Blanks ²	No. of Trip Blanks	Total No. of Analyses ¹
Sediment	TCL PCBs	144	12	12	12 ³	15 ²	NA	171 ¹
Sediment	Lead – To be analyzed in field using XRF	144	12	NA	NA	15 ²	NA	171 ¹
Sediment	Lead – To be analyzed in laboratory	15	1	1	1 ³	15 ²	NA	16 ¹
Sediment	TPH	144	12	12	12 ³	15 ²	NA	171 ¹
Sediment	pH	288	NA	NA	NA	NA	NA	288 ¹
Sediment	TOC	288	15	NA	NA	NA	NA	303 ¹
Sediment	Grain Size	96	NA	NA	NA	NA	NA	96 ¹

¹ Total number of samples does not include matrix spikes/matrix spike duplicates (MS/MSDs). MS/MSDs will be designated on the chain of custody (COC).

² One field rinsate blank will be collected per lot for soil sampling equipment including the plastic trowel / aluminum pan. In addition, a daily field rinsate blank will be collected off of the stainless steel auger to evaluate the decontamination process.

³ Double volume is necessary for MS/MSD analyses for both PCBs and lead analyses

The total number of samples included on this worksheet are included over 3 sampling events (baseline, interim and final). QC samples including duplicates and MS/MSDs will be collected at a rate of 1 per 20 samples, with a minimum of 1 per round.

QAPP Worksheet #21
Field SOPs

SOP # or Reference	Title, Revision Date and/or Number	Originating Organization	SOP Option or Equipment Type	Modified for Project Work? (Y/N)	Comments
1-2	Sample Custody, Rev. 8, February 2015	CDM Smith	Refer to Section 4.0; Use Scribe software	Y	-Sample tags are not required. -Scribe-generated COCs will be used. -Use waterproof ink for any handwritten labels.
1-3	Surface Soil Sampling, Rev. 9, February 2015	CDM Smith	Refer to Section 4.0; Section 4.2	N	
1-4	Subsurface Soil Sampling, Rev. 8, February 2015	CDM Smith	Refer to Section 4.0; Section 4.2, Hand Auger applies	N	
1-6	Water Level Measurement, Revision 9, February 2015	CDM Smith	Refer to Section 4.0	N	Water level indicator
1-11	Sediment or Sludge Sampling	CDM Smith	NA	N	
1-15	Field Portable XRF, Revision 2, February 2015	CDM Smith	Refer to Section 4.0, Refer to quick-cup procedures	N	- XRF Niton XL3t 600 user's guide and manual (Appendix C) -Sediment samples will be dried using a portable electric oven prior to placing into the sample cup for analysis.
2-1	Packaging and Shipping Environmental Samples, Rev. 6, February 2015	CDM Smith	NA	Y	-Methanol shall not be used. -Vermiculite shall not be used.
2-2	Guide to Handling Investigation-Derived Waste, Rev. 8, February 2015	CDM Smith	Refer to Section 4.0	N	
3-5	Lithologic Logging, Rev. 9, February 2015	CDM Smith	Refer to Section 4.0	N	

QAPP Worksheet #21
Field SOPs

SOP # or Reference	Title, Revision Date and/or Number	Originating Organization	SOP Option or Equipment Type	Modified for Project Work? (Y/N)	Comments
4-1	Field Logbook Content and Control, Rev. 8, February 2015	CDM Smith	Refer to Section 4.0	Y	-Logbook notes should include decon procedures used; descriptions of photos taken; problems encountered; notes of conversations with FSTM/SM; and details of samples collected, including CLP numbers and visual observations.
4-2	Photographic Documentation of Field Activities, Rev. 9, February 2015	CDM Smith	Refer to Section 4.0	N	
4-5	Field Equipment Decontamination at Nonradioactive Sites, Rev. 10, February 2015	CDM Smith	Refer to Section 4.0; Use phthalate-free gloves	N	
4-10	Borehole and Well Decommissioning, Rev. 2, February 2015	CDM Smith	Refer to Section 4.0	N	
5-1	Control of Measurement and Test Equipment, Rev. 10, February 2015	CDM Smith	NA	Y	-Leased or rented equipment only to be used.

QAPP Worksheet #22

Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Refer to Worksheet #22 in CDM Smith's Generic QAPP (CDM Smith 2013e) provided in **Appendix D**

Refer to XRF Niton XL3t 600 user's guide and manual provided in **Appendix C**

QAPP Worksheet #23

Analytical SOPs

Samples will be going to DESA or to a CLP lab. DESA laboratory SOPs will apply when the DESA laboratory is able to perform the analyses, and EPA reviews CLP laboratory SOPs.

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	Modified for Project? Y/N
SOM02.4	CLP SOW for Multi-Media, Multi-Concentration Organic Analysis. September 2015.	Definitive	TCL PCBs	GC/ECD	
ISM02.4	CLP SOW for Multi-Media, Multi-Concentration Inorganic Analysis. September 2015.		Lead	ICP-AES	
EPA 8015 B/C	Nonhalogenated Organics by Gas Chromatography. Revision 3. February 2007.		TPH (DRO and GRO)	GC	
Lloyd Kahn	Determination of TOC in Sediment. July 1998. (and Attachment B of method, Supplemental Technical Direction and Additional QC Procedures.)		TOC	Carbon analyzer	
ASTM D7928	Standard Test Method for Particle Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis. 2017.		Grain Size	Sieves, hydrometer	
9045	Manufacturers Manual	Screening	pH	pH meter	

QAPP Worksheet #24
Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
GC/ECD	Initial calibration	Upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met	Initial calibration/ Calibration verification: resolution between two adjacent peaks $\geq 60.0\%$, single components $\geq 90.0\%$ resolved, RTs within the RT window	Inspect the system (e.g., change the column, bake out the detector, clean the injection port); correct problem, re-calibrate	EPA CLP Laboratory GC/ECD Technician	SOM02.4
	Calibration verification	Once every 12 hours	%D must be greater than or equal to -25 percent and less than or equal to 25 percent, %RSD must be less than or equal to 20.0 percent	Inspect system, recalibrate the instrument, and reanalyze samples		
ICP-AES/ ICP-MS	See ISM02.4/per instrument manufacturer's procedures	Initial calibration: daily or once every 24 hours and each time the instrument is set up	ICP-AES & MS: As per instrument manufacturer's procedures, at least 2 standards	Inspect the system, correct problem, re-calibrate, and re-analyze samples	Laboratory ICP-AES / ICP-MS Technician or DESA Laboratory analyst / QA officer	ISM02.4
	Initial calibration	Daily; after tuning and optimizing instrument	Correlation coefficient > 0.995 with a minimum of 3 standards and a blank. MS-A minimum of three replicate integrations are required for data acquisition.	Repeat analysis; re-prepare calibration standards and reanalyze		
	ICV	Before sample analysis	90-110% R; source of standard separate from calibration standards	Re-calibrate; prepare fresh ICV standards; correct problem pre-analyze samples		

QAPP Worksheet #24
Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
	Reporting Limit Standard	After initial calibration verification, standard	80-120% R or concentration $\leq$ 30% difference (from true value)	Re-analyze failed standard		
	CCV	Every 10 samples and beginning and at the end of analytical sequence	90-110% R; source of standard separate from calibration standards	Re-check; re-calibrate and rerun all samples analyzed after last valid CCV		
Soil TOC Analyzer	Calibration and corrective action as per Manufacturer's instruction. No samples shall be analyzed if instrument calibration exceeds the acceptance criteria.				Laboratory analyst/QA officer	Lloyd Kahn
pH meter	Daily buffer checks (2-point bracketing sample pH)	Before use/per batch; other checks as per rental company and manufacture's recommendations	± 0.1 pH units or ± 0.05 pH units (see the instrument manual for the applicable criteria)	Recheck; replace buffer solutions and recheck. If still fails perform instrument check or place out of service	Laboratory analyst/QA officer	NA

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Instrument/ Equipment	Maintenance Activity	Testing Activity Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	Reference
Analytical instrument maintenance, testing and inspection information and availability of spare parts are not available since the FASTAC decision process will be utilized for analytical services. Information is provided in CDM Smith MSA subcontract laboratories' QA Manuals. The MSA laboratory to be utilized (if DESA is not available) is not determined at this time. Maintenance, testing and inspection frequencies are documented in the MSA laboratories SOPs.							
GC/ECD	See SOM02.4; as per instrument manufacturer's recommendations	See SOM02.4; as per instrument manufacturer's recommendations	See SOM02.4; as per instrument manufacturer's recommendations	Acceptable re-calibration; see SOM02.4	Inspect the system, correct problem, re-calibrate and/or reanalyze samples	EPA CLP Laboratory GC/ECD Technician	SOM02.4
ICP-AES/ ICP-MS	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations; check connections	As per instrument manufacturer's recommendations	Acceptable re-calibration; see ISM02.4	Inspect the system, correct problem, re-calibrate and/or reanalyze samples	EPA CLP Laboratory ICP-AES / ICP-MS Technician	ISM02.4
Soil TOC Analyzer	As per Manufacturer's instructions						

QAPP Worksheet #26 & 27

Sample Handling, Custody, and Disposal

Refer to Worksheet #26 & 27 in CDM Smith's Generic QAPP (CDM Smith 2013e) for Sample Handling, Custody, and Disposal information not listed below.

Sampling Organization: CDM Smith

Laboratory: DESA or CLP

Method of sample delivery (shipper/carrier): FedEx

Number of days from reporting until sample disposal: DESA = 30 days; CLP = as per contract

CDM Smith will collect all samples under the supervision of the FTL. The coding system below will be used to identify each sample collected during the Treatability/Pilot Study and FFS.

Sediment Boring Samples: Sediment boring samples will be distinguished by surface "SS" and subsurface "SB" followed by the plot # (1 through 12), boring # (1 through 4) and round (1 through 3). Example: SS-PLOT-01-01-R1 represents the surface sediment sample from the location SS-PLOT-01-01-R1 from a depth of 0 to 6 inches bgs during Round 1. Example: SB-PLOT-12-04-R3 represents the subsurface sediment sample from location SB-PLOT-12-04-R1 from a depth of 12 to 18 inches bgs during Round 3.

QC Sample Numbering System: Each field duplicate sample will be submitted "blind" to the laboratory by using a different sample number than the associated environmental sample. The actual collection time will be recorded for both the environmental sample and its duplicate. Duplicate sample names will be recorded in the field log book, along with its parent sample name.

QAPP Worksheet #28

Analytical Quality Control and Corrective Action

PROCEDURE FOR FIELD DUPLICATE COLLECTION/FIELD RINSATE BLANK COLLECTION

Duplicates: Field duplicate samples are collected and analyzed to assess the overall precision of the field sampling technique. Duplicate samples of the same matrix, will be collected at a rate of 5% (one per 20 samples), or one per every 14 days, or one if less than 20 samples are collected. Duplicate samples will be collected by alternately filling bottles for the same analysis.

Field Rinsate Blanks (Field Blanks): One field rinsate blank will be collected per lot for the sediment sampling equipment including the plastic trowel and aluminum pan and will be analyzed for the same constituents as the environmental samples. Field rinsate blanks, also known as “field blanks” or “equipment blanks,” are used to assess the effectiveness of equipment decontamination. In addition, field rinsate blanks will be collected before the use of the decontaminated equipment for sampling including a stainless steel auger. Field rinsate blanks are generated by pouring demonstrated analyte-free water over or through the decontaminated dedicated sampling tools.

Water will be considered analyte-free when analysis results for PCBs, TPH DRO/GRO and lead analysis are below CRQL. The field rinsate blank will be collected in a way that will minimize potential contamination from the ambient air. The use of the same aliquot of water on all equipment associated with a particular matrix for the required analyses is permissible. Preservation of field rinsate blanks is specified on Worksheet #19. Field rinsate blanks will accompany the set of samples collected by the decontaminated sampling equipment and will be kept between 0 and 6°C.

In this case the samples associated with the field rinsate blank will be noted in the field logbooks and sample trip report.

Cooler Temperature Indicators

One cooler temperature indicator or “temperature blank” will be placed in each cooler containing samples (solid and aqueous) being sent to the laboratory for analysis. The temperature blank will consist of a sample container filled with non-preserved water (potable or distilled). The container will be labeled “COOLER TEMPERATURE INDICATOR” and dated.

Matrix Spikes

Matrix spikes for sediment samples may require extra volume for certain analyses. In accordance with EPA Region 2 direction, MS samples will be designated on environmental samples at a rate of one per sample delivery group (SDG). This designation will be noted on the sample container labels and the sample paperwork. An SDG is defined as one of the following:

1. All samples of an analytical case if the sample number is less than 20 (including environmental duplicates and QC blanks) and if sampling is completed within 7 calendar days.
2. Each group of 20 samples within an analytical case (including environmental duplicates, but excluding QC blanks) if the number is greater than 20.
3. Each 7-day calendar period during which samples within an analytical case are received. This period begins with the receipt of the first sample in the SDG.

QAPP Worksheet #28

Analytical Quality Control and Corrective Action

The following worksheet is presented below:

Worksheet #28a – Lead in sediment samples by XRF (quick-cup method)

Worksheet #28b – TCL PCBs in sediment samples by SOM02.4

Worksheet #28c – Lead in sediment samples by ISM02.4

Worksheet #28d – TCL PCBs in aqueous samples by SOM02.4

Worksheet #28e – Lead in aqueous samples by ISM02.4

Worksheet #28f – Grain size in sediment samples by ASTM D7928

The following worksheets from CDM Smith's Generic QAPP (CDM Smith 2013e) are applicable to this project:

Worksheet #28bh – TPH – DRO and GRO in sediment samples by EPA Method 8015 B/C

Worksheet #28bq – pH in sediment samples by SW-846 EPA Method 9045D

Worksheet #28bi – TOC in sediment samples by Lloyd Kahn

Worksheet #28z – TPH in aqueous samples by EPA Method 8015 B/C

QAPP Worksheet #28a
Lead in sediment by XRF (quick-cup method)
Analytical Quality Control and Corrective Action

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	MPC
Field Duplicates	1 per 20 samples	None	Recalibrate instrument and proceed	CDM Smith ASC	RPD $\leq$ 50%
Preparation Blank	1 per 20 samples	No constituent > CRQL	Suspend analysis until source rectified, reanalyze affected samples	CDM Smith	80% to 120% R
QC Sample ¹	1 per 20 samples	Per laboratory SOP	Suspend analysis until source rectified, reanalyze affected samples	CDM Smith	80% to 120% R

¹ – QC samples will be analyzed every 20 samples and will include the NIST Lead standard and the NIST blank standard. Duplicate samples will be collected at a rate of 5%. The field duplicate sample will be collected and prepared following being oven-dried. A separate sample will be collected for each duplicate and field prep sample. A replicate XRF reading will be taken of each field duplicate to confirm accuracy of XRF instrument. If results differ significantly, the instrument will be re-calibrated per manufacturer's specifications.

² - QC samples will be collected at a rate of 1 per 20 samples and will include a prepared NIST blank standard and NIST Lead standard of known concentrations to accurately re-calibrate the XRF instrument. The measured analyte value should be +/- 20% of the standard value.

³ - The MPC was determined to be within 80% to 120% based on the measured analyte values being within +/- 20% of the standard reference material value. Further detail is included in Technical SOP.

QAPP Worksheet #28b: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Analytical Group

Analytical Method/SOP Reference

Sediment

TCL PCBs/Aroclors

SOM02.4

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Field Duplicates	1 per 20 samples	None		Notify PM and flag duplicate results.	CDM Smith ASC and PM	$\leq 100\% \text{RPD}$ $\text{ABS} \leq 2 \times \text{CRQL}$ when either $\text{results} \leq 5 \times \text{CRQL}$	
Temperature Blank	1 per cooler	0 to 6°C		Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant.	Laboratory analyst and CDM Smith FTL	0 to 6° C acceptable Validator will apply professional judgment in qualifying data above 6 degrees C	
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified.	DESA or CLP laboratory GC/ECD technician	No analyte > CRQL	
Matrix Spike	1 per 20 samples	Aroclor-1016	29-135%R	Flag outliers.	DESA or CLP laboratory GC/ECD technician	Aroclor-1016	29-135%R
		Aroclor-1260	29-135%R			Aroclor-1260	29-135%R
Matrix Spike Duplicate	1 per 20 samples	Aroclor-1016	0-15%RPD	Flag outliers.	DESA or CLP laboratory GC/ECD technician	Aroclor-1016	0-15%RPD
		Aroclor-1260	0-20%RPD			Aroclor-1260	0-20%RPD
LCS	all samples	Aroclor-1016	50-150%R	Check calculations and instruments; reanalyze affected samples.	DESA or CLP laboratory GC/ECD technician	Aroclor-1016	50-150%R
		Aroclor-1260	50-150 R			Aroclor-1260	50-150%R
Surrogate	all samples	30-150%R		Check calculations and instruments; reanalyze affected samples.	DESA or CLP laboratory GC/ECD technician	30-150%R	

QAPP Worksheet #28c: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Sediment
Analytical Group Lead
Analytical Method/SOP Reference ISM02.4

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Field Duplicates	1 per 20 samples	None	Notify PM; flag duplicate results.	CDM Smith ASC and PM	$\leq 100\%$ RPD ABS $\leq 2 \times$ CRQL when either result $\leq 5 \times$ CRQL
Temperature Blank	1 per cooler	0 to 6°C	Laboratory will inform RSCC/ CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant.	Laboratory analyst and CDM Smith FTL	0 to 6° C acceptable Validator will apply professional judgment in qualifying data above 6 degrees C
Preparation Blank	1 per 20 samples	No constituent > CRQL	Suspend analysis until source rectified; re-digest and reanalyze affected samples.	DESA or CLP laboratory ICP-AES/ICP-MS technician	No constituent > CRQL
Spike	1 per 20 samples	75-125%R*	Flag outliers.		75-125%R*
Laboratory Duplicate	1 per 20 samples	$\leq 35\%$ RPD**	Flag outliers.		$\leq 35\%$ RPD**
Post-Digestion Spike	After any analyte (except Ag and Hg) fails spike %R	75-125%R	Flag outliers.		75-125%R
Interference Check Sample [ICP Analysis Only]	Beginning, end, and periodically during run (2 times every 8 hours)	Within ± 2 times CRQL of true value or ± 20 percent of true value, whichever is greater	Check calculations and instruments; reanalyze affected samples.		Within ± 2 times CRQL of true value or ± 20 percent of true value, whichever is greater
LCS	1 per 20 samples	Control limits established by EPA* as per ISM 02.4	Suspend analysis rectify source; re-digest and reanalyze affected samples.		Control limits established by EPA*

*Except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken.

**Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include ABS criteria)

Except when the sample and/or duplicate concentration is less than 5 times the CRQL.

*** If the EPA LCS is unavailable, other EPA QC samples or other certified materials may be used. In such cases, control limits for the LCS must be documented and provided.

QAPP Worksheet #28d: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group TCL PCBs/Aroclors
Analytical Method/SOP Reference SOM02.4

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Field Duplicates	1 per 20 samples	None		Notify PM and flag duplicate results.	CDM Smith ASC and PM	≤50%RPD when PCBs in both samples ≥ 5*CRQL Otherwise ABS ≤ 2xQL	
Temperature Blank	1 per cooler	0 to 6°C		Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant.	Laboratory analyst and CDM Smith FTL	0 to 6° C acceptable Validator will apply professional judgment in qualifying data above 6 degrees C	
Method Blank	1 per ≤20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis –re-extract and reanalyze affected samples.	DESA or CLP laboratory GC/ECD technician	No analyte > CRQL No target analyte concentrations ≥ ½ CRQL	
Matrix Spike	1 per ≤20 samples; if requested	Aroclor-1016	29-135%R	Flag outliers.	DESA or CLP laboratory GC/ECD technician	Aroclor-1016	29-135%R
		Aroclor-1260	29-135%R			Aroclor-1260	29-135%R
Matrix Spike Duplicate		Aroclor-1016	0-15%RPD			Aroclor-1016	0-15%RPD
		Aroclor-1260	0-20%RPD			Aroclor-1260	0-20%RPD
LCS	1 per ≤20 samples	Aroclor-1016	50-150%R	Check calculations and instruments; reanalyze affected samples.	DESA or CLP laboratory GC/ECD technician	Aroclor-1016	50-150%R
		Aroclor-1260	50-150%R			Aroclor-1260	50-150%R
Surrogate	all samples	30-150%R		Check calculations and instruments; reanalyze affected samples.	DESA or CLP laboratory GC/ECD technician	30-150%R	

QAPP Worksheet #28e: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Lead ICP MS/AES
Analytical Method/SOP Reference ISM02.4

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Field Duplicates	1 per 20 samples	None	Notify PM and flag duplicate results.	CDM Smith ASC and PM	$\leq 50\% \text{RPD}$, $\text{ABS} \leq 2 \times \text{CRQL}$ when any result $\leq 5 \times \text{CRQL}$
Temperature Blank	1 per cooler	0 to 6°C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant.	Laboratory analyst and CDM Smith FTL	0 to 6° C acceptable Validator will apply professional judgment in qualifying data above 6 degrees C
Preparation Blank	1 per ≤ 20 samples	No constituent > CRQL	Suspend analysis rectify source; redigest and reanalyze affected samples.	DESA or CLP laboratory ICP technician	No constituent > CRQL
Spike	1 per ≤ 20 samples	75-125%R*	Flag outliers.	DESA or CLP laboratory ICP technician	75-125%R*
Laboratory Duplicate	1 per ≤ 20 samples	$\pm 20\% \text{RPD}^{**}$	Flag outliers.	DESA or CLP laboratory ICP technician	$\leq 20\% \text{RPD}^{**}$
Post-Digestion Spike	after any analyte (except Ag) fails spike %R	75-125%R	Flag outliers.	DESA or CLP laboratory ICP technician	75-125%R
Interference Check Sample [ICP Analysis Only]	Beginning of each run	$\pm \text{CRQL} + \text{true value}$ or ± 20 percent of true value, whichever is greater	Check calculations and instruments; reanalyze affected samples.	DESA or CLP laboratory ICP technician	± 2 times CRQL of true value or ± 20 percent of true value, whichever is greater
LCS	1 per ≤ 20 samples	70-130%R	Suspend analysis until source rectified; re-digest and reanalyze affected samples.	DESA or CLP laboratory ICP technician	70-130%R

*Except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken.

** Except when the sample and/or duplicate concentration is less than 5 times the CRQL, then $\pm \text{CRQL}$.

QAPP Worksheet #28f Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Sediment
Analytical Group Grain Size
Analytical Method/SOP Reference ASTM D7928

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Laboratory Duplicate / Field Duplicate	1 per sample	None	Flag outliers. Data assessor will inform project manager of variability. Data validator will recommend which results set is to be used.	DESA or CDM Smith Laboratory	≤100%RPD

QAPP Worksheet #29
Project Documents and Records

Sample Collection and Field Records			
Record	Generation	Verification	Storage location/archival
Field logbook or data collection sheets	Field Sampler or FTL or Designee	Design Task Manager	Project File
Scribe COC Forms	Sample Manager or Designee	FTL or Designee	Project File
Air Bills	Sample Manager or Designee	FTL or Designee	Project File
Sample Tracking Forms	Sample Manager or Designee	FTL or Designee	Project File
Daily QC Reports	FTL or Designee	SM or Designee	Project File
Deviations – Field Change Notification Forms	FTL or Designee	Design Task Manager or Designee	Project File
Correspondence	CDM Smith SM	CDM Smith SM or Designee	Project File
Analytical Services Tracking System (ANSETS) Forms	Sample Manager or Designee	ASC	Project File
Soil Boring logs	FTL or Designee	Field Geologist or Designee	Project File
Equipment Calibration and Maintenance Log	FTL or Designee	Field Scientist or Designee	Project File
Photographs	FTL or Designee	Field Scientist or Designee	Project File
Inspection and maintenance records	FTL or Designee	Field Geologist or Designee	Project File
Sample Disposal and Waste Manifests	FTL or Designee	Field Scientist or Designee	Project File

QAPP Worksheet #29
Project Documents and Records

Project Assessments			
Record	Generation	Verification	Storage location/archival
Corrective action report	QAM	CDM Smith SM	Project File
Data verification checklists	FTL or Designee	ASC	Project File
Data validation report	Data validator	Feasibility Study Task Manager	Project File
Treatability and FFS Report	Various	CDM Smith SM	Project File
Laboratory Records			
Record	Generation	Verification	Storage location/archival
Bid Sheets, scopes of work	SM or Designee	Technical Reviewer and Procurement Specialist	Procurement File
Subcontract Laboratory certifications	Laboratory QA Officer	Chemist or QA Specialist	Procurement File
Subcontract Laboratory QA Plans	Laboratory QA Officer	Chemist or QA Specialist	Procurement File
SOPs	Laboratory QA Officer	Chemist or QA Specialist	Procurement File
Lab Logs	Laboratory Manager	Laboratory Manager	Laboratory File

QAPP Worksheet #29
Project Documents and Records

Laboratory Data Deliverables		
Record	Inorganics	Organics
Narrative	X	X
COC	X	X
Summary Results	X	X
Analytical sample results	X	X
QC Results	X	X
Chromatograms	X	X
Sample Preparation Log	X	X
Sample Run Log	X	X
Tentatively Identified Compounds	X	X
Raw Data	X ¹	X

¹ The XRF results will be provided in an excel format listing the sample name followed by the analyte concentration result.

QAPP Worksheet #31, 32 & 33 Assessments and Corrective Action

Refer to Worksheet #31, 32 & 33 in CDM Smith's Generic QAPP (CDM Smith 2013e) in Appendix D.

No audits will be performed. Self-assessment will be performed for select projects on the RAC2 Contract in accordance with CDM Smith's RAC2 QMP (CDM Smith 2012b). A self-assessment is not scheduled for this Site.

QAPP Worksheet #34 Data Verification and Validation Inputs

Refer to Worksheet #34 in CDM Smith's Generic QAPP (CDM Smith 2013e) in Appendix D. XRF results will be used for screening purposes and will not need to be validated.

QAPP Worksheet #35 Data Verification Procedures

Refer to Worksheet #35 in CDM Smith's Generic QAPP (CDM Smith 2013e) in Appendix D. Please note that CDM Smith will not be sending the quick-cup samples for laboratory analysis. Field duplicates will be evaluated per the Generic QAPP field duplicate criteria.

QAPP Worksheet #36 Data Validation Procedures

Refer to Worksheet #36 in CDM Smith's Generic QAPP (CDM Smith 2013e) in Appendix D.

XRF results will be used for screening purposes and will not need to be validated. The laboratory samples will be compared to the XRF screening results to develop an order of magnitude comparison of XRF and laboratory data. In subsequent interim and final sampling events, additional XRF and laboratory samples will be collected to delineate lead contamination in sediment within the Westerly Wetlands as discussed on Worksheet #37.

QAPP Worksheet #37

Data Usability Assessment

Personnel (organization and position/title) responsible for participating in the data usability assessment: CDM Smith Site Manager, RQAS, and ASC

The usability assessment will be completed as follows:

The Data Usability Assessment will be performed by a team of personnel at CDM Smith. The Site Manager, Paul Hagerman will be responsible for information in the assessment and will also be responsible for assigning task work to the individual task members who will be supporting the work. Note that the Data Usability Assessment will be conducted on validated or reviewed data. After the Data Usability Assessment has been performed, data deemed appropriate for use will then be used in the subsequent project evaluation. For sediment, the assessment will only be performed on the contaminants of concern PCBs and lead, unless any other unanticipated analytes are detected. A decision will be made at that time whether additional analytes will be included in the assessment.

A summary of the Data Usability Assessment will be provided in the Treatability Study Report and FFS Report. The following items will be assessed:

Precision – Results of laboratory duplicates will be assessed during data validation and data will be qualified according to the data validation procedures cited on Worksheet #36. Field duplicates will be assessed by matrix using the relative percent difference (RPD) for each pair of results reported above the CRQL for organic analyses. RPD acceptance criteria, presented in Worksheet #12, will be used to assess field sampling precision. Absolute difference will be used for low results as described in Worksheets #12 and #28. The laboratory confirmation samples will be compared to the screening results to further confirm accuracy of XRF and delineate lead contamination in sediment within the Westerly Wetlands. Since the soil material is expected to have sediment and clay content, a criterion of 75% RPD will be used to compare the screening data to the laboratory confirmation sample results.

Field duplicates - The SM will review the extent of exceedances of the field duplicate results. For sediment, the exceedances will be compared with the field lithological logs, if available. Based on this review, the SM will determine whether the exceedance is due to inherent soil heterogeneity or the result of sample handling in the field or laboratory. This information will be included in the data assessment report. As an added measure, the FTL will be asked to inspect the soil coning and quartering procedures and re-train staff if needed. The data assessor will review the data validation report. If the field duplicate comparison is not included, it will be performed by the assessor.

Accuracy/Bias Contamination – Laboratory blank results will be assessed as part of data validation. During the data validation process the validator will qualify the data following the procedures listed on Worksheet #36. A discussion summarizing the results of laboratory accuracy and bias based on contamination will be presented and limitations on the use of the data will be described.

Overall Accuracy/Bias – The results of instrument calibration and MS recoveries will be reviewed and data will be qualified according to the data validation procedures cited on Worksheet #36. A discussion summarizing the results of laboratory accuracy and any limitations on the use of the data will be described.

QAPP Worksheet #37

Data Usability Assessment

Sensitivity – Data will be compared to criteria provided on Worksheet #15. A discussion summarizing any conclusions about sensitivity of the analyses will be presented and any limitations on the use of the data will be described.

Representativeness – A review of adherence to the sampling plan and field procedures will be performed in order to assess the representativeness of the sampling program. Data validation narratives will also be reviewed and any conclusions about the representativeness of the data set will be discussed.

Comparability – Study results will be used in conjunction with existing data to make qualitative and quantitative assessments of the data to be used to produce the Site reports.

Reconciliation – The DQIs presented in Worksheet #12 will be examined to determine if the MPCs were met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of major impacts observed from data validation, DQIs and MPC assessments. Based on the results of these assessments, the quality of the data will be determined. As a result of the quality determined, the usability of the data for each analysis will be established. After the combined usability of the data from all analyses for an objective is determined, it will be concluded if the DQIs were met and whether project goals were achieved. As part of the reconciliation of each objective, conclusions will be drawn and any limitations on the usability of any of the data will be described.

Completeness - The Environmental database will be queried to summarize the number of sample results in each analytical fraction that are rejected versus the total data set. These data will be used along with the planned samples indicated in the QAPP to calculate the completeness of the obtained data set.

Data validation reports will be reviewed to determine the quality of the data and potential impacts on data usability. Field duplicates will be evaluated against the MPCs outlined in worksheet #12. Non-compliant data will be discussed in the Treatability/Pilot Study and FFS report. The following equations will be used:

1. To calculate field duplicate precision:

$$RPD = 100 \times \frac{|X1 - X2|}{(X1 + X2)} \quad \text{where } X1 \text{ and } X2 \text{ are the reported concentrations for each duplicate or replicate}$$

2. To calculate completeness:

$$\% \text{ Completeness} = \frac{V}{n} \times 100 \quad \text{where } V = \text{number of measurements judged valid; } n = \text{total number of measurements made and}$$

$$\% \text{ Completeness} = \frac{C}{X} \times 100 \quad \text{where } C = \text{number of samples collected; } X = \text{total number of measurements planned}$$

QAPP Worksheet #37

Data Usability Assessment

The results will be evaluated using temporal and spatial relationships of the data. This activity will be performed during the data usability evaluation. Not all “J” qualified data is usable, so all lines of evidence to support data use will be evaluated. Although “J” data are reasonable for use, CDM Smith will also document the evaluation of all qualified results against the values, data quality, and bias of surrounding data. If needed, qualified results at plume edges will be mapped and evaluated. Validated results will be further examined during data evaluation and re-coded in accordance with EPA Region 2 directives.

For qualified results that are outliers or at the edge of contaminated areas:

- a) Discuss how data outliers will be addressed
- b) Evaluate against all issues such as geology, depth, past history
- c) Consider whether qualified data are reasonable based on surrounding data (e.g., data qualified due to missed holding time may be lower than we expect)
- d) Address data quality bias and reason for qualification
- e) Evaluate effect of data qualification on the data

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Tables

Table 1
Surface Sediment Sample Table
Treatability and Focused Feasibility Study
Burnt Fly Bog Site
Marlboro, New Jersey

Sample Name	Plot #	Boring #	Round #	PCB	TPH-GRO	TPH-DRO	Lead by XRF*	pH	Total Organic Carbon	Grain Size
Round 1 - Baseline										
SS-PLOT-01-01-R1	1	1	1				X	X	X	X
SS-PLOT-01-02-R1		2	1				X	X	X	X
SS-PLOT-01-03-R1		3	1				X	X	X	X
SS-PLOT-01-04-R1		4	1				X	X	X	X
SS-PLOT-02-01-R1	2	1	1				X	X	X	X
SS-PLOT-02-02-R1		2	1				X	X	X	X
SS-PLOT-02-03-R1		3	1				X	X	X	X
SS-PLOT-02-04-R1		4	1				X	X	X	X
SS-PLOT-03-01-R1	3	1	1				X	X	X	X
SS-PLOT-03-02-R1		2	1				X	X	X	X
SS-PLOT-03-03-R1		3	1				X	X	X	X
SS-PLOT-03-04-R1		4	1				X	X	X	X
SS-PLOT-04-01-R1	4	1	1				X	X	X	X
SS-PLOT-04-02-R1		2	1				X	X	X	X
SS-PLOT-04-03-R1		3	1				X	X	X	X
SS-PLOT-04-04-R1		4	1				X	X	X	X
SS-PLOT-05-01-R1	5	1	1				X	X	X	X
SS-PLOT-05-02-R1		2	1				X	X	X	X
SS-PLOT-05-03-R1		3	1				X	X	X	X
SS-PLOT-05-04-R1		4	1				X	X	X	X
SS-PLOT-06-01-R1	6	1	1				X	X	X	X
SS-PLOT-06-02-R1		2	1				X	X	X	X
SS-PLOT-06-03-R1		3	1				X	X	X	X
SS-PLOT-06-04-R1		4	1				X	X	X	X
SS-PLOT-07-01-R1	7	1	1	X	X	X		X	X	X
SS-PLOT-07-02-R1		2	1	X	X	X		X	X	X
SS-PLOT-07-03-R1		3	1	X	X	X		X	X	X
SS-PLOT-07-04-R1		4	1	X	X	X		X	X	X
SS-PLOT-08-01-R1	8	1	1	X	X	X		X	X	X
SS-PLOT-08-02-R1		2	1	X	X	X		X	X	X
SS-PLOT-08-03-R1		3	1	X	X	X		X	X	X
SS-PLOT-08-04-R1		4	1	X	X	X		X	X	X
SS-PLOT-09-01-R1	9	1	1	X	X	X		X	X	X
SS-PLOT-09-02-R1		2	1	X	X	X		X	X	X
SS-PLOT-09-03-R1		3	1	X	X	X		X	X	X
SS-PLOT-09-04-R1		4	1	X	X	X		X	X	X
SS-PLOT-10-01-R1	10	1	1	X	X	X		X	X	X
SS-PLOT-10-02-R1		2	1	X	X	X		X	X	X
SS-PLOT-10-03-R1		3	1	X	X	X		X	X	X
SS-PLOT-10-04-R1		4	1	X	X	X		X	X	X
SS-PLOT-11-01-R1	11	1	1	X	X	X		X	X	X
SS-PLOT-11-02-R1		2	1	X	X	X		X	X	X
SS-PLOT-11-03-R1		3	1	X	X	X		X	X	X
SS-PLOT-11-04-R1		4	1	X	X	X		X	X	X
SS-PLOT-12-01-R1	12	1	1	X	X	X		X	X	X
SS-PLOT-12-02-R1		2	1	X	X	X		X	X	X
SS-PLOT-12-03-R1		3	1	X	X	X		X	X	X
SS-PLOT-12-04-R1		4	1	X	X	X		X	X	X

Table 1
Surface Sediment Sample Table
Treatability and Focused Feasibility Study
Burnt Fly Bog Site
Marlboro, New Jersey

Sample Name	Plot #	Boring #	Round #	PCB	TPH-GRO	TPH-DRO	Lead by XRF*	pH	Total Organic Carbon	Grain Size
Round 2 - Interim										
SS-PLOT-01-01-R2	1	1	2				X	X	X	
SS-PLOT-01-02-R2		2	2				X	X	X	
SS-PLOT-01-03-R2		3	2				X	X	X	
SS-PLOT-01-04-R2		4	2				X	X	X	
SS-PLOT-02-01-R2	2	1	2				X	X	X	
SS-PLOT-02-02-R2		2	2				X	X	X	
SS-PLOT-02-03-R2		3	2				X	X	X	
SS-PLOT-02-04-R2		4	2				X	X	X	
SS-PLOT-03-01-R2	3	1	2				X	X	X	
SS-PLOT-03-02-R2		2	2				X	X	X	
SS-PLOT-03-03-R2		3	2				X	X	X	
SS-PLOT-03-04-R2		4	2				X	X	X	
SS-PLOT-04-01-R2	4	1	2				X	X	X	
SS-PLOT-04-02-R2		2	2				X	X	X	
SS-PLOT-04-03-R2		3	2				X	X	X	
SS-PLOT-04-04-R2		4	2				X	X	X	
SS-PLOT-05-01-R2	5	1	2				X	X	X	
SS-PLOT-05-02-R2		2	2				X	X	X	
SS-PLOT-05-03-R2		3	2				X	X	X	
SS-PLOT-05-04-R2		4	2				X	X	X	
SS-PLOT-06-01-R2	6	1	2				X	X	X	
SS-PLOT-06-02-R2		2	2				X	X	X	
SS-PLOT-06-03-R2		3	2				X	X	X	
SS-PLOT-06-04-R2		4	2				X	X	X	
SS-PLOT-07-01-R2	7	1	2	X	X	X		X	X	
SS-PLOT-07-02-R2		2	2	X	X	X		X	X	
SS-PLOT-07-03-R2		3	2	X	X	X		X	X	
SS-PLOT-07-04-R2		4	2	X	X	X		X	X	
SS-PLOT-08-01-R2	8	1	2	X	X	X		X	X	
SS-PLOT-08-02-R2		2	2	X	X	X		X	X	
SS-PLOT-08-03-R2		3	2	X	X	X		X	X	
SS-PLOT-08-04-R2		4	2	X	X	X		X	X	
SS-PLOT-09-01-R2	9	1	2	X	X	X		X	X	
SS-PLOT-09-02-R2		2	2	X	X	X		X	X	
SS-PLOT-09-03-R2		3	2	X	X	X		X	X	
SS-PLOT-09-04-R2		4	2	X	X	X		X	X	
SS-PLOT-10-01-R2	10	1	2	X	X	X		X	X	
SS-PLOT-10-02-R2		2	2	X	X	X		X	X	
SS-PLOT-10-03-R2		3	2	X	X	X		X	X	
SS-PLOT-10-04-R2		4	2	X	X	X		X	X	
SS-PLOT-11-01-R2	11	1	2	X	X	X		X	X	
SS-PLOT-11-02-R2		2	2	X	X	X		X	X	
SS-PLOT-11-03-R2		3	2	X	X	X		X	X	
SS-PLOT-11-04-R2		4	2	X	X	X		X	X	
SS-PLOT-12-01-R2	12	1	2	X	X	X		X	X	
SS-PLOT-12-02-R2		2	2	X	X	X		X	X	
SS-PLOT-12-03-R2		3	2	X	X	X		X	X	
SS-PLOT-12-04-R2		4	2	X	X	X		X	X	

Table 1
Surface Sediment Sample Table
Treatability and Focused Feasibility Study
Burnt Fly Bog Site
Marlboro, New Jersey

Sample Name	Plot #	Boring #	Round #	PCB	TPH-GRO	TPH-DRO	Lead by XRF*	pH	Total Organic Carbon	Grain Size
Round 3 - Final										
SS-PLOT-01-01-R3	1	1	3				X	X	X	
SS-PLOT-01-02-R3		2	3				X	X	X	
SS-PLOT-01-03-R3		3	3				X	X	X	
SS-PLOT-01-04-R3		4	3				X	X	X	
SS-PLOT-02-01-R3	2	1	3				X	X	X	
SS-PLOT-02-02-R3		2	3				X	X	X	
SS-PLOT-02-03-R3		3	3				X	X	X	
SS-PLOT-02-04-R3		4	3				X	X	X	
SS-PLOT-03-01-R3	3	1	3				X	X	X	
SS-PLOT-03-02-R3		2	3				X	X	X	
SS-PLOT-03-03-R3		3	3				X	X	X	
SS-PLOT-03-04-R3		4	3				X	X	X	
SS-PLOT-04-01-R3	4	1	3				X	X	X	
SS-PLOT-04-02-R3		2	3				X	X	X	
SS-PLOT-04-03-R3		3	3				X	X	X	
SS-PLOT-04-04-R3		4	3				X	X	X	
SS-PLOT-05-01-R3	5	1	3				X	X	X	
SS-PLOT-05-02-R3		2	3				X	X	X	
SS-PLOT-05-03-R3		3	3				X	X	X	
SS-PLOT-05-04-R3		4	3				X	X	X	
SS-PLOT-06-01-R3	6	1	3				X	X	X	
SS-PLOT-06-02-R3		2	3				X	X	X	
SS-PLOT-06-03-R3		3	3				X	X	X	
SS-PLOT-06-04-R3		4	3				X	X	X	
SS-PLOT-07-01-R3	7	1	3	X	X	X		X	X	
SS-PLOT-07-02-R3		2	3	X	X	X		X	X	
SS-PLOT-07-03-R3		3	3	X	X	X		X	X	
SS-PLOT-07-04-R3		4	3	X	X	X		X	X	
SS-PLOT-08-01-R3	8	1	3	X	X	X		X	X	
SS-PLOT-08-02-R3		2	3	X	X	X		X	X	
SS-PLOT-08-03-R3		3	3	X	X	X		X	X	
SS-PLOT-08-04-R3		4	3	X	X	X		X	X	
SS-PLOT-09-01-R3	9	1	3	X	X	X		X	X	
SS-PLOT-09-02-R3		2	3	X	X	X		X	X	
SS-PLOT-09-03-R3		3	3	X	X	X		X	X	
SS-PLOT-09-04-R3		4	3	X	X	X		X	X	
SS-PLOT-10-01-R3	10	1	3	X	X	X		X	X	
SS-PLOT-10-02-R3		2	3	X	X	X		X	X	
SS-PLOT-10-03-R3		3	3	X	X	X		X	X	
SS-PLOT-10-04-R3		4	3	X	X	X		X	X	
SS-PLOT-11-01-R3	11	1	3	X	X	X		X	X	
SS-PLOT-11-02-R3		2	3	X	X	X		X	X	
SS-PLOT-11-03-R3		3	3	X	X	X		X	X	
SS-PLOT-11-04-R3		4	3	X	X	X		X	X	
SS-PLOT-12-01-R3	12	1	3	X	X	X		X	X	
SS-PLOT-12-02-R3		2	3	X	X	X		X	X	
SS-PLOT-12-03-R3		3	3	X	X	X		X	X	
SS-PLOT-12-04-R3		4	3	X	X	X		X	X	

Notes:

DRO - diesel range organics

GRO - gasoline range organics

PCB - polychlorinated biphenyls

TPH - total petroleum hydrocarbons

XRF - xray fluoroescence

* Confirmation samples will be collected for lead at a rate of 10% and shipped for laboratory analysis

Table 2
Subsurface Sediment Sample Table
Treatability and Focused Feasibility Study
Burnt Fly Bog Site
Marlboro, New Jersey

Sample Name	Plot #	Boring #	Round #	PCB	TPH-GRO	TPH-DRO	Lead by XRF	pH	Total Organic Carbon	Grain Size
Round 1 - Baseline										
SB-PLOT-01-01-R1	1	1	1				X	X	X	X
SB-PLOT-01-02-R1		2	1				X	X	X	X
SB-PLOT-01-03-R1		3	1				X	X	X	X
SB-PLOT-01-04-R1		4	1				X	X	X	X
SB-PLOT-02-01-R1	2	1	1				X	X	X	X
SB-PLOT-02-02-R1		2	1				X	X	X	X
SB-PLOT-02-03-R1		3	1				X	X	X	X
SB-PLOT-02-04-R1		4	1				X	X	X	X
SB-PLOT-03-01-R1	3	1	1				X	X	X	X
SB-PLOT-03-02-R1		2	1				X	X	X	X
SB-PLOT-03-03-R1		3	1				X	X	X	X
SB-PLOT-03-04-R1		4	1				X	X	X	X
SB-PLOT-04-01-R1	4	1	1				X	X	X	X
SB-PLOT-04-02-R1		2	1				X	X	X	X
SB-PLOT-04-03-R1		3	1				X	X	X	X
SB-PLOT-04-04-R1		4	1				X	X	X	X
SB-PLOT-05-01-R1	5	1	1				X	X	X	X
SB-PLOT-05-02-R1		2	1				X	X	X	X
SB-PLOT-05-03-R1		3	1				X	X	X	X
SB-PLOT-05-04-R1		4	1				X	X	X	X
SB-PLOT-06-01-R1	6	1	1				X	X	X	X
SB-PLOT-06-02-R1		2	1				X	X	X	X
SB-PLOT-06-03-R1		3	1				X	X	X	X
SB-PLOT-06-04-R1		4	1				X	X	X	X
SB-PLOT-07-01-R1	7	1	1	X	X	X		X	X	X
SB-PLOT-07-02-R1		2	1	X	X	X		X	X	X
SB-PLOT-07-03-R1		3	1	X	X	X		X	X	X
SB-PLOT-07-04-R1		4	1	X	X	X		X	X	X
SB-PLOT-08-01-R1	8	1	1	X	X	X		X	X	X
SB-PLOT-08-02-R1		2	1	X	X	X		X	X	X
SB-PLOT-08-03-R1		3	1	X	X	X		X	X	X
SB-PLOT-08-04-R1		4	1	X	X	X		X	X	X
SB-PLOT-09-01-R1	9	1	1	X	X	X		X	X	X
SB-PLOT-09-02-R1		2	1	X	X	X		X	X	X
SB-PLOT-09-03-R1		3	1	X	X	X		X	X	X
SB-PLOT-09-04-R1		4	1	X	X	X		X	X	X
SB-PLOT-10-01-R1	10	1	1	X	X	X		X	X	X
SB-PLOT-10-02-R1		2	1	X	X	X		X	X	X
SB-PLOT-10-03-R1		3	1	X	X	X		X	X	X
SB-PLOT-10-04-R1		4	1	X	X	X		X	X	X
SB-PLOT-11-01-R1	11	1	1	X	X	X		X	X	X
SB-PLOT-11-02-R1		2	1	X	X	X		X	X	X
SB-PLOT-11-03-R1		3	1	X	X	X		X	X	X
SB-PLOT-11-04-R1		4	1	X	X	X		X	X	X
SB-PLOT-12-01-R1	12	1	1	X	X	X		X	X	X
SB-PLOT-12-02-R1		2	1	X	X	X		X	X	X
SB-PLOT-12-03-R1		3	1	X	X	X		X	X	X
SB-PLOT-12-04-R1		4	1	X	X	X		X	X	X

Table 2
Subsurface Sediment Sample Table
Treatability and Focused Feasibility Study
Burnt Fly Bog Site
Marlboro, New Jersey

Sample Name	Plot #	Boring #	Round #	PCB	TPH-GRO	TPH-DRO	Lead by XRF	pH	Total Organic Carbon	Grain Size
Round 2 - Interim										
SB-PLOT-01-01-R2	1	1	2				X	X	X	
SB-PLOT-01-02-R2		2	2				X	X	X	
SB-PLOT-01-03-R2		3	2				X	X	X	
SB-PLOT-01-04-R2		4	2				X	X	X	
SB-PLOT-02-01-R2	2	1	2				X	X	X	
SB-PLOT-02-02-R2		2	2				X	X	X	
SB-PLOT-02-03-R2		3	2				X	X	X	
SB-PLOT-02-04-R2		4	2				X	X	X	
SB-PLOT-03-01-R2	3	1	2				X	X	X	
SB-PLOT-03-02-R2		2	2				X	X	X	
SB-PLOT-03-03-R2		3	2				X	X	X	
SB-PLOT-03-04-R2		4	2				X	X	X	
SB-PLOT-04-01-R2	4	1	2				X	X	X	
SB-PLOT-04-02-R2		2	2				X	X	X	
SB-PLOT-04-03-R2		3	2				X	X	X	
SB-PLOT-04-04-R2		4	2				X	X	X	
SB-PLOT-05-01-R2	5	1	2				X	X	X	
SB-PLOT-05-02-R2		2	2				X	X	X	
SB-PLOT-05-03-R2		3	2				X	X	X	
SB-PLOT-05-04-R2		4	2				X	X	X	
SB-PLOT-06-01-R2	6	1	2				X	X	X	
SB-PLOT-06-02-R2		2	2				X	X	X	
SB-PLOT-06-03-R2		3	2				X	X	X	
SB-PLOT-06-04-R2		4	2				X	X	X	
SB-PLOT-07-01-R2	7	1	2	X	X	X		X	X	
SB-PLOT-07-02-R2		2	2	X	X	X		X	X	
SB-PLOT-07-03-R2		3	2	X	X	X		X	X	
SB-PLOT-07-04-R2		4	2	X	X	X		X	X	
SB-PLOT-08-01-R2	8	1	2	X	X	X		X	X	
SB-PLOT-08-02-R2		2	2	X	X	X		X	X	
SB-PLOT-08-03-R2		3	2	X	X	X		X	X	
SB-PLOT-08-04-R2		4	2	X	X	X		X	X	
SB-PLOT-09-01-R2	9	1	2	X	X	X		X	X	
SB-PLOT-09-02-R2		2	2	X	X	X		X	X	
SB-PLOT-09-03-R2		3	2	X	X	X		X	X	
SB-PLOT-09-04-R2		4	2	X	X	X		X	X	
SB-PLOT-10-01-R2	10	1	2	X	X	X		X	X	
SB-PLOT-10-02-R2		2	2	X	X	X		X	X	
SB-PLOT-10-03-R2		3	2	X	X	X		X	X	
SB-PLOT-10-04-R2		4	2	X	X	X		X	X	
SB-PLOT-11-01-R2	11	1	2	X	X	X		X	X	
SB-PLOT-11-02-R2		2	2	X	X	X		X	X	
SB-PLOT-11-03-R2		3	2	X	X	X		X	X	
SB-PLOT-11-04-R2		4	2	X	X	X		X	X	
SB-PLOT-12-01-R2	12	1	2	X	X	X		X	X	
SB-PLOT-12-02-R2		2	2	X	X	X		X	X	
SB-PLOT-12-03-R2		3	2	X	X	X		X	X	
SB-PLOT-12-04-R2		4	2	X	X	X		X	X	

Table 2
Subsurface Sediment Sample Table
Treatability and Focused Feasibility Study
Burnt Fly Bog Site
Marlboro, New Jersey

Sample Name	Plot #	Boring #	Round #	PCB	TPH-GRO	TPH-DRO	Lead by XRF	pH	Total Organic Carbon	Grain Size
Round 3 - Final										
SB-PLOT-01-01-R3	1	1	3				X	X	X	
SB-PLOT-01-02-R3		2	3				X	X	X	
SB-PLOT-01-03-R3		3	3				X	X	X	
SB-PLOT-01-04-R3		4	3				X	X	X	
SB-PLOT-02-01-R3	2	1	3				X	X	X	
SB-PLOT-02-02-R3		2	3				X	X	X	
SB-PLOT-02-03-R3		3	3				X	X	X	
SB-PLOT-02-04-R3		4	3				X	X	X	
SB-PLOT-03-01-R3	3	1	3				X	X	X	
SB-PLOT-03-02-R3		2	3				X	X	X	
SB-PLOT-03-03-R3		3	3				X	X	X	
SB-PLOT-03-04-R3		4	3				X	X	X	
SB-PLOT-04-01-R3	4	1	3				X	X	X	
SB-PLOT-04-02-R3		2	3				X	X	X	
SB-PLOT-04-03-R3		3	3				X	X	X	
SB-PLOT-04-04-R3		4	3				X	X	X	
SB-PLOT-05-01-R3	5	1	3				X	X	X	
SB-PLOT-05-02-R3		2	3				X	X	X	
SB-PLOT-05-03-R3		3	3				X	X	X	
SB-PLOT-05-04-R3		4	3				X	X	X	
SB-PLOT-06-01-R3	6	1	3				X	X	X	
SB-PLOT-06-02-R3		2	3				X	X	X	
SB-PLOT-06-03-R3		3	3				X	X	X	
SB-PLOT-06-04-R3		4	3				X	X	X	
SB-PLOT-07-01-R3	7	1	3	X	X	X		X	X	
SB-PLOT-07-02-R3		2	3	X	X	X		X	X	
SB-PLOT-07-03-R3		3	3	X	X	X		X	X	
SB-PLOT-07-04-R3		4	3	X	X	X		X	X	
SB-PLOT-08-01-R3	8	1	3	X	X	X		X	X	
SB-PLOT-08-02-R3		2	3	X	X	X		X	X	
SB-PLOT-08-03-R3		3	3	X	X	X		X	X	
SB-PLOT-08-04-R3		4	3	X	X	X		X	X	
SB-PLOT-09-01-R3	9	1	3	X	X	X		X	X	
SB-PLOT-09-02-R3		2	3	X	X	X		X	X	
SB-PLOT-09-03-R3		3	3	X	X	X		X	X	
SB-PLOT-09-04-R3		4	3	X	X	X		X	X	
SB-PLOT-10-01-R3	10	1	3	X	X	X		X	X	
SB-PLOT-10-02-R3		2	3	X	X	X		X	X	
SB-PLOT-10-03-R3		3	3	X	X	X		X	X	
SB-PLOT-10-04-R3		4	3	X	X	X		X	X	
SB-PLOT-11-01-R3	11	1	3	X	X	X		X	X	
SB-PLOT-11-02-R3		2	3	X	X	X		X	X	
SB-PLOT-11-03-R3		3	3	X	X	X		X	X	
SB-PLOT-11-04-R3		4	3	X	X	X		X	X	
SB-PLOT-12-01-R3	12	1	3	X	X	X		X	X	
SB-PLOT-12-02-R3		2	3	X	X	X		X	X	
SB-PLOT-12-03-R3		3	3	X	X	X		X	X	
SB-PLOT-12-04-R3		4	3	X	X	X		X	X	

Notes:

DRO - diesel range organics

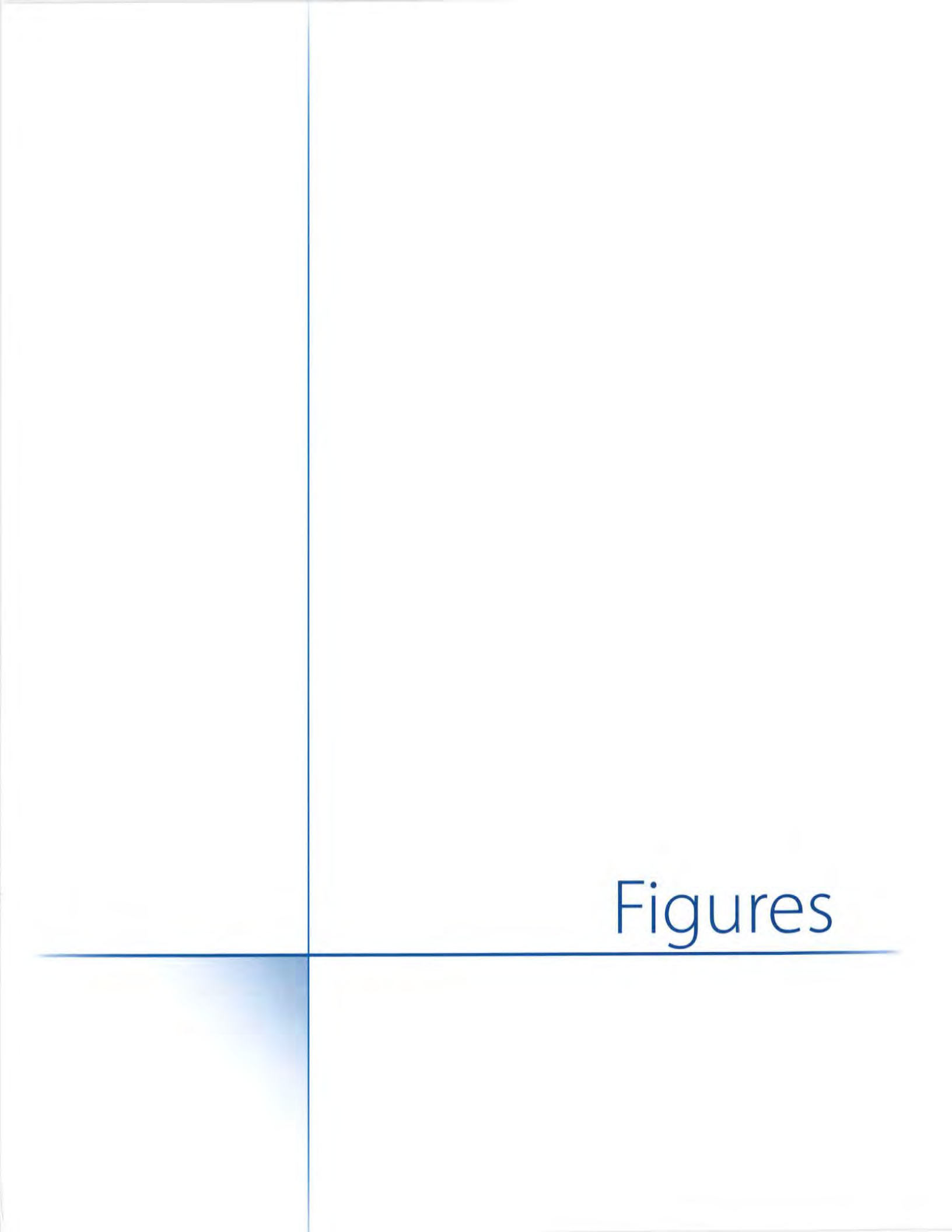
GRO - gasoline range organics

PCB - polychlorinated biphenyls

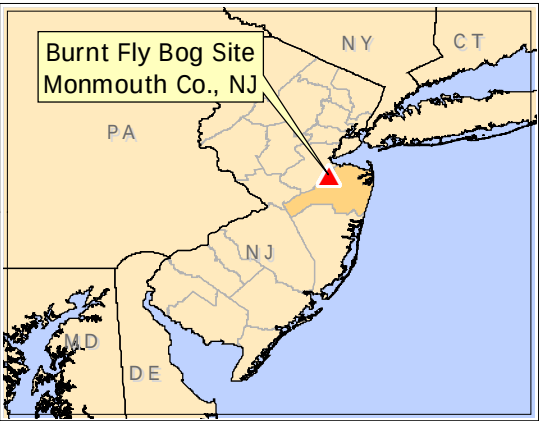
TPH - total petroleum hydrocarbons

XRF - xray fluorescence

* Confirmation samples will be collected for lead at a rate of 10% and shipped for laboratory analysis

A decorative graphic consisting of a vertical blue line and a horizontal blue line intersecting. The horizontal line extends from the left edge of the page to the right, passing through the text. The vertical line extends from the top edge to the bottom, passing through the intersection. A blue gradient is visible in the bottom-left corner, fading from a darker blue to a lighter blue.

Figures



Magnetic North

This figure was taken from the 2014 BERA Report (USEPA).

Coordinate system: New Jersey State Plane
 FIPS: 2900
 Datum: NAD83
 Units: Feet

Legend

— On-Site Access Road

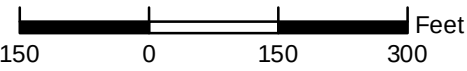
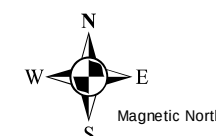
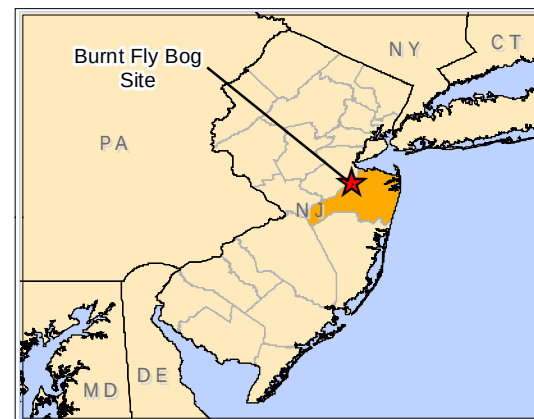
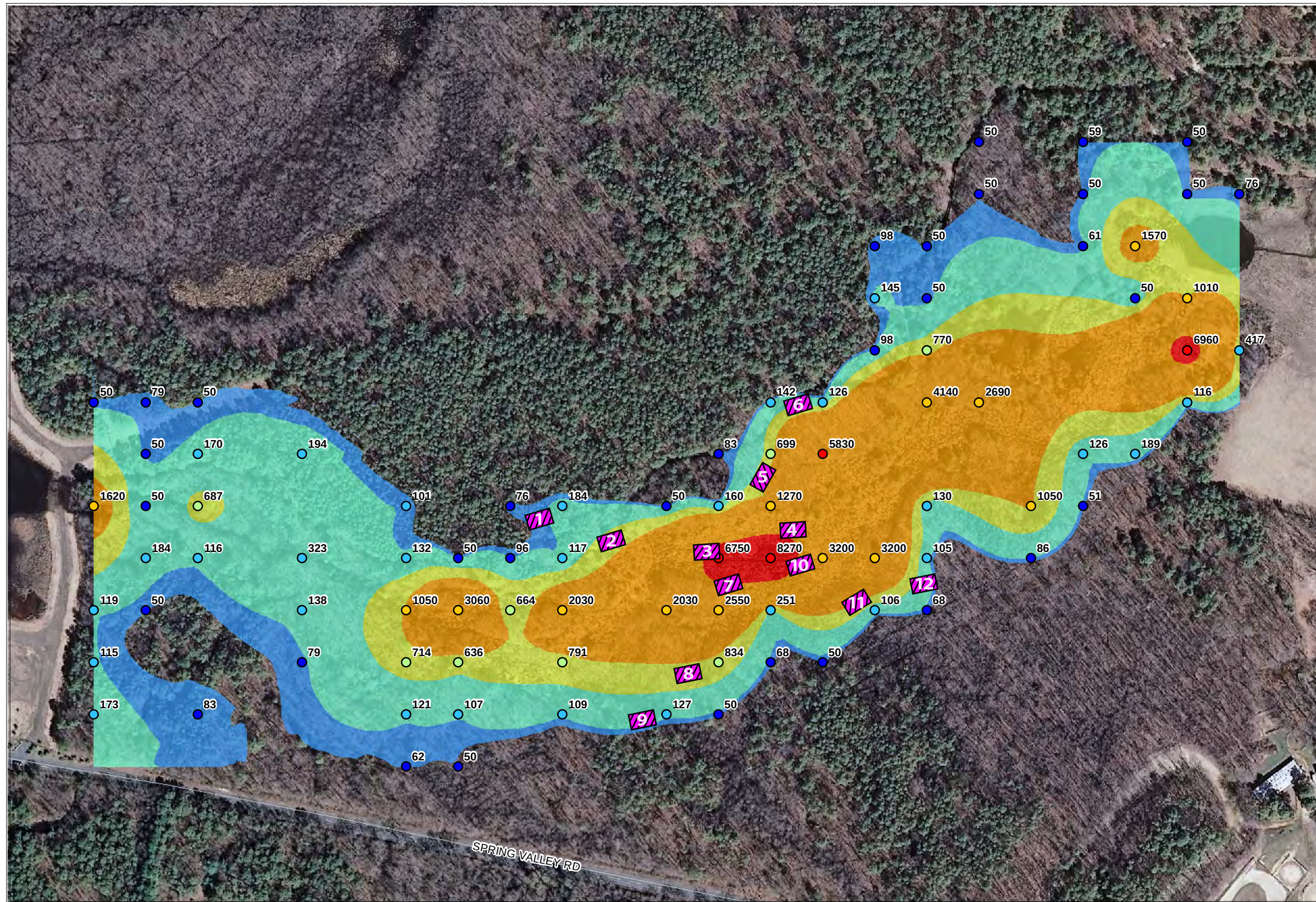


Figure 1
 Site Map
 Burnt Fly Bog
 Marlboro, NJ



Legend

Surface Lead Sampling Location

- 50
- 100
- 500
- 1000
- 5000

Surface Lead Concentration (mg/kg)

- 50 – 50.05
- 50.05 – 100
- 100 – 500
- 500 – 1,000
- 1,000 – 5,000
- 5,000 – 8,270

Remedial Investigation (RI) Activities

- Proposed Plot Locations

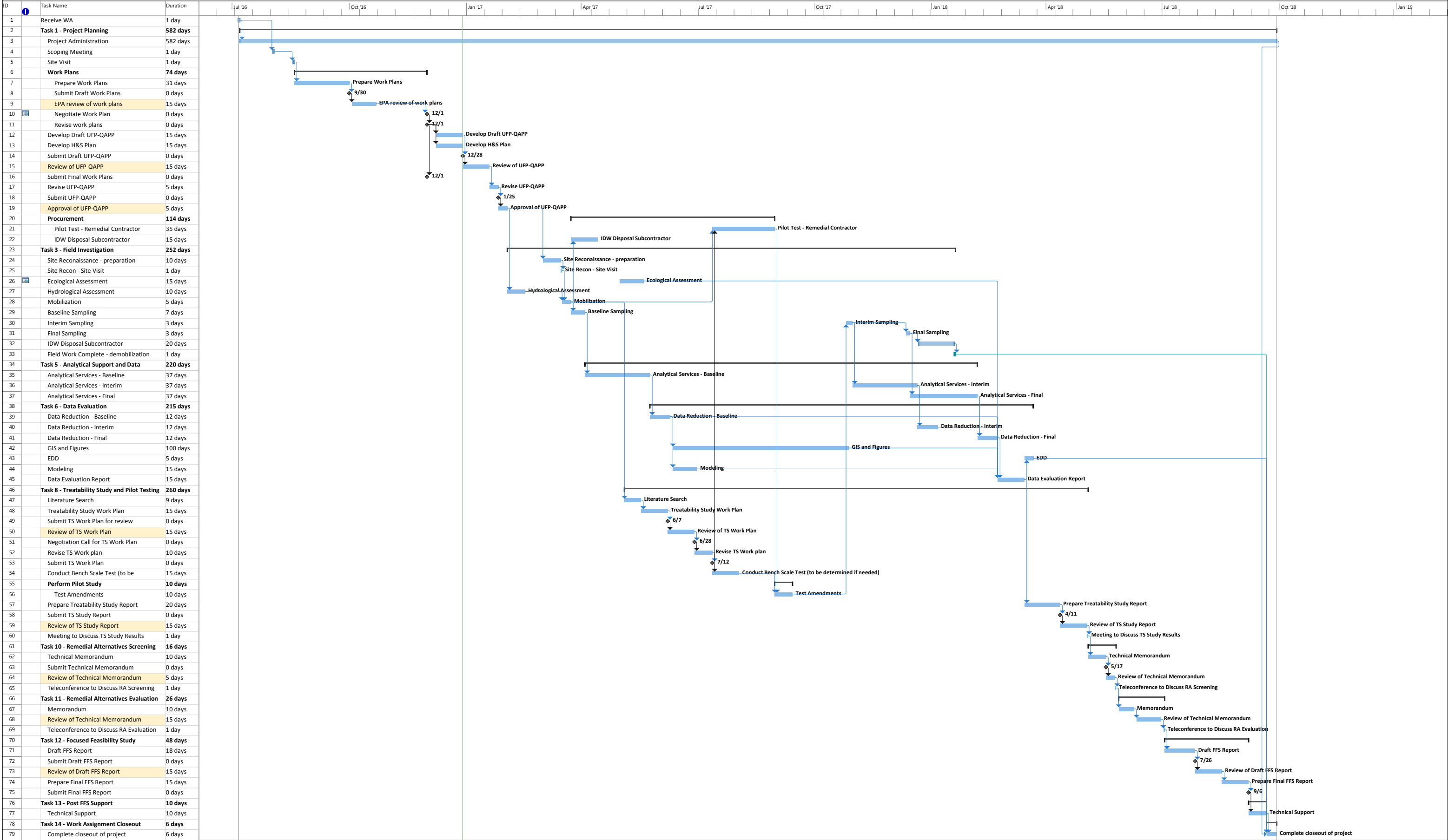
This figure was taken from the 2014 BERA Report (USEPA).

Coordinate system: New Jersey State Plane
 FIPS: 2900
 Datum: NAD83
 Units: Feet

Note: Plots 1 through 6 will be analyzed for Lead. Plots 7 through 12 will be analyzed for PCBs and TPH.

0 200 400
 Feet

Figure 3
Project Tasks and Schedules
Burnt Fly Bog
Marlboro, NJ



Appendix B

Appendix B

Field Forms

Boring Logs

Daily Sign-In Sheets

Drum Tracking

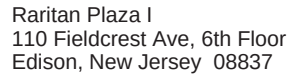
Field Planning Meeting Attendance Sheet

Health and Safety Attendance Sheet

Synoptic Water Level Measurements

Checklist for Ecological Assessment

Well Assessment Checklist



Project Name: Burnt Fly Bog, OU3
Project Number:

Surface Elevation (ft amsl):
Total Depth:
Depth to Initial Water Level (ft bgs):
Field Screening Instrument:
Logged by:

Depth (ft bgs)	Sample Number	Blows per 6 inches	Sample Interval (ft)	Recovery (ft)	PID Reading (ppm)	Graphic Log	Material Description

Remarks:

DAILY SIGN-IN SHEET
Burnt Fly Bog Superfund Site

Date	Print Name	Signature	Affiliation	Time On-Site	Time Off-Site

IDW TRACKING LOG SHEET

Client/Site Name: **EPA/Burnt Fly Bog Site**

[illegible]

ID = identification

Comments:

IDW = investigation derived waste

CDM Federal Programs

Program/Task: Burnt Fly Bog Treatability and Focused Feasibility Study

Subject of Training: Treatability and Focused Feasibility Study Field Planning Meeting

Date/Time: _____

Location: _____

Instructor(s): _____

Attendees:

<u>Print Name</u>	<u>Signature</u>	<u>Affiliation</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

cc: Project Files

CDM Federal Programs

Program/Task: Burnt Fly Bog Treatability and Focused Feasibility Study

Subject of Training: Health and Safety Topics -

Date/Time: _____

Location: Texas Road, Marlboro, NJ 07751

Instructor(s): _____

Attendees:

<u>Print Name</u>	<u>Signature</u>	<u>Affiliation</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

cc: Project Files

SYNOPTIC WATER LEVEL MEASUREMENTS

Site Name: Burnt Fly Bog Superfund Site

[illegible]

All readings are from Top of Inner Casing (TIC)

Checklist for Ecological Assessment/Sampling

I. SITE DESCRIPTION

1. Site Name: _____

Location: _____

County: _____ City: _____ State: _____

2. Latitude: _____ Longitude: _____

3. What is the approximate area of the site? _____

4. Is this the first site visit? Yes____ No____ Dates of previous site visits: _____

5. Please attach to the checklist USGS topographic map(s) of the site, if available.

6. Are aerial or other site photographs available? Yes _____ No _____

If yes, attach any available photos to the site map.

7. The land use on the site is:

_____% Urban
_____% Rural
_____% Residential
_____% Industrial (light heavy)
_____% Agricultural (Crops_____)
_____% Recreational
(Describe; note if it is a park, etc.)

_____% Undisturbed
_____% Other

The area surrounding the site is:

_____ mile radius

_____% Urban
_____% Rural
_____% Residential
_____% Industrial (light heavy)
_____% Agricultural (Crops_____)
_____% Recreational
(Describe; note if it is a park, etc.)

_____% Undisturbed
_____% Other

8. Has any movement of soil taken place at the site? Yes____ No____.

If yes, please identify the most likely cause of this disturbance:

__ Agricultural Use __ Heavy Equipment __ Mining __ Natural Events __ Erosion __ Other

Describe: _____

9. Do any potentially sensitive environmental areas exist adjacent to or in proximity to the site, e.g., Federal and State parks, National and State monuments, wetlands, prairie potholes? *Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information.*

Provide the sources of information used to identify sensitive areas, and indicate their general location on the site map.

10. What type of facility is located at the site?

Chemical _____ Manufacturing __ Mixing _____ Waste disposal __ Other (specify) _____

11. What are the suspected contaminants of concern and the maximum anticipated concentrations?

12. Check any potential routes of off-site migration of contaminants observed at the site:

Swales__ Depressions____ Drainage ditches____ Runoff__ Windblown particulates__ Vehicular traffic__
Other (specify) _____

13. If known, what is the approximate depth to the water table? _____

14. Is the direction of surface runoff apparent from site observations? Yes____ No____ If yes, to which of the following does the runoff discharge? Surface water__ Groundwater__ Sewer__ Collection impoundment__

15. Is there a navigable waterbody or tributary to a navigable waterbody? Yes___ No___

16. Is there a waterbody anywhere on, or in the vicinity of the site? If yes, also complete Section III and/or Section IV: Aquatic Habitat Checklists. Yes_____ (approx. distance_____) No_____

17. Is there evidence of flooding? Yes_____ No_____ *Wetlands and flood plains are not always obvious; do not answer "no" without confirming information.* If yes, complete Section V: Wetland Habitat Checklist.

18. If a field guide was used to aid any of the identifications, please provide a reference. Also, estimate the time spent identifying fauna: _____

19. Are any threatened and/or endangered species (plant or animal) known to inhabit the area? Yes_____No_____ *If yes, you are required to verify this information with the U.S. Fish and Wildlife Service.* If species' identities are known, please list them: _____

20. Record weather conditions at the time this checklist was prepared:

DATE:_____

_____ Temperature (C/ F)

_____ Normal daily high temperature

_____ Wind (direction/speed)

_____ Precipitation (rain, snow)

_____ Cloud cover

IA. SUMMARY OF OBSERVATIONS AND SITE SETTING

Completed by_____ Affiliation_____

Additional Preparers_____

Site Manager_____

Date_____

II. TERRESTRIAL HABITAT CHECKLIST

IIA. WOODED

1. Are there any wooded areas at the site? Yes_____ No_____ If no, go to Section IIB: Shrub/Scrub.
2. What percentage or area of the site is wooded? (_____% _____ acres). Indicate the wooded area on the site map which is attached to a copy of this checklist. Please identify what information was used to determine the wooded area of the site.
3. What is the dominant type of vegetation in the wooded area? (Circle one: Evergreen/Deciduous/ Mixed)
Provide a photograph, if available.
Dominant plant, if known:_____
4. What is the predominant size of the trees at the site? Use diameter at breast height.
0-6 in.____ 6-12 in._____ > 12 in._____
5. Specify type of understory present, if known. Provide a photograph, if available.

IIB. SHRUB/SCRUB

1. Is shrub/scrub vegetation present at the site? Yes__ No_____ If no, go to Section IIC: Open Field.
2. What percentage of the site is covered by scrub/shrub vegetation? (_____% _____ acres). Indicate the areas of shrub/scrub on the site map. Please identify what information was used to determine this area.
3. What is the dominant type of scrub/shrub vegetation, if known? Provide a photograph, if available.
4. What is the approximate average height of the scrub/shrub vegetation? 0-2 ft.____ 2-5 ft.____ > 5 ft.____
5. Based on site observations, how dense is the scrub/shrub vegetation? Dense__ Patchy__ Sparse__

IIC. OPEN FIELD

1. Are there open (bare, barren) field areas present at the site? Yes_____ No_____ If yes, please indicate the type:
Prairie/plains_____ Savannah_____ Old field_____ Other (specify)_____
2. What percentage of the site is open field? (_____% _____ acres). Indicate the open fields on the site map.
3. What are the dominant plants? Provide a photograph, if available.
4. What is the approximate average height of the dominant plant?_____
5. Describe the vegetation cover: Dense_____ Sparse__ Patchy__

IID. MISCELLANEOUS

1. Are types of terrestrial habitats other than woods, scrub/shrub, and open field present? Yes_____ No_____ If yes, identify and describe them:_____
2. Describe the terrestrial miscellaneous habitats and identify these areas on the site map.
3. What observations, were made at the site regarding the presence/absence of insects, fish, birds, mammals, etc.?
4. Review the questions in Section I to determine if additional habitat checklists should be completed for this site.

III. AQUATIC HABITAT CHECKLIST -- NON-FLOWING SYSTEMS

Note: Aquatic systems are often associated with wetlands. Please refer to Section V, Wetland Habitat Checklist.

1. What type of open-water, non-flowing system is present at the site?
Natural (pond, lake) Artificially created (lagoon, reservoir, canal, impoundment)
2. If known, name the waterbodies on or adjacent to the site: _____
3. If a waterbody is present, what are its known uses (e.g.: recreation, navigation, etc.)? _____
4. What is the approximate size of the waterbody? _____ acres.
5. Aquatic vegetation present? Yes_ No____ If yes, identify: Emergent_____ Submergent_____ Floating_____
6. If known, what is the depth of the water? _____
7. What is the general composition of the substrate? Check all that apply.
Bedrock Sand (coarse)____ Muck (fine/black)____
Boulder (>10 in.)____ Silt (fine)____ Debris____
Cobble (2.5-10 in.)____ Marl (shells)____ Detritus____
Gravel (0.1-2.5 in.)____ Clay (slick)____ Concrete____
Other (specify)_____
8. What is the source of water in the waterbody?
River/Stream/Creek____ Groundwater____ Industrial discharge____ Surface runoff____ Other (specify)____
9. Is there a discharge from the site to the waterbody? Yes____ No____ If yes, please describe this discharge and its path: _____
10. Is there a discharge from the waterbody? Yes____ No____ If yes, and the information is available, identify from the list below the environment into which the waterbody discharges.
River/Stream/Creek onsite offsite Distance____
Groundwater onsite offsite
Wetland onsite offsite Distance____
Impoundment onsite offsite
11. Identify any field measurements and observations of water quality that were made. For parameters which data were collected provide the measurement and the units of measure below:
____ Area
____ Depth (average)
____ Temperature (depth of the water at which the reading was taken) _____
____ pH
____ Dissolved oxygen
____ Salinity
____ Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth _____)
____ Other (specify) _____
12. Describe observed color and area of coloration: _____
13. Mark the open-water, non-flowing system on the site map attached to this checklist.
14. What observations, if any, were made at the waterbody regarding the presence/absence of benthic macroinvertebrates, fish, birds, mammals, etc.? _____

IV. AQUATIC HABITAT CHECKLIST -- FLOWING SYSTEMS

Note: Aquatic systems are often associated with wetlands. Please refer to Section V, Wetland Habitat Checklist.

1. What types of flowing water systems are present at the site?
River/Stream/Creek_____ Dry wash/Arroyo Brook_____
Artificially Created_____ Intermittent Stream Channeling_____
Other (specify)_____
2. If known, what is the name of the water body?_____
3. For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)?
Yes_____ No_____ If yes, describe observed indicators:_____
4. What is the general composition of the substrate? Check all that apply.
Bedrock Sand (coarse)_____ Muck (fine/black)_____
Boulder (>10 in.)_____ Silt (fine)_____ Debris_____
Cobble (2.5-10 in.)_____ Marl (shells)_____ Detritus_____
Gravel (0.1-2.5 in.)_____ Clay (slick)_____ Concrete_____
Other (specify)_____
5. What is the condition of the bank (e.g., height, slope, extent of vegetative cover)?_____
6. Is the system influenced by tides? Yes_____ No_____ What information was used to make this determination?
7. Is the flow intermittent? Yes_____ No_____ What information used in making this determination?
8. Is there a discharge from the site to the waterbody? Yes_____ No_____ If yes, describe the discharge and its path:_____

9. Is there a discharge from the waterbody? Yes_____ No_____ If yes, identify where the waterbody discharges and whether the discharge is on site or off site:_____
10. Identify any field measurements and observations of water quality that were made. For parameters which data were collected, provide the measurement and the units of measure in the appropriate space below:
____ Width (ft.)
____ Depth (ft.)
____ Velocity (specify units):_____
____ Temperature (depth of the water at which the reading was taken_____)
____ pH
____ Dissolved oxygen
____ Salinity
____ Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth _____)
____ Other (specify)_____
11. Describe observed color and area of coloration:_____
12. Aquatic vegetation present? Yes_____ No_____ If yes, identify: Emergent_ Submergent_____ Floating_____
13. Mark the flowing water system on the attached site map.
14. What observations were made at the waterbody regarding the presence/absence of benthic macroinvertebrates, fish, birds, mammals, etc.?_____

V. WETLAND HABITAT CHECKLIST

1. Based on observations/available information, are designated or known wetlands definitely present? Yes__ No____
Please note the sources of observations and information used (e.g., USGS Topographic Maps, National Wetland Inventory, Federal or State Agency, etc.) to make this determination:_____

2. Based on the location of the site (e.g., along a waterbody, in a floodplain) and site conditions (e.g., standing water; dark, wet soils; mud cracks; debris line; water marks), are wetland habitats suspected? Yes____ No____ If yes, proceed with the remainder of the wetland habitat identification checklist.

3. What type(s) of vegetation are present in the wetland?
Submergent____ Emergent____ Scrub/Shrub____ Wooded____ Other (specify)____

4. Provide a general description of the vegetation present in and around the wetland (height, color, etc.). Provide a photograph of the known or suspected wetlands, if available.

5. Is standing water present? Yes__ No____ If yes, is this water: Fresh or Brackish?
What is the approximate area of the water (sq. ft.)?_____
Please complete questions 4, 11, 12 in Checklist III - Aquatic Habitat -- Non-Flowing Systems.

6. Is there evidence of flooding at the site? Yes____ No____ What observations were noted?
Buttressing____ Water marks____ Mud cracks____ Debris line____ Other (describe below)

7. If known, what is the source of the water in the wetland?
Stream/River/Creek/Lake/Pond____ Groundwater____ Flooding____ Surface Runoff____

8. Is there a discharge from the site to a known or suspected wetland? Yes____ No____ If yes, please describe.

9. Is there a discharge from the wetland? Yes____ No____. If yes, to what waterbody is discharge released?
Surface Stream/River____ Groundwater____ Lake/Pond____ Marine____

10. If a soil sample was collected, describe the appearance of wetland soil. Circle or write in the best response.
Color (blue/gray, brown, black, mottled) _____
Water content (dry, wet, saturated/unsaturated) _____

11. Mark the observed wetland area(s) on the attached site map.

EPA Region 2 Superfund Well Assessment Checklist

Facility Information

Site Name: _____

Site Address: _____

Site County: _____

Site State: _____

EPA Site ID Number: _____

Site Owner: _____

EPA Project Manager: _____

Well Locational Information

State Well ID: _____
Well Tag ID: _____
Well Installation date: _____

	From Log	By GPS
Ground Surface Elevation		
Latitude		
Longitude		
Northing (State Plane)		
Easting (State Plane)		

Cross streets (if applicable): _____

GPS Instrument used: _____

Datum: _____

Accuracy/Precision: _____

Well Construction Details

Type of well (Circle one)	Flush Mount	Stick up	Multilevel Well*

Well lock\security type: _____

Elevation (top of inner casing): _____

Surface casing material: _____

Well casing material: _____

Surface Casing diameter: _____ inches

Well Diameter: _____ inches

Well Depth (as installed): _____ *ftbgs*Well Depth (as measured): _____ *ft* to *c*

Screened interval: _____ ft

Open hole interval: _____ ft

Depth to water:	<i>ftbtoc</i>

Date: _____ Time: _____

* If multilevel well please see attached worksheet.

EPA Region 2 Superfund Well Assessment Checklist

Well Headspace Readings

PID/FID Reading taken inside top of casing (if applicable): _____ ppm

Multi-gas/CGI meter Readings taken (if applicable):

LEL:	_____ % LEL
O ₂ :	_____ 40% Vol.
CO:	_____ ppm
H ₂ S:	_____ ppm

Do readings indicate unsafe conditions exist? Yes No

Well Condition

Is the concrete pad in good condition?	Yes	No
Is the well surface casing in good condition?	Yes	No
Is the surface casing vertical?	Yes	No
Is there an internal well seal?	Yes	No
Has there been physical damage to the well?	Yes	No
Does sounding depth match completed depth?	Yes	No
Is measuring point marked?	Yes	No
Is the well clearly labeled?	Yes	No
Flush mount - Is it secure from runoff?	Yes	No

Other Comments _____

Recommendations

Well needs to be redeveloped	Yes	No
Well needs to be re-surveyed.	Yes	No
Well needs to be repaired.	Yes	No
Well needs to be replaced.	Yes	No
Well needs to be properly abandoned.	Yes	No
No action necessary.	Yes	No

Comments

Inspected by:	
Date of Inspection:	
Reviewed by:	
	(Print)
	(Sign)

Appendix C

Appendix C

X-Ray Fluorescence (XRF) Instrument User's Guide and Manual

NITON XL3t 600 Analyzer
User's Guide

Version 6.5

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About This User's Guide



WARNING! Do not attempt to use this analyzer without first reading and understanding the entire User's Guide! ♦



CAUTION NITON Analyzers are not intrinsically safe analyzers in regard to sparking. All pertinent Hot Work procedures should be followed in areas of concern. ♦

Unpacking and Assembling Your NITON XRF Analyzer

- Inspect the shipping carton for signs of damage such as crushed or water damaged packaging. Immediately notify the shipping company and Thermo Fisher Scientific, in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, if there is any visible damage to the shipping container or any of its contents.
- Open the packing carton. If your analyzer is not packed in its carrying case, please call Thermo Fisher Scientific immediately, in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460.
- Verify the contents of the shipping container against the enclosed packing list. If there are any discrepancies between the actual contents of the shipping container and the enclosed packing list, please notify Thermo Fisher Scientific immediately, in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460.
- Open the carrying case and visually inspect the analyzer for damage before removing it from the case. Call the shipper and Thermo Fisher Scientific if you find any damage to the case or its contents.
- Save the shipping carton and all packing materials. Store them in a safe, dry area for reuse the next time that you ship the analyzer.

The NITON XRF Analyzer Overview

The NITON XL3 Analyzer is a single unit, hand held, high performance portable x-ray fluorescence (XRF) elemental analyzer.

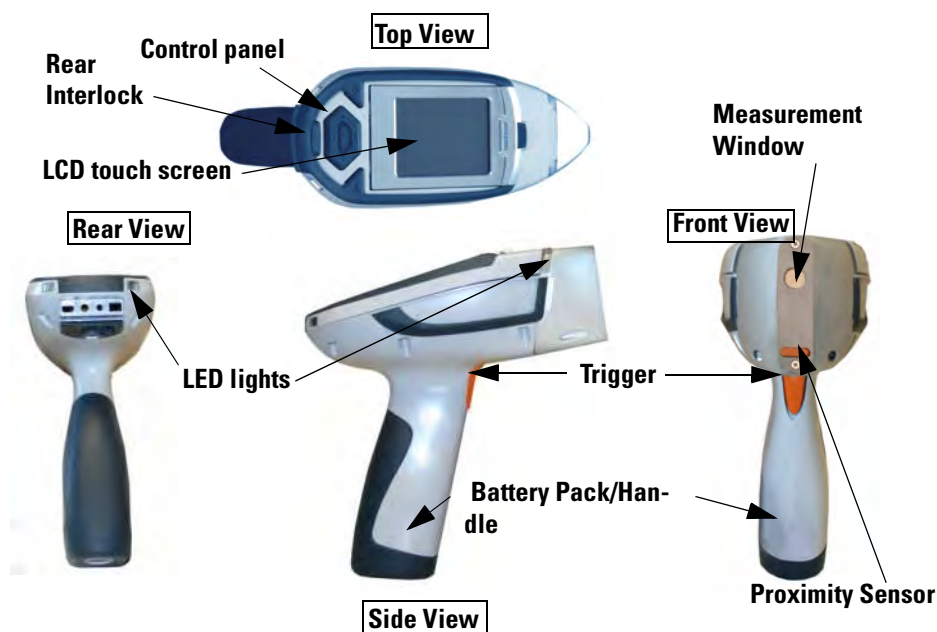


Figure 0-1. Analyzer Overview

The Control Panel

The control panel is located on the analyzer's top housing, directly below the LCD touch screen (see [Figure 0-1](#)). The control panel consists of a 4 way touch pad, a center button, and two control buttons, one on each side. Using either the control panel or the touch screen you may navigate through all of the analyzer's screens and menus. You can control the movement of the screen cursor by pressing the four way control pad in one of four directions to highlight each of the menu options. The Select button in the center of the four way touch pad is used to select highlighted menu options. The on/off/escape button both controls the power to the analyzer and serves as an "escape" button. When the on/off/escape button is pushed and immediately released, it functions as an "escape", and brings you back to the Main Menu from the current screen in the menu system.



Figure 0-2. The Control Panel

Push and hold the on/off/escape button for at least 3 seconds to turn the analyzer on. Push the on/off/escape button and hold it down for about 10 seconds to shut off power to the analyzer from any screen in the menu system.

You also have the option of operating the analyzer, including navigating the menu system, by using the built in touch screen. To select a menu option, tap on the icon once. The touch screen icons have the same functionality as the four way touch pad, the on/off/escape button, and the select or enter button. This User's Guide will refer to the process of choosing a course of action by selecting an icon from a menu, either using the touch screen or using the control panel buttons, as “selecting.”

Selecting the **Return** icon works everywhere throughout the User Interface to bring you back to the previous menu from the current menu in the menu system. Use the on/off/escape button to return to the **Main Menu**.

The LCD Touch Screen

The LCD Touch Screen on your XL3 Analyzer is designed to swing up and down to different angles for ease in viewing and interacting with your analyzer. The LCD Touch Screen is connected to your analyzer along the base of the screen, right above the Control panel. The screen is not designed to separate from the analyzer, but can be adjusted to any arbitrary angle between zero degrees - that is, flush with the analyzer - and 85 degrees, which is almost perpendicular. The LCD Touch Screen will stay at any given angle between these extremes until moved to a different angle. When in closed position, the screen is secured by a catch at the top center of the screen housing.



Figure 0-3. XL3 Analyzer Showing LCD Screen Tilted.

- To raise the LCD Touch Screen, disengage the catch at the top-center of the LCD Touch Screen housing and gently pull the screen towards you until it is at the best angle for your use.
- To close the LCD Touch Screen, gently push away from you along the top edge of the screen housing. The screen will swing down until the catch solidly engages with an audible click.

Note The LCD Touch Screen cannot be removed from your XL3 analyzer. Removing or attempting to remove the LCD Touch Screen will damage your analyzer and void your warranty.

Note Always close your LCD Touch Screen before storing or transporting your XL3 analyzer.

The Data Ports

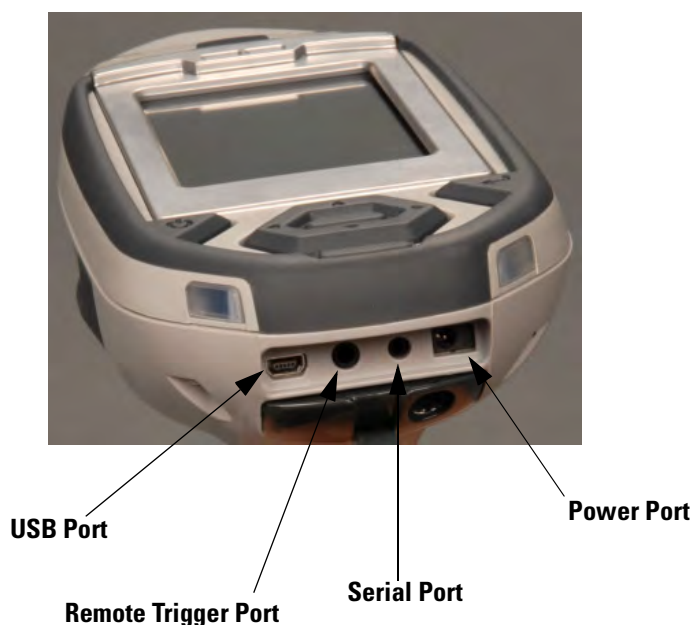


Figure 0-4. Data Ports on the XL3

USB Port	The USB Port is a communications and control port, for uploading and downloading data, configuration files, and software to the analyzer.
Remote Trigger Port	The Remote Trigger Port controls the analyzer's trigger function, for use with the Extend-a-pole, In Situ Tripod, and test stands.
Serial Port	The Serial Port is a communications and control port, for uploading and downloading data, configuration files, and software to the analyzer.
Power Port	The power port is used to run the XL3 under external power.

Instrument Startup

To turn on the analyzer, depress the **on/off/escape** button on the control panel for approximately 10 seconds.

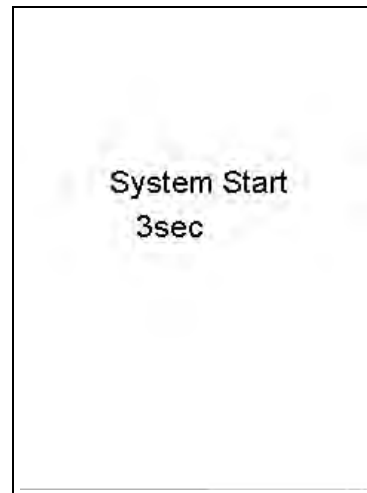


Figure 0-5. System Start Screen

On startup, the screen will be replaced by a **Start Screen** (see [Figure 0-5](#)) which will automatically count down from 9 to 0 in increments of one second.



Figure 0-6. Logon Screen

When the Start is complete, the Start Screen will be replaced by the Logon screen (see [Figure 0-6](#).) Tap anywhere on this screen to continue.

The Logon Screen will be replaced by a Warning Screen, see [Figure 0-7](#), advising you that this analyzer produces radiation when the lights are flashing. You must acknowledge this warning by selecting the “Yes” button before logging on. Selecting the “No” button will return you to the Logon Screen.

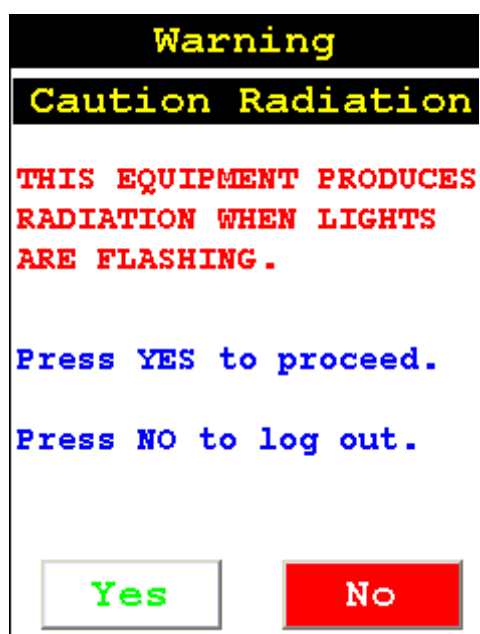


Figure 0-7. Warning Screen

After selecting the “Yes” button, the Virtual Numeric Keypad becomes available for you to log onto the analyzer.



Figure 0-8. Virtual Numeric Keypad for Logon

Select your 4 digit security code, followed by the enter (E) key. The temporary password assigned by default is 1-2-3-4, followed by the “E” key. If you enter an incorrect number, you can use the “<” key to backspace over it, or use the “C” key to clear everything. After you have completed the log on procedure, the word "USER" will appear on the bottom of the screen, then the Main Menu will appear. Note that security codes are editable. Please see the NDT manual for instructions on creating user-definable passwords.

Check the date/time. The time should be set correctly for accurate and verifiable record keeping (See Chapter 1 page 92).

Your analyzer can be stored and operated safely in temperatures from -5° C (23° F) to 50° C (122° F). You will not be able to take a measurement if the analyzer overheats. If it is hot to the touch, you should allow it to cool before testing.

The NAV Menu

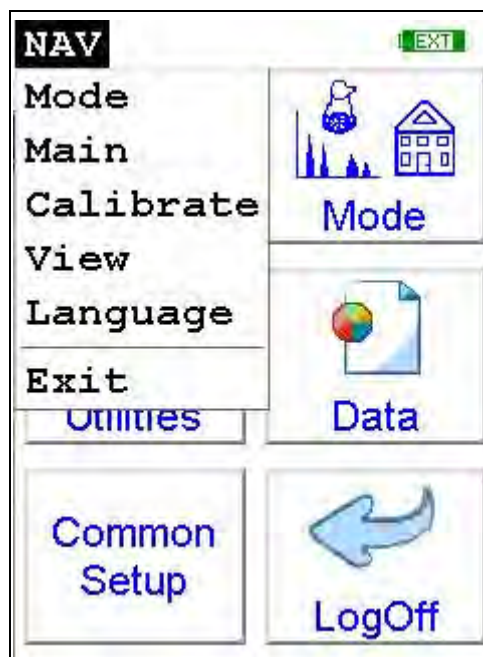


Figure 0-9. The NAV Menu

The Navigation Menu, or NAV Menu, is available in all screens, though only through the touch screen interface. Within a menu, the particular options available from the NAV Menu may change with the context. For example, within the View Menu, the NAV Menu changes options depending on the mode you are currently using.

Access the NAV Menu by selecting the word NAV in the screen. A drop-down menu of choices will appear. Selecting an option from the NAV Menu will take you directly to a particular menu, no matter where you are in the menu hierarchy. Selecting the “View” option from the NAV Menu, for example, will bring you directly to the Data Menu.

The NAV Menu cannot be selected through the Control Panel.

The Battery Life Indicator

The Battery Life Indicator is visible on all screens in the menu system. The indicator is visible in the top right portion of the screen, and graphically shows you how much battery life is left, enabling you to change batteries as needed to avoid unexpected shutdowns.

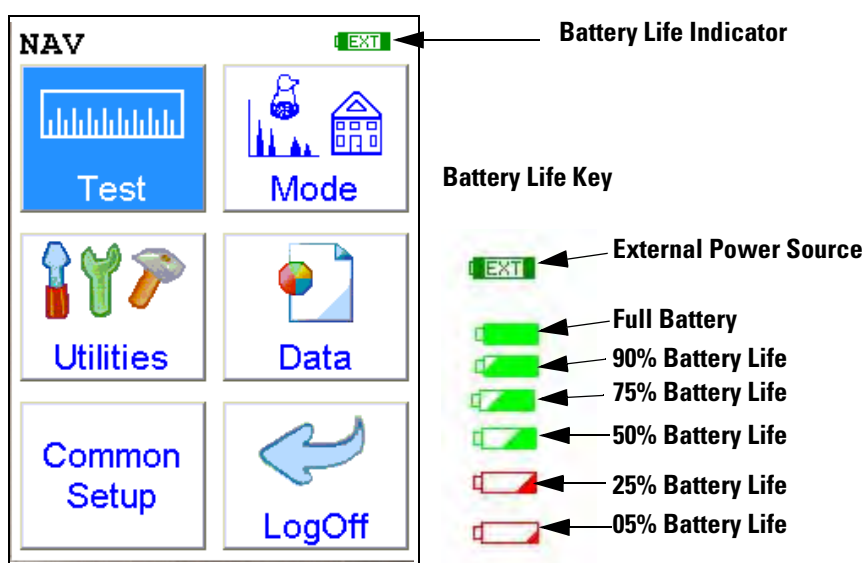


Figure 0-10. Battery Life Indicator

The more green visible in the indicator, the higher the charge. The more red visible in the indicator, the lower the charge. It's best to charge one battery while using the other, to avoid work slowdowns or stoppages due to battery charge conditions.



WARNING! In the highly unlikely event that the x-ray tube remains on when the trigger is not depressed, disconnect the battery pack immediately to turn off the x-ray tube, and call Thermo Fisher Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States at +1-978-670-7460, or your local Authorized NITON Analyzers Service Center. ♦

The Menu Path

The Menu Path shows you graphically how to get to the function being described in several discrete steps from the universal start position, the Main Menu.

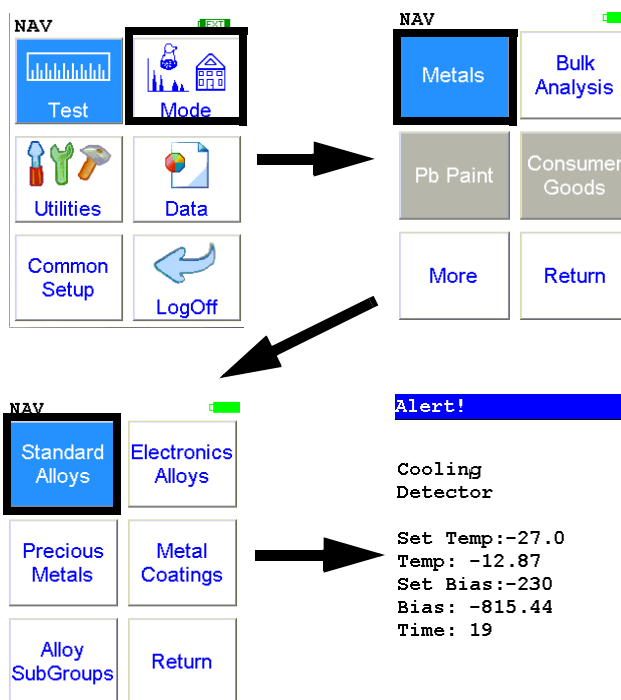


Figure 0-11. Example Menu Path

In the Menu Path, the order is top to bottom, then if needed left to right, starting with the Main Menu and ending with the function wanted. The arrows show the succession of menus, while the icon to be selected is highlighted by a heavy rectangular border.

This Menu path should be read as:

To get to this screen, starting at the Main Menu, select the Mode icon, select the Metals icon, then select the Standard Alloys icon.

Chapter 1 Applications

The NAV Menu

The **NAV Menu** enables you to move between various menus and screens directly, without going through the intervening screens. Select a destination from the drop down menu and you will be brought directly to that menu or screen.

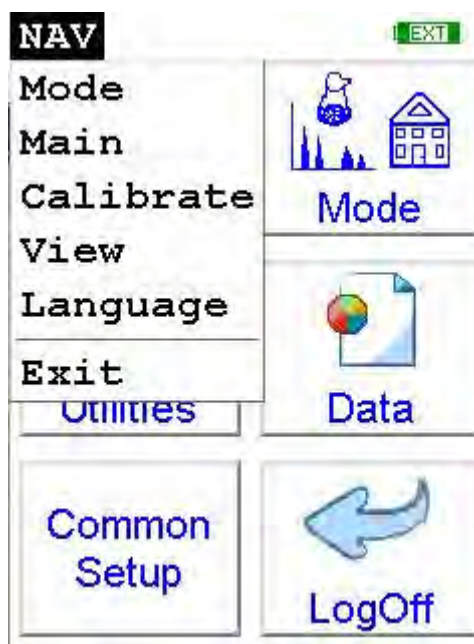


Figure 1-1. The NAV Menu

The Tools Menu

The **Tools Menu** enables you to perform common data-related tasks such as printing and averaging. Select a task from the drop down menu to initiate that task.

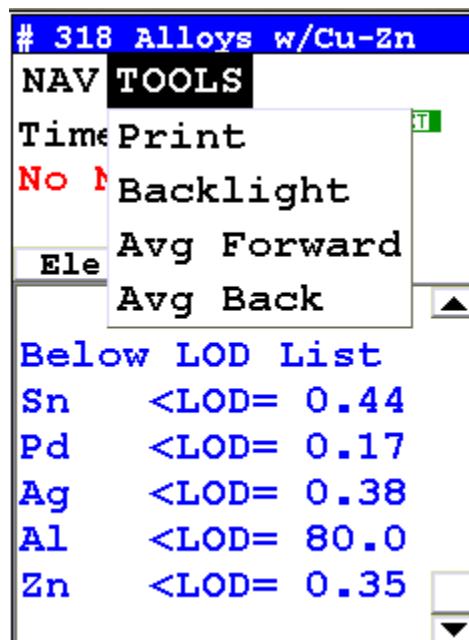


Figure 1-2. The Tools Menu

The Tools Menu, like the NAV Menu, uses context sensitive menus. The following is the most common menu set.

Print Enables you to print the sample analysis to the optional printer.

Backlight Enables you to turn backlighting on and off.

Avg Forward Enables you to average different readings together from this analysis forward. Select **Avg Forward** to initiate future sample averaging. **Avg Forward** will set up an automatic personal averaging protocol to be followed until your analyzer is shut down, or this feature is disabled. To begin, select the number of readings you want to average from the virtual numeric keypad. Your analyzer will calculate an average reading after that number of tests, and continue this pattern until stopped. For example, if you select 3 on the virtual keypad, the analyzer will automatically calculate, average, and store a reading for every three tests you take, storing the individual readings along the way.

Avg Back

Enables you to average different readings together from this analysis backward. Select **Avg Back** to initiate backwards sample averaging. **Avg Back** will take a number of readings you select and average their analytical results. The range is counted from the last reading backward by the number of readings selected. If your last reading was #15, selecting 3 would average readings #13, 14, and 15. The average is calculated, displayed, and stored into memory as the next sequential reading number.

The range number is selected using a virtual keypad on your analyzer similar to the keypad used for login. Select the digits in the range number from the keypad, then select the “E” key to enter the number. “C” will clear all, and “<” will clear the last digit entered. The average will automatically be displayed.

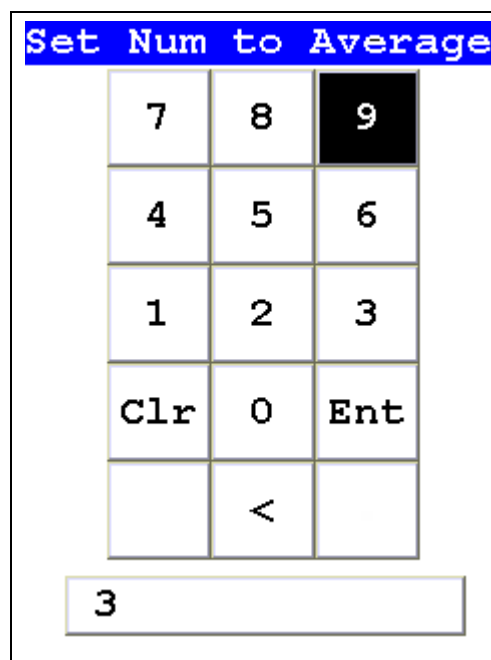


Figure 1-3. The Virtual Numeric Keypad for Averaging

Note You cannot average readings taken with different element lists - or with different filter settings if the filter settings have different element lists - with either **Avg Back** or **Avg Forward**. Alloy and Industrial Bulk modes each use the same element lists with the different filter settings, so averaging works when switching between filter settings when in either of these modes. Thin Film and Bulk modes both use different element lists for different filter settings, and readings with different filter settings cannot be averaged when using either of these modes. You can never average readings taken in different modes. ♦

Note The **Tools Menu** is only available when viewing readings, and the menu is only accessible through the touch screen interface or NDTTr. ♦

Stop Avg Fwd/Back

Avg Back and Avg Forward are toggles. The option on the Tools Menu changes to its opposite when selected. To stop averaging, select Stop Avg Fwd or Stop Avg Back from the Tools Menu as appropriate.

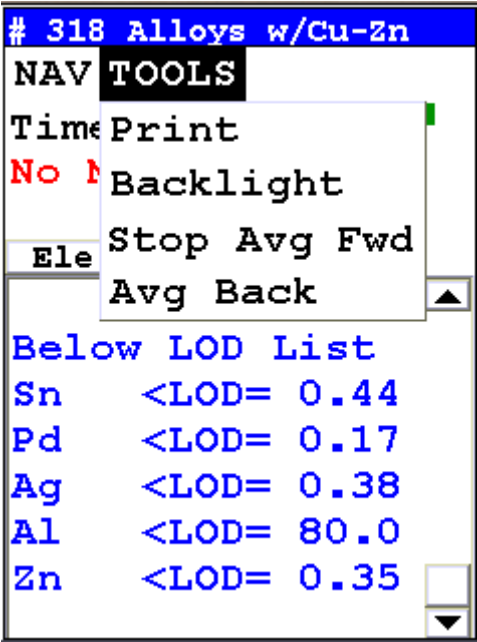


Figure 1-4. The Tools Menu - Averaging Toggles

Example Averaging

# 17 Std Filter			
NAV TOOLS			
Time 39.1 sec EXT			
Ele	%	+/-	
Zr	0.63	0.35	▲
Sr	0.69	0.35	□
As	0.77	0.45	
Hg	4.66	2.49	
Zn	20.88	2.67	
Cu	2.89	1.04	
Fe	3.09	1.50	
Below LOD List			
Ba	<LOD= 12.5 ▼		

# 18 Std Filter			
NAV TOOLS			
Time 36.6 sec EXT			
Ele	%	+/-	
Sn	23.84	15.08	▲
Zr	0.47	0.30	□
Pb	1.23	0.78	
As	0.69	0.42	
Hg	3.66	2.18	
Zn	17.19	2.39	
Cu	3.31	1.10	
Ni	1.46	0.81	
Fe	2.44	1.31	▼

# 21 Std Filter			
NAV TOOLS			
Time 148.9 sec EXT			
Avg of 17-20			
Ele	%	+/-	
Avg of 17-20			
Sn	20.80	13.37	▲
Ag	35.01	22.69	□
Zr	0.54	0.32	
Sr	0.51	0.29	
As	0.80	0.45	
Hg	4.60	2.46	
Zn	19.24	2.55	
Cu	3.05	1.06	▼

# 19 Std Filter			
NAV TOOLS			
Time 36.6 sec EXT			
Ele	%	+/-	
Sn	32.19	17.21	▲
Ag	38.65	23.42	□
Zr	0.53	0.32	
Sr	0.69	0.35	
Pb	1.27	0.80	
As	0.77	0.45	
Hg	4.54	2.46	
Zn	17.51	2.44	
Cu	3.17	1.09	▼

# 20 Std Filter			
NAV TOOLS			
Time 36.6 sec EXT			
Ele	%	+/-	
Ag	57.90	26.44	▲
Zr	0.53	0.32	□
As	0.97	0.50	
Hg	5.56	2.72	
Zn	21.39	2.70	
Cu	2.82	1.03	
Ni	2.43	1.06	
Co	1.86	1.04	
Fe	4.98	1.90	▼

Figure 1-5. Averaging four readings

Dust Wipe Testing Mode Menu

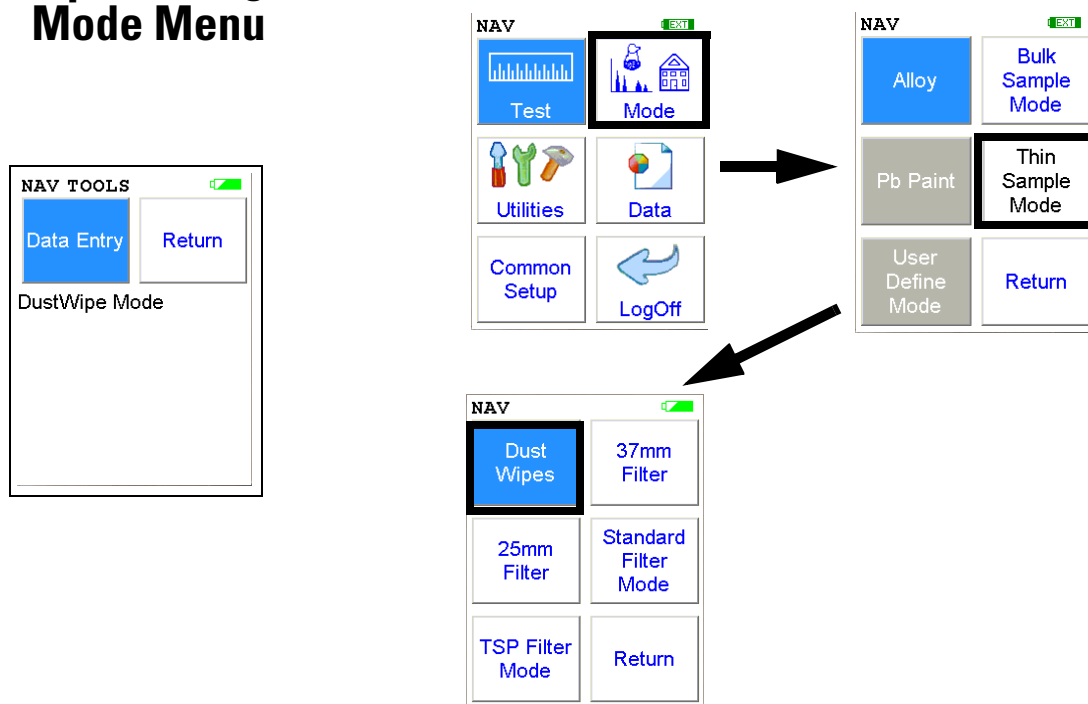


Figure 1-1. Dust Wipe Mode Menu Path

From the **Dust Wipe Testing Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Dust Wipe Testing Menu** to go to the “[The Data Entry Screen](#)” on [page 1-48](#), to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

The **Dust Wipe Mode** prompts you to take four readings on a properly folded and bagged dust wipe, which are then averaged to give you a final test result. Dust wipes are usually analyzed for Pb, though many other contaminants may also be detected.

The wipe recommended by NITON is the Lead Wipe. If the use of other brands is desired, consult with NITON prior to any testing.

Note Some brands of wipes are not compatible with the NITON method. ♦

Lead Wipes are available from Thermo or from:

Lynx Products

Thorofare, New Jersey

(800) 767-6933

The following instructions are appropriate for screening purposes. The instrument displays levels of contamination in μg per wipe. The wipe reflects the levels of contaminants of the area wiped. Current regulations require lead contamination below $40 \mu\text{g}/\text{ft}^2$ on floors, $250 \mu\text{g}/\text{ft}^2$ on window sills, and $400 \mu\text{g}/\text{ft}^2$ in window wells.

Note Check with all local, state and federal regulatory bodies, as the regulations may change from location to location, and from time to time. ♦

Taking a Dust Wipe Sample

We highly recommend that you will follow the HUD guidelines for taking a dust wipe which are summarized here:

1. **Measure a known area of the surface, preferably one square foot**
2. **Wear clean surgical gloves. Wipe the measured square with parallel strokes**
3. **Fold the wipe in half. Wipe in strokes 90° to the original direction.**
4. **Fold the wipe in half again.**

Note Thus far, you have followed one of the HUD procedures for taking a wipe test. The following procedure is specific for testing with your instrument, though it will not affect your results should you decide on submitting the sample to an accredited laboratory. ♦

5. **Fold the wipe in half three more times. You will now have a pad measuring about 1 x 1.5 inches (2.5 x 3.7 cm). It is important to fold the wipe carefully, so that the final wipe is a neat rectangle.**

6. **Dry the wipe.** This can be done either by air drying for several hours or in an oven at 250 degrees F (121 degrees C) for 20 minutes.
7. **Place the folded wipe in one of the 1.5" X 2" plastic bags (P/N 187-473) provided**
8. **Position the wipe, in the bag, in the dust wipe holder (P/N 187-1430/187-1431).**
9. **The dust wipe is now ready to test. NITON recommends that the plastic bags NOT be re-used, to eliminate the chance of cross-contamination of subsequent wipes.**

Taking Measurements of Your Dust Wipe Sample

Following the procedure below will assure that your analyzer measures the entire area of the folded dust wipe:

1. **Position the metal dust wipe holder on the number one position of the test stand.**
2. **Position the instrument in the nose cone adaptor of the test stand, close the lid, and initiate the first measurement using NDTr. See the NDT Manual for details.**
3. **Open the lid, place the wipe holder in the number two position of the test stand. Close the lid, and initiate the second measurement using NDTr.**
4. **Open the lid, place the wipe holder in the number three position of the test stand. Close the lid, and initiate the third measurement using NDTr.**
5. **Open the lid, place the wipe holder in the number four position of the test stand. Close the lid, and initiate the fourth measurement using NDTr. Your analyzer will then average the results of the four measurements to give a final reading.**

Dust Wipe Testing Mode Menu

When changing the position of the Dust Wipe Holder on its locator pegs, make sure the proper number shows through the square hole in the upper left corner.



Dust Wipe Holder Showing Position 1



Position 2



Position 3



Position 4

Figure 1-2. Dustwipe Holder Showing Four Measurement Positions

Reading The Measurement and Final Results Screens

The Measurement screen is continually updated during each test. When each test is terminated, the screen will update one final time and store the results for future review or downloading. After the fourth step of the test sequence is complete, the Final Results screen will appear.

When the four measurements are complete, the instrument automatically averages the results to yield the average loading in $\mu\text{g}/\text{wipe}$. These results are displayed on the Final Result screen. (Note that [Figure 1-3](#) and [Figure 1-4](#) show multiple elements measured on a dust wipe sample. NITON 300 Series Analyzers will only display results for Pb.)

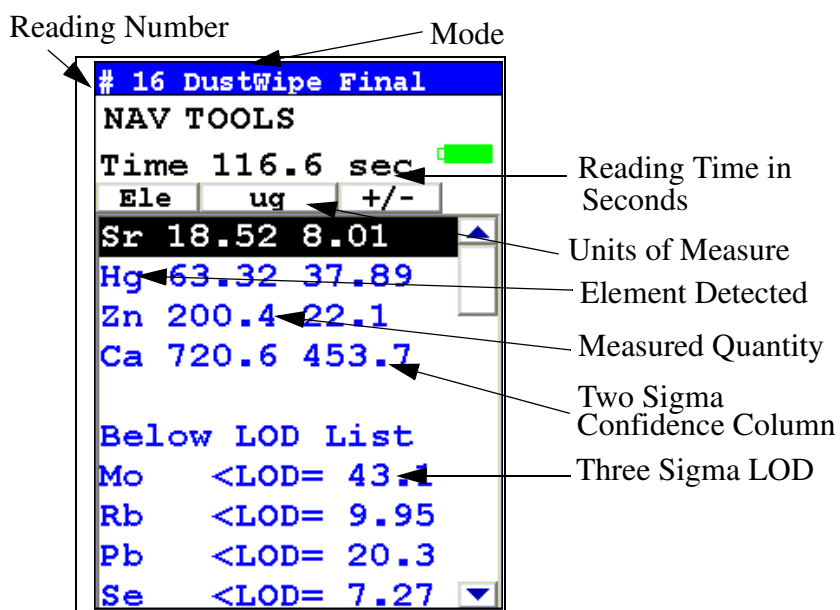


Figure 1-3. Reading the Final Results Screen

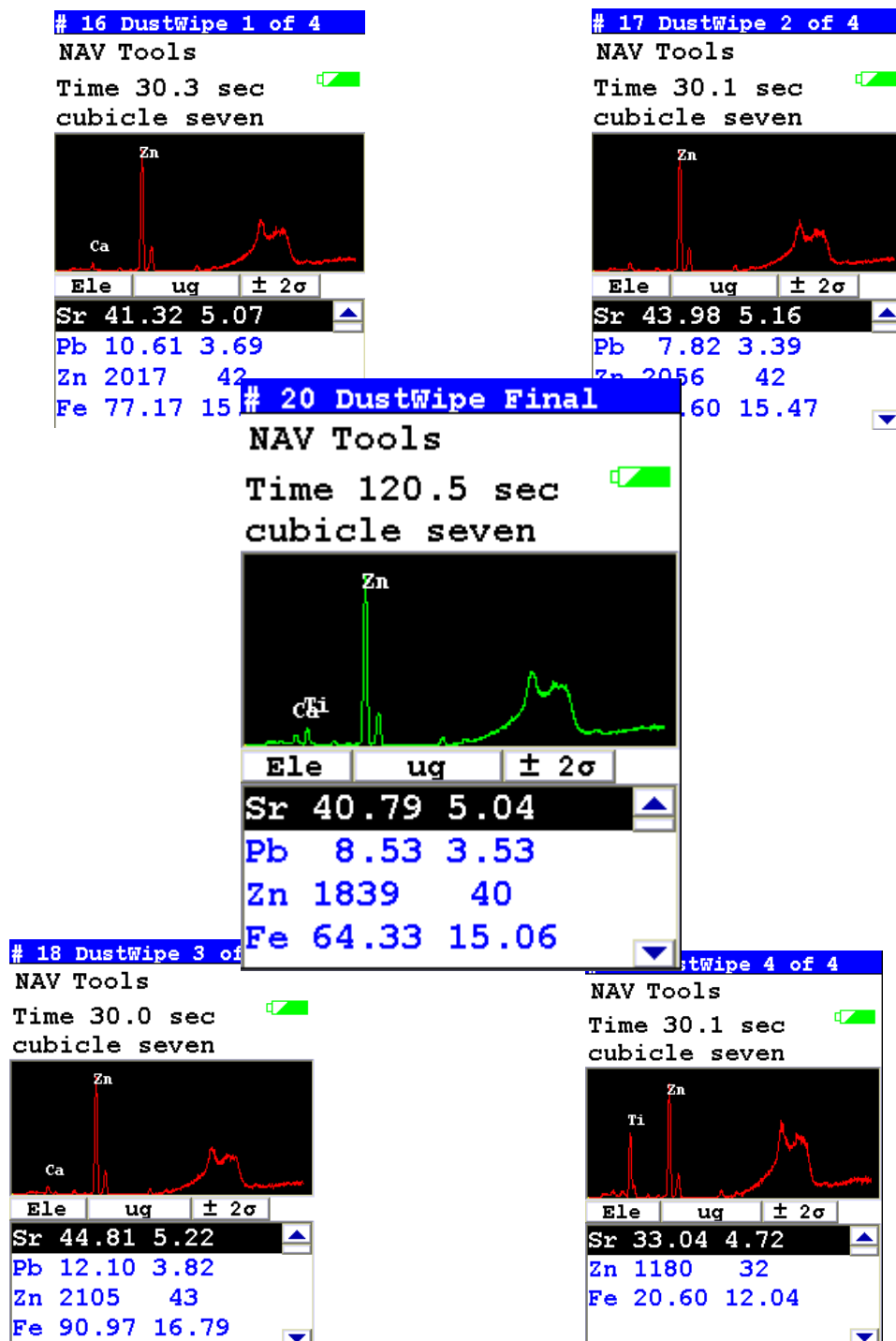


Figure 1-4. All Five Dustwipe Reading Screens

37mm Testing Mode Menu

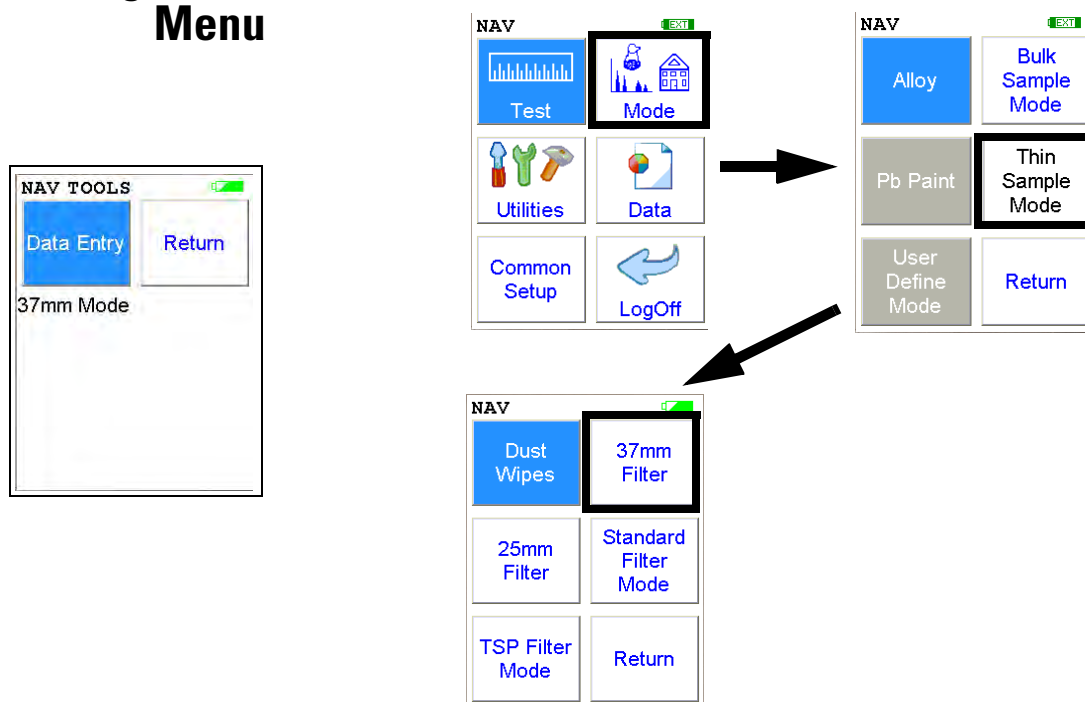


Figure 1-1. 37mm Testing Mode Menu Path

From the **37mm Testing Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **37mm Testing Menu** to go to the “[The Data Entry Screen](#)” on [page 1-48](#), to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

Preparing a filter

37 mm filters are often used for monitoring personal exposure. Dust vacuum measures (DVM) use the same size filters and are tested in much the same way. To prepare the filter for testing, remove it from the air-sampling cassette and load it in the correct sized filter sleeve. The filter sleeve consists of a thin piece of cardboard sandwiched between two layers of plastic film. The circular cutout in the cardboard should be slightly larger in diameter than the filter.

Note To avoid contaminating the test results, wear clean surgical gloves when handling the filter. If using tweezers or forceps to handle the filter, make certain they are clean, and never reuse a filter sleeve. ♦

1. On a clean surface, take a filter sleeve and peel back the top layer of film.
2. Remove the bottom plug from the air sampling cassette. Separate the sections of the cassette so you can reach the filter.
3. Poke both the filter and filter pad through the outflow plug hole of the cassette, to release them from their seat in the cassette.
4. Touching only the edges of the filter and the pad, gently separate one from the other.
5. Lift the filter from the cassette and place it on the sleeve in the cutout. Be careful not to have the filter touch the paper mounting of the sleeve, as the light adhesive that holds the plastic in place may rip the filter.
6. Fold back the clear plastic of the filter sleeve, covering the filter. A little wrinkling of the plastic is acceptable.

Note It is advisable to practice mounting several blank filters prior to mounting your first test sample. ♦

Positioning the 37 mm Filter and Performing a Test.

Note Make certain to place the filter stand on a flat stable surface. Be careful to work on a surface which will not contaminate the test fixtures or samples. ♦

Following the procedure below will assure that your analyzer measures the entire area of the filter:

1. Position the sample on the number one position of the metal 37mm Sample Holder (P/N 187-1432) in the test stand.
2. Position the instrument in the nose cone adaptor of the test stand, close the lid, and initiate the first measurement using NDTr. See the NDT Manual for details.

3. Open the lid, place the sample on the number two position of the 37mm sample holder in the test stand. Close the lid, and initiate the second measurement using NDTr.
4. Open the lid, place the sample on the number three position of the 37mm sample holder in the test stand. Close the lid, and initiate the third measurement using NDTr. Your analyzer will then average the results of the three measurements to give a final reading.

When changing the position of the sample on the locator pegs of the 37mm Sample Holder, make sure the proper number shows in the lower left corner.



37mm Sample Holder



Position 1



Position 2



Position 3

Figure 1-2. The 37mm Sample Holder Showing All Three Sample Positions

The instrument will automatically calculate the contaminant loading, in μg , after the three readings have been completed.

Reading The Measurement Screen in 37mm Testing Mode

The Measurement screen is continually updated during each test. When each test is terminated, the screen will update one final time, display the phrase Final Results, and store the results for future review or downloading. 37mm Testing Mode reports in units of μg of loading on the filter. Using the volumetric flow rate and air sampling time, the results can be converted to $\mu\text{g}/\text{m}^3$ concentrations off line.

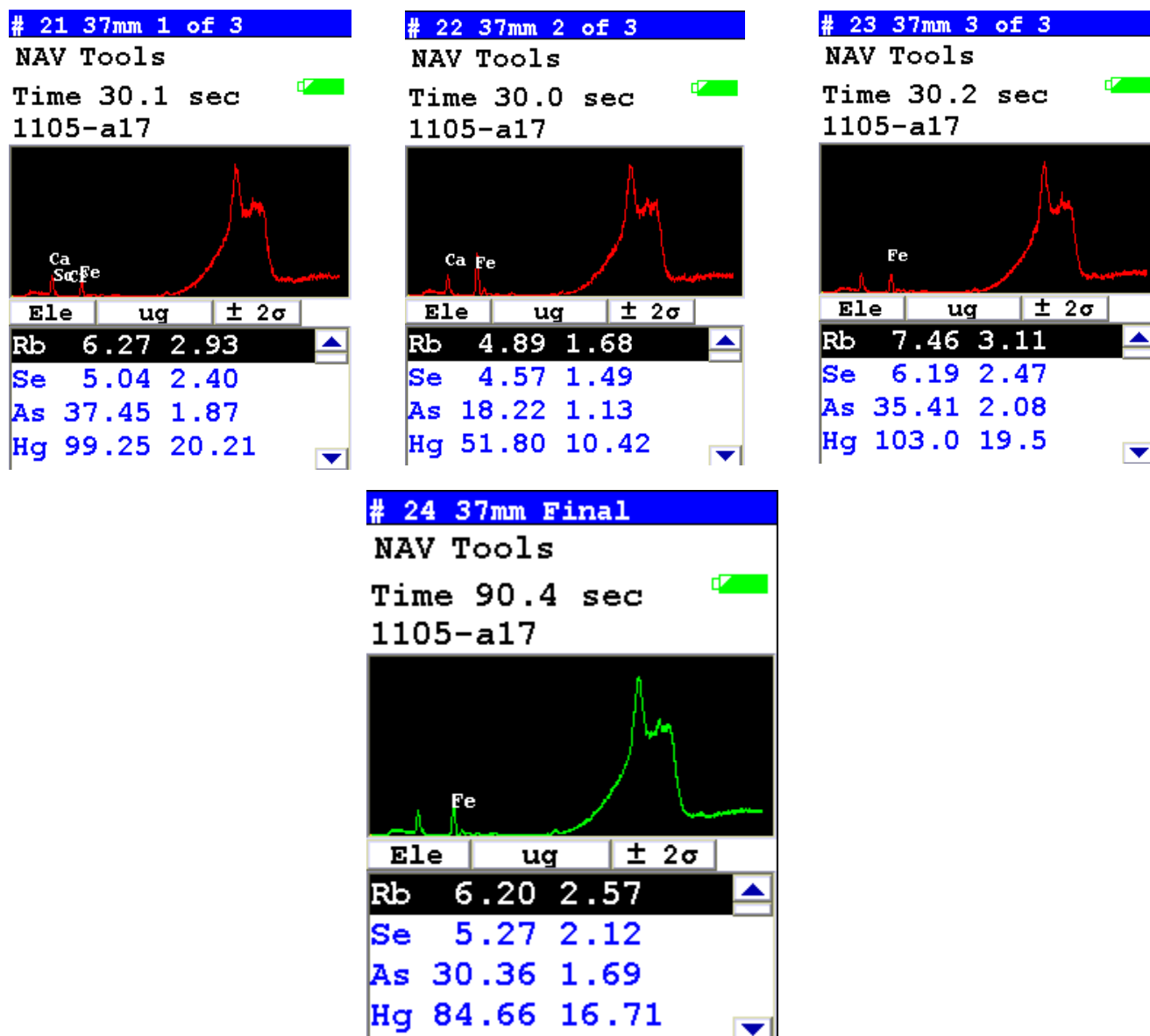


Figure 1-3. All Four 37mm Reading Screens

Note Thermo Scientific considers the sample to be the filter only, and not the sampler itself, so the values obtained by this method may be considered minimum estimates only, especially if the cassette overloaded and residue is left behind when the filter is removed. ♦

37mm Testing Mode Menu

25mm Testing Mode Menu

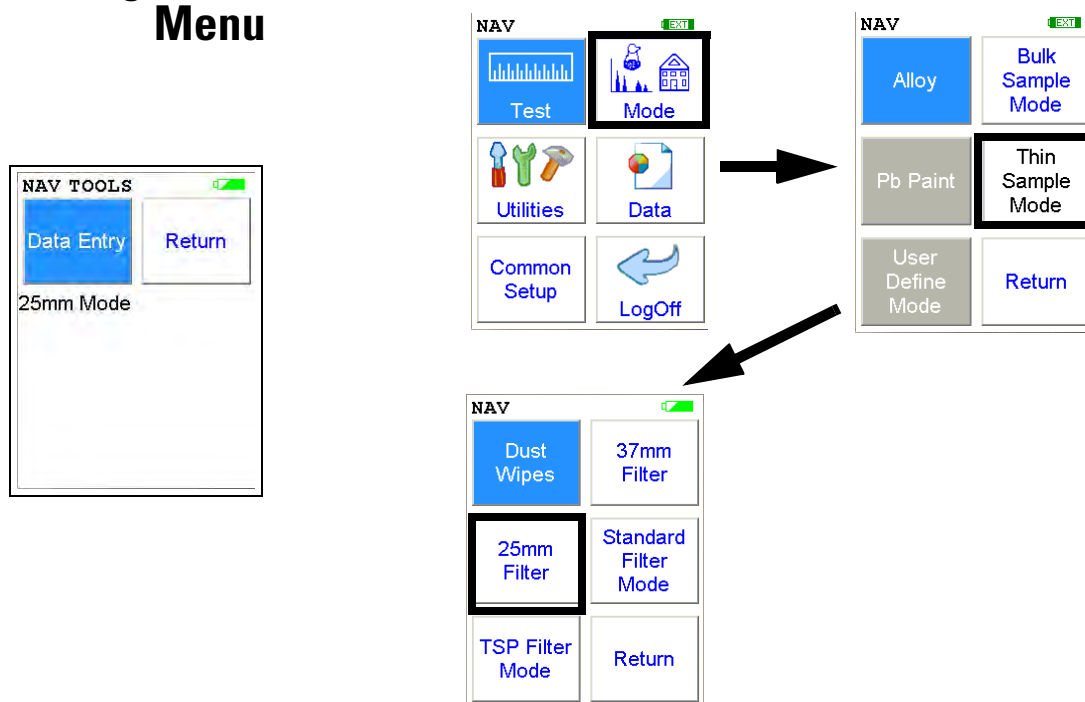


Figure 1-1. 25mm Testing Mode Menu Path

From the **25mm Testing Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **25mm Testing Menu** to go to the “[The Data Entry Screen](#)” on [page 1-48](#), to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

Preparing a filter

25 mm filters are often used for monitoring personal exposure. Dust vacuum measures (DVM) use the same size filters and are tested in much the same way. To prepare the filter for testing, remove it from the air-sampling cassette and load it in a the correct sized filter sleeve. The filter sleeve consists of a thin piece of cardboard sandwiched between two layers of plastic film. The circular cutout in the cardboard should be slightly larger in diameter than the filter.

Note To avoid contaminating the test results, wear clean surgical gloves when handling the filter. If using tweezers or forceps to handle the filter, make certain they are clean, and never reuse a filter sleeve. ♦

1. On a clean surface, take a filter sleeve and peel back the top layer of film.
2. Remove the bottom plug from the air sampling cassette. Separate the sections of the cassette so you can reach the filter.
3. Poke both the filter and filter pad, through the outflow plug hole of the cassette, to release them from their seat in the cassette.
4. Touching only the edges of the filter and the pad, gently separate one from the other.
5. Lift the filter from the cassette and place it on the sleeve in the cutout. Be careful not to have the filter touch the paper mounting of the sleeve, as the light adhesive that holds the plastic in place may rip the filter.
6. Fold back the clear plastic of the filter sleeve, covering the filter. A little wrinkling of the plastic is acceptable.

Note It is advisable to practice mounting several blank filters prior to mounting your first test sample. ♦

Positioning the 25 mm Filter and Performing a Test.

Note Make certain to place the filter stand on a flat stable surface. Be careful to work on a surface which will not contaminate the test fixtures or samples. ♦

1. Remove the drawer from the test platform. Verify that the adaptor for holding 25 mm filters is in place. Insert the filter sleeve with the filter to be tested in position one of the adaptor, and slide the drawer back into the test stand.
2. Select the Thin Sample Mode Select menu, and then choose 25mm CE Filters icon
3. Position the instrument in the nose cone adaptor and initiate the first reading.

The instrument will automatically calculate the contaminant loading, in mg, after the reading has been completed.

Reading The Measurement Screen in 25mm Testing Mode

The Measurement screen is continually updated during the test. When the test is terminated, the screen will update one final time, display the phrase Final Results, and store the results for future review or downloading. 25mm Testing Mode reports in units of μg of loading per filter, and using the volumetric flow rate and airsampling time, the results can be converted to $\mu\text{g}/\text{m}^3$ concentrations off-line.

# 21 25mm Final		
NAV TOOLS		
Time 30.4 sec 		
Ele	ug	+/-
Mo	35.95	8.53
Se	19.23	1.44
As	29.43	2.99
Hg	148.4	11.3
Zn	126.6	8.8
Co	25.99	4.00
Fe	87.40	11.02
Below LOD List		
Sr	<LOD= 3.95	

Figure 1-2. 25mm Final Results Screen

Note Thermo Scientific considers the sample to be the filter only, and not the sampler itself, so the values obtained by this method may be considered minimum estimates only, especially if the filter is overloaded and residue is left behind when the filter is removed. ♦

25mm Testing Mode Menu

Standard Testing Mode Menu

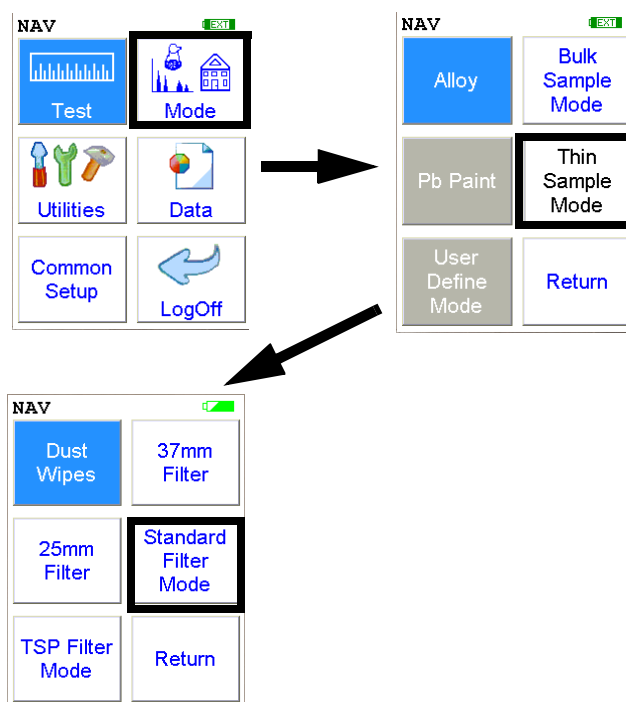
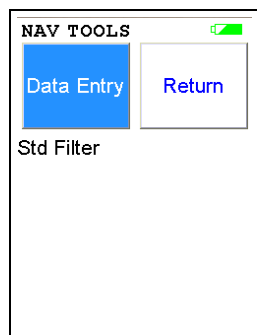


Figure 1-1. Standard Testing Mode Menu Path

From the **Standard Testing Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **Standard Testing Menu** to go to the “[The Data Entry Screen](#)” on [page 1-48](#), to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

You should use Standard Thin Sample Mode to test thin samples that have uniform contamination or deposition. These include many filters for liquids and gases, various types of coatings, and the leaves of plants. Operators who want to make a single measurement and obtain a result in units of $\mu\text{g}/\text{cm}^2$ should use Standard Thin Sample Mode.



CAUTION Standard Thin Sample Mode should not be used for quantitative lead-paint testing. Use only the three Paint Testing modes to test lead-based paint. ♦

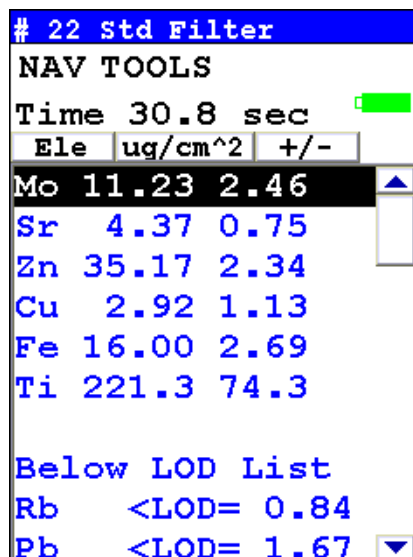
In Standard Thin Sample Mode, each measurement is a separate test. For this reason, there is no Final Result screen in this mode. The results of each test are given in $\mu\text{g}/\text{cm}^2$ for up to 14 elements.

Note Testing coatings and paints with Standard Thin Sample Mode may yield lower-than-actual results. The penetration depth of the measurement is highly dependent on the composition of the sample. ♦

Note Standard Thin Sample Mode does not correct for shielding caused by the presence of overlaying coatings. Thus, for coatings testing, the results should be viewed as the minimum amount of contaminants present. If an element is not detected, it may be that the element is present but entirely shielded by overlaying coatings. ♦

Reading The Measurement Screen in Standard Thin Sample Mode

The Measurement screen is continually updated during the test. When the test is terminated, the screen will update one final time, display the phrase Final Results, and store the results for future review or downloading. Standard Thin Sample Mode reports in units of $\mu\text{g}/\text{cm}^2$



# 22 Std Filter		
NAV TOOLS		
Time 30.8 sec		
Ele	$\mu\text{g}/\text{cm}^2$	+/-
Mo	11.23	2.46
Sr	4.37	0.75
Zn	35.17	2.34
Cu	2.92	1.13
Fe	16.00	2.69
Ti	221.3	74.3
Below LOD List		
Rb	<LOD= 0.84	
Pb	<LOD= 1.67	

Figure 1-2. The Final Reading Screen for Standard Thin Sample Mode

For more information on this feature, please contact NITON's Customer Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 or your local Authorized NITON Analyzers Service Center.

TSP Filter Mode Menu

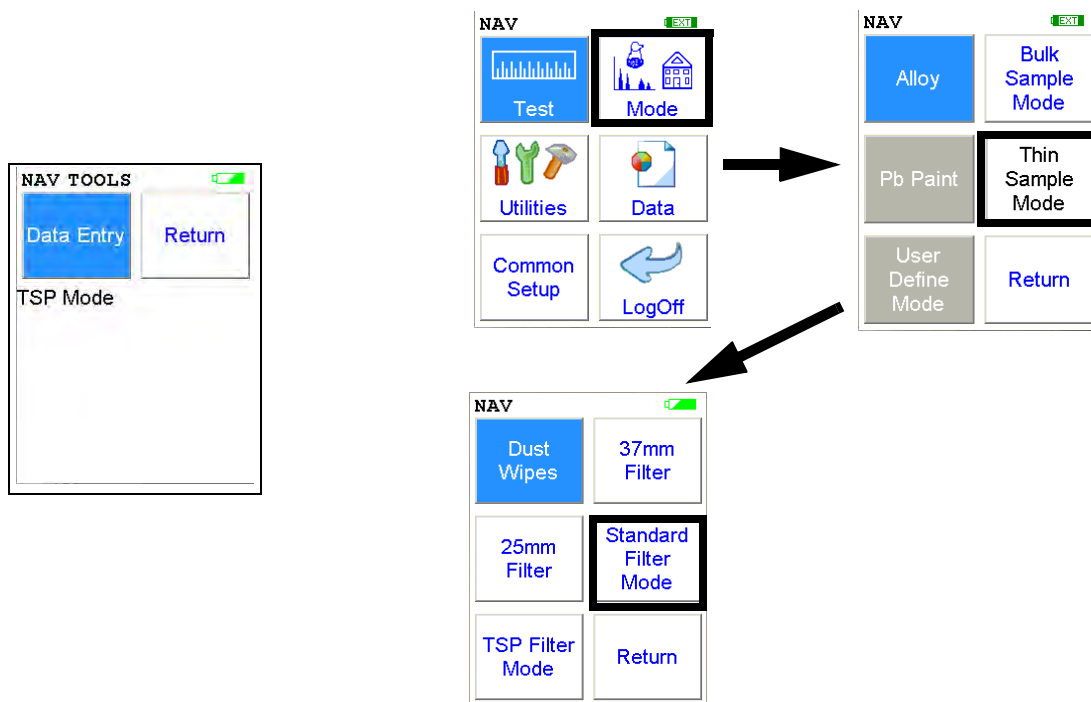


Figure 1-1. TSP Filter Mode Menu Path

From the **TSP Filter Testing Menu**, you can immediately initiate a sample test using the proper preconditions for operation, enter data about your sample using the **Data Entry** icon, or return to the **Main Menu**.

Select the **Data Entry** icon from the **TSP Filter Testing Menu** to go to the “[The Data Entry Screen](#)” on [page 1-48](#), to input data about the sample which you are testing. The data you enter will be associated with the next sample you test.

TSP and PM10 filters are generally used with high volume air sampler systems to monitor ambient air at lead abatement sites, construction sites, and other places where airborne particulate matter is a problem.

Note To avoid contaminating the test results, wear clean surgical gloves when handling the filter. If using tweezers or forceps to handle the filter, make certain they are clean. ♦

1. **Preparing a filter and performing a test**
2. **Mentally divide the filter into 4 quadrants.**

3. Select the Thin Sample Mode menu, and then choose the TSP Filters icon
4. Take your first reading approximately in the center of any quadrant.
5. Take your second reading from approximately the middle of the quadrant diagonally opposite from where you took your first reading.

Note Be careful to work on a surface which will not contaminate the test fixtures or samples. ♦

The instrument will automatically calculate the contaminant loading, in micrograms, after the reading has been completed.

Reading The Measurement Screen in TSP Filter Mode

The Measurement screen is continually updated during each test. When each test is terminated, the screen will update one final time, display the phrase Final Results, and store the results for future review or downloading. TSP Filter Testing Mode reports in units of micrograms of loading, and, using the volumetric flow rate and airsampling time, the results can be converted to micrograms per volume.

# 24 TSP 1 of 2			
NAV TOOLS			
Time 30.7 sec			
Ele	ug	+/-	
Mo 5006	967		
Sr 1704	290		
Zn 16.2K	1.0K		
Cu 2613	527		
Fe 9022	1175		
Below LOD List			
Rb	<LOD= 324.		
Pb	<LOD= 656.		
Se	<LOD= 244.		

# 26 TSP Final			
NAV TOOLS			
Time 61.5 sec			
Ele	ug	+/-	
Mo 4444	975		
Sr 1690	293		
Zn 15.7K	1.0K		
Cu 1516	465		
Fe 8031	1141		
Below LOD List			
Rb	<LOD= 326.		
Pb	<LOD= 697.		
Se	<LOD= 251.		

Figure 1-2. The Final Reading Screen for TSP Filter Mode

Note Thermo Scientific considers the sample to be the filter only, and not the sampler itself, so the values obtained by this method may be considered minimum estimates only. ♦

TSP Filter Mode Menu

Analyzing Thin Samples



CAUTION After being powered on, your NITON Series Analyzer will perform an internal re-calibration before an analysis is initiated. It is recommended that you let your instrument warm up for ten minutes after start up, before testing is begun. ♦

There are six different methods of operation for taking a sample measurement, and your analyzer will be configured to use one of those methods, depending on the regulatory requirements of your locality. These methods are:

- **Trigger-Only method.** With the Trigger-Only method, you only need to place the measurement window close to the sample to be analyzed and pull the trigger for sample analysis to be initiated.
- **Trigger-and-Proximity-Sensor method.** With the Trigger-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the instrument, then pull the trigger for sample analysis to be initiated.
- **Momentary-Trigger-Touch-and-Proximity-Sensor method.** With the Momentary-Trigger-Touch-and-Proximity-Sensor method, you must place the measurement window against the surface to be analyzed to engage the proximity sensor on the front of the instrument, then pull the trigger.
- **The trigger may be released and the reading will continue until you release the proximity button, or other criteria (such as Max Time) are reached.**
- **Trigger-and-Interlock method.** With the Trigger-and-Interlock method, you need to place the measurement window close to the sample to be analyzed, press and keep pressing the interlock button at the rear of the instrument with your free hand, then pull the trigger for sample analysis to be initiated.
- **Trigger-Interlock-and-Proximity-Sensor method.** With the Trigger-Interlock-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the instrument, press and keep pressing the interlock button at the rear of the instrument with your free hand, then pull the trigger for sample analysis to be initiated.

- **Easy Trigger method.** With the Easy trigger method, you need only place the measurement window against the sample area and pull the trigger once to initiate a sample analysis. Your analyzer will continuously sample the backscatter, using a complex internal algorithm, to determine if the measurement window is against a sample or pointing to the empty air. If it finds that there is no sample directly against the measurement window, the analyzer will stop directing radiation through the window as soon as this determination is made.

Note The analyzer is constantly checking the backscatter characteristics to determine if a sample is against the measurement window, whether or not the Easy Trigger method is being used, and will shut off any radiation directed through the window if it determines that there is no sample present. ♦

With any of these methods, analysis will stop if any one of the preconditions are violated. For example, with the Trigger-Interlock-and-Proximity-Sensor method, if the trigger or the Proximity Sensor or the Interlock is released, the reading will stop immediately, and the shutters will close, and the X-ray tube will shut down.

After your NITON analyzer is calibrated, initiate a sample reading using the appropriate method. If you attempt to initiate a sample reading using a different method, the analyzer will inform you that one or more of the preconditions need to be met in order for sample analysis to begin.

Initiate the proper preconditions for operation to turn on the x-ray tube, open the calibration shutter, and begin a measurement. Although the three LED lights will begin to flash as soon the initiating preconditions are met, as a safety precaution, the x-ray tube will not turn on immediately, and no reading will begin for approximately 0.5 seconds.



WARNING! The preconditions for operation must be continued for the duration of the reading. If the preconditions are violated, the x-ray tube will turn off, the calibration shutter will close, and the measurement will end. The four LED lights will stop blinking when the measurement is ended. The flashing of the LED lights is not synchronized to minimize power consumption. ♦

To end the test, simply release the trigger mechanism, or any other applicable preconditions.



WARNING! When all four LED lights are blinking, the x-ray tube is on. This should only occur during a measurement, while the preconditions for operation are met. On startup, the front pair of lights will blink. If the LED lights blink at any other time, disconnect the battery pack and call Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or your local Authorized NITON Analyzer Service Center. ♦

Your NITON Analyzer will display the Results Screen throughout the duration of each reading. The Results Screen is updated regularly throughout the reading. When the reading is complete, a final screen update will appear, and your NITON analyzer will display the final results of the measurement which has just been completed.



WARNING! Do not attempt to take measurements while downloading readings! This will generate an error requiring a system reset, and may corrupt your stored readings, requiring all stored readings to be erased. ♦

The Data Entry Screen

The **Data Entry Screen** is accessed whenever you select the **Data Entry** icon from any screen. This screen allows you to input data in several different fields, or categories, concerning your sample, in several different ways:

- By selecting the Virtual Keyboard button and typing the parameter in using the **Virtual Keyboard**.
- By creating a new, or editing your analyzer's existing, '.ndf' file through the NDT program. You can then select from the various custom options you have created using the Drop-down List button.

These fields are saved along with the subsequent reading, and allow you to associate important information about the sample directly with the reading, so that you have a full description of the sample tied into the reading itself.

Once you have input data into a field, that information carries over into the next reading, so that you only have to input the information that has changed since the last reading. For example, if you are analyzing several samples of a particular lot, you only need to input the lot information once during that series of readings, changing only the sample name.

The screenshot shows the 'Data' screen with a blue header. Below the header is a section titled 'NAV Tools'. There are five main input sections, each with a label in a black box and a corresponding input field. To the right of each input field are two buttons: a 'Virtual Keyboard Button' (represented by a keyboard icon) and a 'Drop-down List Button' (represented by a downward arrow icon). The sections are labeled 'SAMPLE', 'LOCATION', 'INSPECTOR', 'CONDITION', and 'TYPE'. Arrows point from the labels on the right to the corresponding buttons on the screen.

Figure 1-1. The Data Entry Screen - First page

This is the first section of the **Data Entry Screen**. There are five parameters in this section.

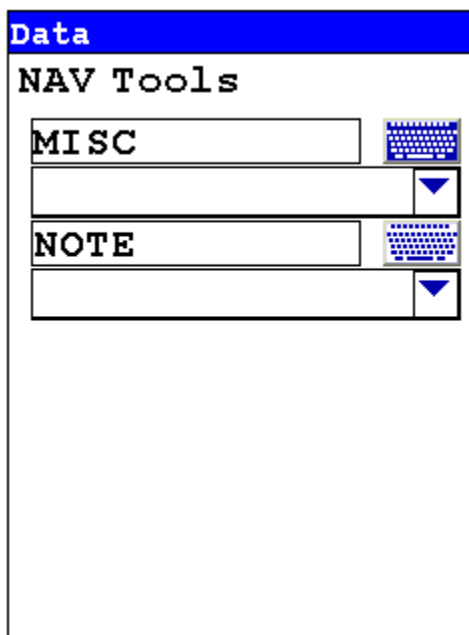
Selecting **Sample** allows you to input the sample name parameter

Selecting **Location** allows you to input the particular Location information, if known

Selecting **Inspector** allows you to input the parameter for the Inspector's name.

Selecting **Condition** allows you to input information on the sample's Condition.

Selecting **Type** allows you to input information on the sample's Type.



The screenshot shows a software interface titled "Data" in a blue header bar. Below the header, the text "NAV Tools" is displayed. There are two main input sections. The first section is labeled "MISC" and contains a text input field followed by a small keyboard icon and a dropdown arrow. The second section is labeled "NOTE" and contains a text input field followed by a small keyboard icon and a dropdown arrow. The interface is simple with a white background and black text.

This is the second section of the **Data Entry Screen**. There are two parameters in this section.

Selecting **Misc** allows you to input miscellaneous parameter

Selecting **Note** allows you to input any note information, if you wish.

Selecting Data Entry from View Data Mode

You can select Data Entry from the NAV Menu while in View Data Mode, but the ability to edit or enter data is disabled. The screen will show the data already entered, with no buttons for drop down menu selection or Virtual Keyboard.

Data	
NAV Tools	
SAMPLE	***** XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX
12245-04-21-08	▼
LOCATION	***** XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX
WEST elm RENOVATION	▼
INSPECTOR	***** XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX
mike SHIRLEY	▼
CONDITION	***** XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX
GOOD	▼
TYPE	***** XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX XXXXXXXXXX
25mm	▼

Figure 1-2. Data Entry Screen while Viewing Data

Navigating the Data Entry Screen



Figure 1-3. The Control Panel

The following description of screen navigation using the control panel assumes that the analyzer is held so that the display is held upright as in [Figure 1-3](#).

- To move from column to column, use the Right and Left portion of the 4-way touch pad.
- To move from row to row, use the Up and Down portions of the 4-way touch pad.
- To select the highlighted option, press the Enter button on the control panel.

The **Data Entry Screen** is divided into sections of 5 setting parameters. By using the Down portion of the 4-way touch pad when you are on the last row of a section, the display will change to the next section. By using the Up portion of the 4-way touch pad when you are on the first row of a section, the display will change to the previous section.

By selecting the **On/Off** button, you can exit the **Data Entry Screen**.

The Virtual Keyboard

Data Entry									
plaque									
1	2	3	4	5	6	7	8	9	0
q	w	e	r	t	y	u	i	o	p
a	s	d	f	g	h	j	k	l	-
z	x	c	v	b	n	m	.	shift	
backspace			space		clr		return		

Figure 1-4. Lower Case Virtual Keyboard

Data Entry									
RANDOM									
!	@	#	\$	%	^	&	*	(	)
Q	W	E	R	T	Y	U	I	O	P
A	S	D	F	G	H	J	K	L	_
Z	X	C	V	B	N	M	,	shift	
backspace			space		clr		return		

Figure 1-5. Upper Case Virtual Keyboard

The Virtual Keyboard is an alphanumeric keyboard which appears on the LCD Touch Screen Display. You can use the Virtual Keyboard either with the four-way touch pad and control panel buttons, or using the touch screen display directly.

At the top of the screen is the data field you are entering data into, in this case "A1234567890A". Also in this field is the underscore cursor, which graphically shows where the next character will be placed. Up to 25 characters can be stored in the data fields, though only the first 15 will be displayed on the analyzer's touch screen.

Next is the Virtual Keyboard itself, with numbers 0-9, letters A-Z, the special characters *, <, >, and -, and the Shift key, to toggle between upper and lower case keyboards.

Last is the control key line. This contains the keys for Return, Space, Clr, and Backspace. The Return key will enter the data and return you to the Data Entry Screen, the Backspace key will delete the last entered character, the Space key will insert a space at the cursor position, and the Clr screen button will clear the data you have entered.

Since the **Virtual Keyboard** is oriented 90 degrees from the standard in order to use a landscape display, the down portion of the 4-way touch-pad will select the key to the right of the current position, the left portion will select the key immediately below, the up portion will select the key to the left, and the right portion will select the key immediately above. Use the Select and Enter button to enter the currently selected key.

All screen areas can be directly accessed using the LCD Touch Screen by touch.

The Measurement Screen

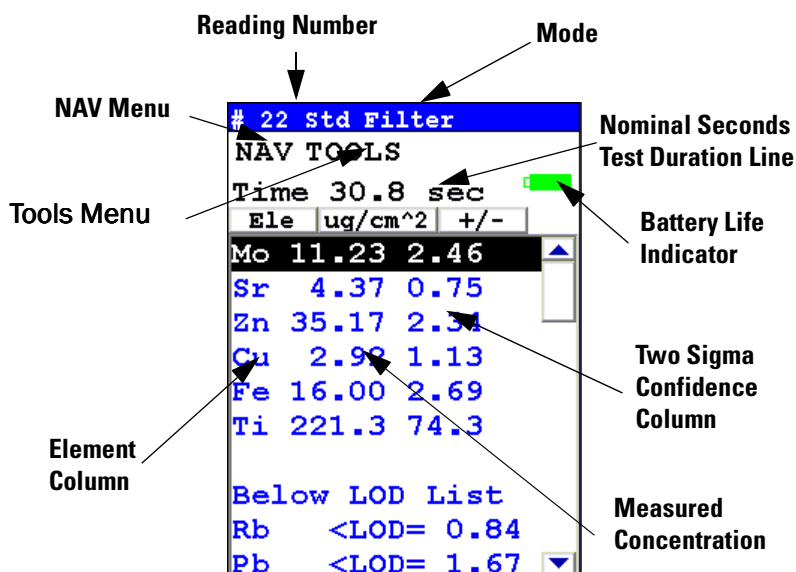


Figure 1-6. The Standard Filter Measurement Screen

The Results Screen displays the following information:

- The Reading Number line shows a number automatically assigned by your NITON analyzer in order to uniquely identify each reading. The reading number automatically increments up by one with each successive reading.
- The Nominal Seconds Test Duration line shows the number of nominal seconds elapsing since the initiation of the reading. Nominal seconds are true, clock seconds slowed down to compensate for the electronic dead-time that occurs when the analyzer is taking a measurement.
- The Mode line displays the test mode in use during the measurement.
- The **Element** (left) column shows the elements that have been detected in the sample.
- The **Concentration Level** (central) column shows the concentration levels of the corresponding elements in percentages.

- The **Confidence** (right) column displays the 2 sigma (95%) confidence interval for the corresponding elements. Elements with atomic number greater than iron do not exceed several percent

The Measurement Screen

Standard Soil Mode

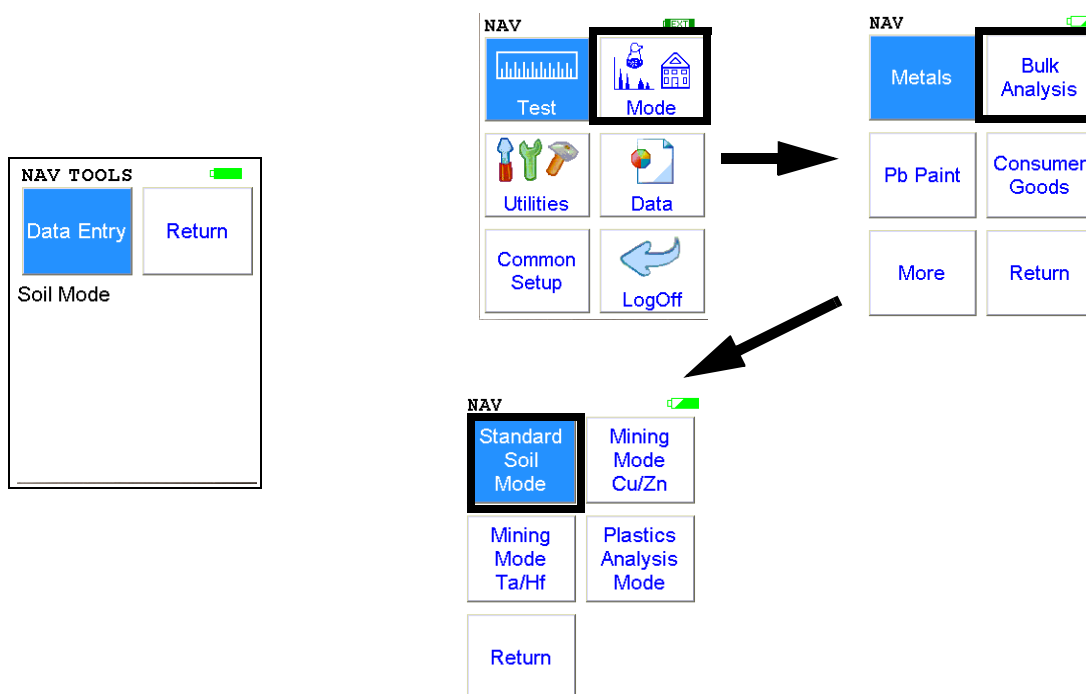


Figure 1-1. Standard Soil Mode Menu Path

To use the **Standard Soil Mode**, simply select the **Standard Soil Mode** icon from the **Bulk Analysis Menu** to place your instrument into **Standard Soil Mode**. Use the **Standard Soil Mode** if:

- The percentage of the elements of interest are <1.0%
- The material is of a light matrix, for example aluminum silicate
- Elements with atomic number greater than iron do not exceed several percent

This mode of operation is optimum for any sample whose elements of interest are present at less than 1%. **Standard Soil Mode** utilizes the Compton Scatter (Inelastic Collisions) of a particular sample. Compton scatter occurs when primary X-rays do not cause fluorescence but instead collide with the atoms of the sample. The Compton Scatter that occurs is directly proportional to the density (average atomic number (Z)) of the sample. A light matrix material, such as an oil or sand, will have a much greater scatter than that of a heavy matrix, such as ore. The analyzer measures this scatter peak and automatically adjusts the concentration based on the matrix of the material and allows for the analysis of a bulk sample without the use of site

specific calibration standards. This mode is used chiefly for the analysis of contaminants in soils.

Standard Soil Mode

NITON provides three soil standards: Lead high, Lead medium, and Lead low, to check the calibration of the instrument when testing in **Standard Soil Mode**.

Note Although the standards do not contain every element that the Environmental Analyzer is capable of testing, when an instrument correctly measures the standards you have received with your instrument, your instrument will correctly measure all other elements.

Test the standards regularly. NITON recommends testing immediately after the instrument finishes self-calibration. Test the standard samples appropriate to the type of tests you are conducting, and once every 1–2 hours thereafter.

Note For defensible Quality Control, keep a record of the time and precision of every calibration.



WARNING! Tampering with the 5,500 ppm (lead high) lead-in-soil standard may cause exposure to lead dust. Keep all standards out of the reach of children.



CAUTION Never tamper with Test Standards. They should not be used unless they are completely intact.

During each test, the instrument looks at the full range of x-ray spectrum and continuously corrects for cross-element interference.

The Measurement Screen

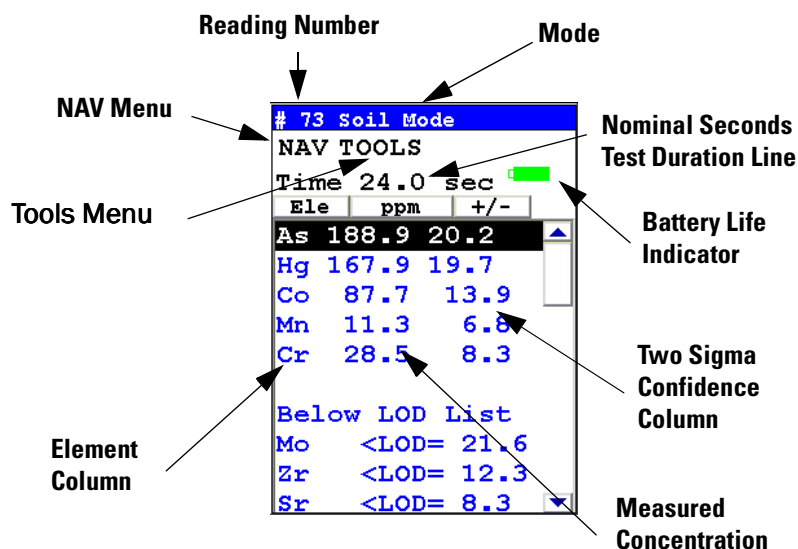


Figure 1-2. The Standard Bulk Measurement Screen

At the top are the elements detected in the sample, and underneath this, elements that are below the detection limit.

Use the 4 way touch pad or touch screen to scroll through the elements.

Detection Limit

For an element to be detected by your analyzer in a given sample, the measured concentration of the sample must be at least three times the standard deviation of the measurement. This detection limit will depend on the composition of the sample.

Precision

The measurement precision for each element displayed appears to the right of the measured concentration, under the heading “+/-”. The precision of each measurement is two times the standard deviation (sigma).

An element is classified as “detected” if the measured concentration (in ppm) is at least 1.5 times the precision. Detected elements are displayed in ppm, followed by the measurement precision. Non-detected elements are shown as < the detection limit for that sample. The detection limit for a given element varies depending on the other elements in the matrix.

The Measurement Screen

Analyzing Bulk Samples



CAUTION Whenever you turn on your NITON Analyzer after it has been off for more than 30 minutes, you should measure your check sample to assure proper operation. If the instrument is not reading properly, you should re-calibrate your NITON Analyzer's sample analysis electronics before you start to take readings. When the instrument is turned on after being off for more than 30 minutes, your NITON analyzer will require a 10 minute warm-up period before the instrument can be calibrated, unless this 10 minute warm-up period is manually overridden.

There are six different methods of operation for taking a sample measurement, and your analyzer will be configured to use one of those methods for soil samples, depending on the regulatory requirements of your locality. These methods are:

- **Trigger-Only method.** With the Trigger-Only method, you only need to place the measurement window close to the sample to be analyzed and pull the trigger for sample analysis to be initiated.
- **Trigger-and-Proximity-Sensor method.** With the Trigger-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the instrument, then pull the trigger for sample analysis to be initiated.
- **Momentary-Trigger-Touch-and-Proximity-Sensor method.** With the Momentary-Trigger-Touch-and-Proximity-Sensor method, you must place the measurement window against the surface to be analyzed to engage the proximity sensor on the front of the instrument, then pull the trigger. The trigger may be released and the reading will continue until you release the proximity button, or other criteria (such as Max Time) are reached.
- **Trigger-and-Interlock method.** With the Trigger-and-Interlock method, you need to place the measurement window close to the sample to be analyzed, press and keep pressing the interlock button at the rear of the instrument with your free hand, then pull the trigger for sample analysis to be initiated.

- **Trigger-Interlock-and-Proximity-Sensor method.** With the Trigger-Interlock-and-Proximity-Sensor method, you must place the measurement window against the sample to be analyzed to engage the proximity sensor on the front of the instrument, press and keep pressing the interlock button at the rear of the instrument with your free hand, then pull the trigger for sample analysis to be initiated.
- **Easy Trigger method.** With the Easy trigger method, you need only place the measurement window against the sample area and pull the trigger once to initiate a sample analysis. Your analyzer will continuously sample the backscatter, using a complex internal algorithm, to determine if the measurement window is against a sample or pointing to the empty air. If it finds that there is no sample directly against the measurement window, the analyzer will stop directing radiation through the window as soon as this determination is made.

Note The analyzer is constantly checking the backscatter characteristics to determine if a sample is against the measurement window, whether or not the Easy Trigger method is being used, and will shut off any radiation directed through the window if it determines that there is no sample present.

With any of these methods, analysis will stop if any one of the preconditions are violated. For example, with the Trigger-Interlock-and-Proximity-Sensor method, if the trigger or the Proximity Sensor or the Interlock is released, the reading will stop immediately, and the X-ray tube will shut down.

After your NITON analyzer is calibrated, initiate a sample reading using the appropriate method. If you attempt to initiate a sample reading using a different method, the analyzer will inform you that one or more of the preconditions need to be met in order for sample analysis to begin. Initiate the proper preconditions for operation to turn on the x-ray tube, and begin a measurement. Although the four LED lights will begin to flash as soon the initiating preconditions are met, as a safety precaution, the x-ray tube will not turn on immediately, and no reading will begin for approximately 0.5 seconds.

Note The four LED lights will blink during calibration. ♦



WARNING! The preconditions for operation must be continued for the duration of the reading. If the preconditions are violated, the x-ray tube will turn off, the calibration shutter will close, and the measurement will end. The four LED lights will stop blinking when the measurement is ended. The flashing of the LED lights is not synchronized to minimize power consumption. ♦

To end the test, simply release the trigger mechanism, or any other applicable preconditions.



WARNING! When all four LED lights are blinking, the x-ray tube is on. This should only occur during a measurement, while the preconditions for operation are met. On startup, the front pair of lights will blink. If the LED lights blink at any other time, disconnect the battery pack and call Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or your local Authorized NITON Analyzer Service Center. ♦

Your NITON Analyzer will display the Results Screen throughout the duration of each reading. The Results Screen is updated regularly throughout the reading. When the reading is complete, a final screen update will appear, and your NITON analyzer will display the final results of the measurement which has just been completed.



WARNING! Do not attempt to take measurements while downloading readings! This will generate an error requiring a system reset, and may corrupt your stored readings, requiring all stored readings to be erased. ♦

The Data Entry Screen

The **Data Entry Screen** is accessed whenever you select the **Data Entry** icon from any screen. This screen allows you to input data in several different fields, or categories, concerning your sample, in several different ways:

- By selecting the Virtual Keyboard button and typing the parameter in using the **Virtual Keyboard**.
- By creating a new, or editing your analyzer's existing, '.ndf' file through the NDT program. You can then select from the various custom options you have created using the Drop-down List button.

These fields are saved along with the subsequent reading, and allow you to associate important information about the sample directly with the reading, so that you have a full description of the sample tied into the reading itself.

Once you have input data into a field, that information carries over into the next reading, so that you only have to input the information that has changed since the last reading. For example, if you are analyzing several samples of a particular lot, you only need to input the lot information once during that series of readings, changing only the sample name.

The screenshot shows the 'Data' screen with a blue header. Below the header is a section titled 'NAV Tools'. The main area contains five input fields, each with a label to its left and a button to its right. The labels are 'SAMPLE', 'LOCATION', 'INSPECTOR', 'COR 1', and 'COR 2'. The buttons are 'Virtual Keyboard' (represented by a keyboard icon) and 'Drop-down List' (represented by a downward arrow icon). Arrows point from the labels to the input fields, and from the buttons to the corresponding labels. A label 'Parameter Field Name' points to the 'SAMPLE' field, and a label 'Parameter Field' points to the 'INSPECTOR' field.

Figure 1-1. The Data Entry Screen - First page

This is the first section of the **Data Entry Screen**. There are five parameters in this section.

Selecting **Sample** allows you to input the sample name parameter.

Selecting **Location** allows you to input the particular Location information, if known.

Selecting **Inspector** allows you to input the parameter for the Inspector's name.

Selecting **Cor1** allows you to input information on the sample's origin Latitude Coordinate.

Selecting **Cor2** allows you to input information on the sample's origin Longitude Coordinate.

The screenshot displays a software interface titled "Data" in a blue header bar. Below the header, the text "NAV Tools" is visible. There are two main input sections. The first section is labeled "MISC" in a black box, followed by a white text input field and a small blue button with a downward arrow. The second section is labeled "NOTE" in a black box, followed by a white text input field and a similar blue button. To the right of each input field is a small icon of a document with a grid pattern.

This is the second section of the **Data Entry Screen**. There are two parameters in this section.

Selecting **Misc** allows you to input the any miscellaneous parameters.

Selecting **Note** allows you to input any Note information, if wanted.

Changing the Data Entry Screen to Two Column

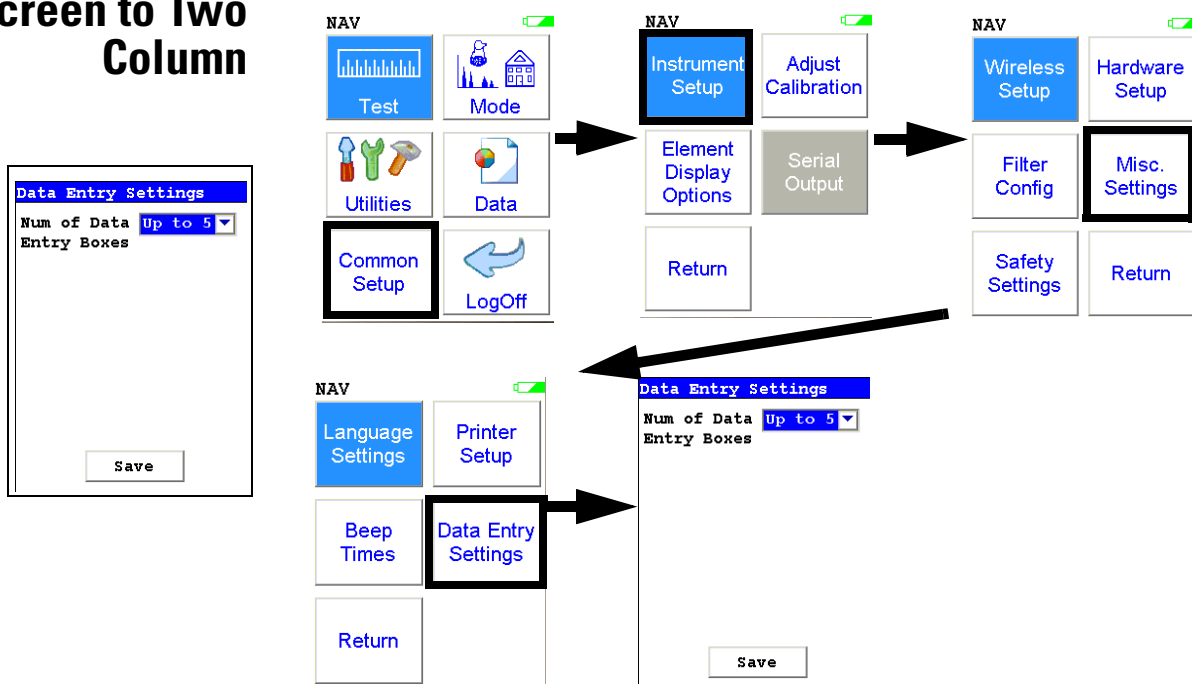


Figure 1-2. Data Entry Settings Menu Path

You can change the Data Entry display from the default single column to two columns in order to fit all the fields on one page, if you prefer. Select the Data Entry Settings icon from the Misc. Settings Menu to change your preferences.

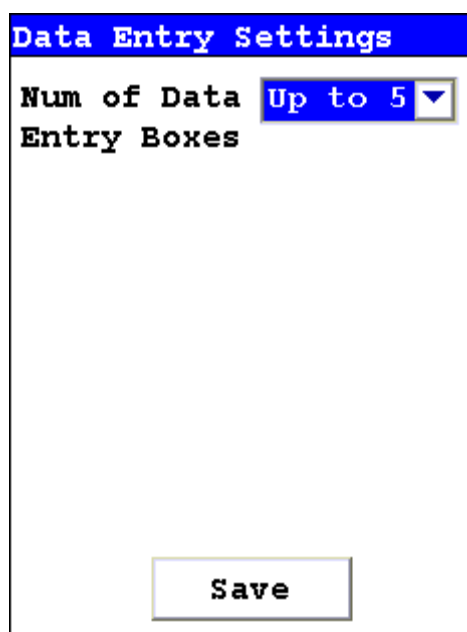


Figure 1-3. Data Entry Settings Screen

Selecting the triangle button to the side of the Num of Data Entry Boxes field will open a drop down menu. From this menu you can choose between showing up to five boxes per page, the default, and up to eight boxes per page. Select the option you prefer, and select the Save button to save the setting.

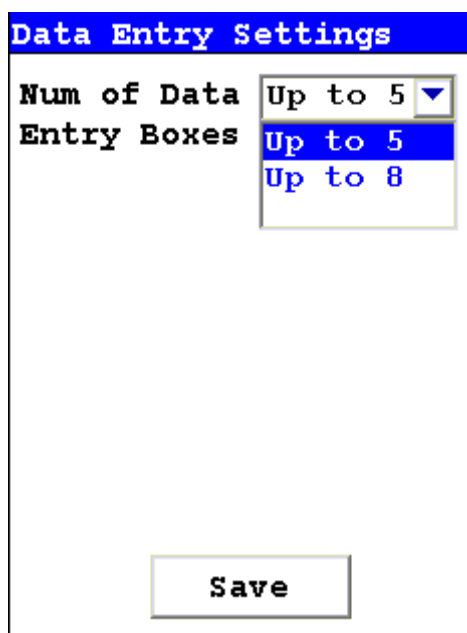


Figure 1-4. The Drop Down Menu

Under the default setting, a mode with more than five boxes will open up a second page to display the remaining boxes. Under the optional setting, a mode with up to eight boxes will display on one page, with the overflow page not opening unless there are nine or more Data Entry boxes.

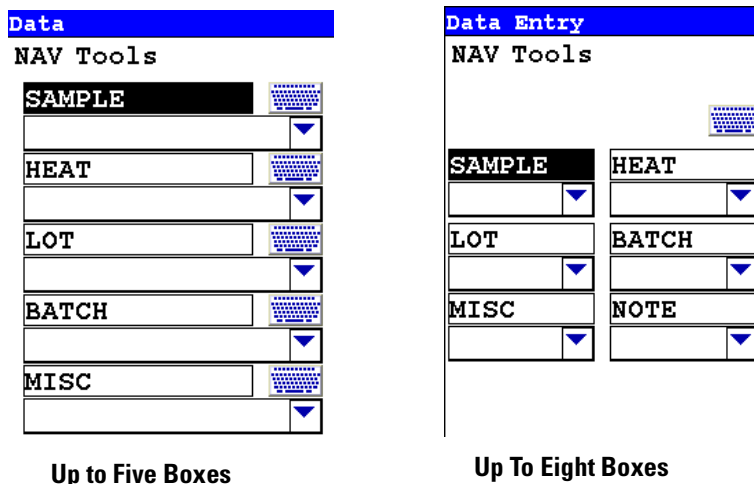
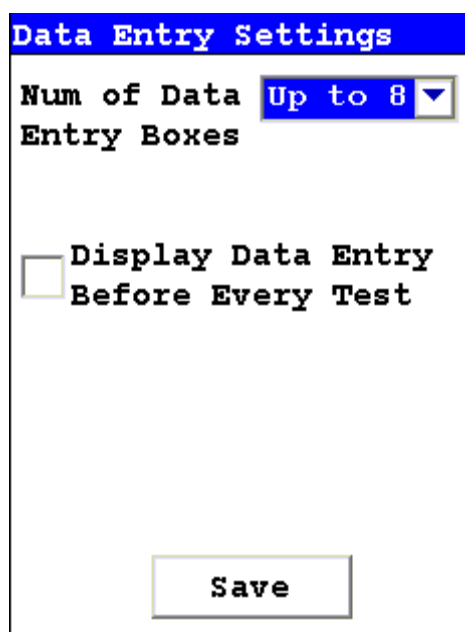


Figure 1-5. Comparing the Data Entry Display Options

With the default, up to five boxes, setting, the boxes are longer, and can display more descriptive text. With the optional, up to eight, setting, the boxes are shorter, but retain the full descriptive text internally. Choose whichever setting you feel most comfortable working with.

Displaying Data Entry Boxes After Testing By Default



Data Entry Settings

Num of Data Entry Boxes **Up to 8**

☐ Display Data Entry Before Every Test

Save

On the Up to Eight boxes screen, there is a checkbox to force the Data Entry screen to display. Checking the Display Data Entry Before Every Test checkbox will enable this, which can serve as a reminder to the user to enter data at test time. Despite the text, though, this checkbox forces the Data Entry screen to display *after* every test, not before every test. This only works with the “Up to Eight” option enabled.

Selecting Data Entry from View Data Mode

You can select Data Entry from the NAV Menu while in View Data Mode, but the ability to edit or enter data is disabled. The screen will show the data already entered, with no buttons for drop down menu selection or Virtual Keyboard.

The screenshot shows a screen titled "Data" with a sub-header "NAV Tools". Below this, there are several input fields, each with a disabled selection button (a blue square with a white downward arrow). The fields and their values are:

Field	Value
SAMPLE	
DRIPLINE WEST	
LOCATION	
	burbura
INSPECTOR	
	mike
COR 1	
	123 .6
COR 2	
	334 .5

Figure 1-6. Data Entry Screen while Viewing Data

Navigating the Data Entry Screen



Figure 1-7. The Control Panel

The following description of screen navigation using the control panel assumes that the analyzer is held so that the display is held upright as in [Figure 1-7](#).

- To move from column to column, use the Right and Left portion of the 4-way touch pad.
- To move from row to row, use the Up and Down portions of the 4-way touch pad.
- To select the highlighted option, press the Enter button on the control panel.

The **Data Entry Screen** is divided into sections of 5 setting parameters. By using the Down portion of the 4-way touch pad when you are on the last row of a section, the display will change to the next section. By using the Up portion of the 4-way touch pad when you are on the first row of a section, the display will change to the previous section.

By selecting the **On/Off** button, you can exit the **Data Entry Screen**.

The Virtual Keyboard

Data Entry									
plaque									
1	2	3	4	5	6	7	8	9	0
q	w	e	r	t	y	u	i	o	p
a	s	d	f	g	h	j	k	l	-
z	x	c	v	b	n	m	.	shift	
backspace			space		clr		return		

Figure 1-8. Lower Case Virtual Keyboard

Data Entry									
RANDOM									
!	@	#	\$	%	^	&	*	(	)
Q	W	E	R	T	Y	U	I	O	P
A	S	D	F	G	H	J	K	L	_
Z	X	C	V	B	N	M	,	shift	
backspace			space		clr		return		

Figure 1-9. Upper Case Virtual Keyboard

The Virtual Keyboard is an alphanumeric keyboard which appears on the LCD Touch Screen Display. You can use the Virtual Keyboard either with the four-way touch pad and control panel buttons, or using the touch screen display directly.

At the top of the screen is the data field you are entering data into, in this case "A1234567890A". Also in this field is the underscore cursor, which graphically shows where the next character will be placed. Up to 25 characters can be stored in the data fields, though only the first 15 will be displayed on the analyzer's touch screen.

Next is the Virtual Keyboard itself, with numbers 0-9, letters A-Z, the special characters *, <, >, and -, and the Shift key, to toggle between upper and lower case keyboards.

Last is the control key line. This contains the keys for Return, Space, Clr, and Backspace. The Return key will enter the data and return you to the Data Entry Screen, the Backspace key will delete the last entered character, the Space key will insert a space at the cursor position, and the Clr screen button will clear the data you have entered.

Since the **Virtual Keyboard** is oriented 90 degrees from the standard in order to use a landscape display, the down portion of the 4-way touch-pad will select the key to the right of the current position, the left portion will select the key immediately below, the up portion will select the key to the left, and the right portion will select the key immediately above. Use the Select and Enter button to enter the currently selected key.

All screen areas can be directly accessed using the LCD Touch Screen by touch.

The Measurement Screen

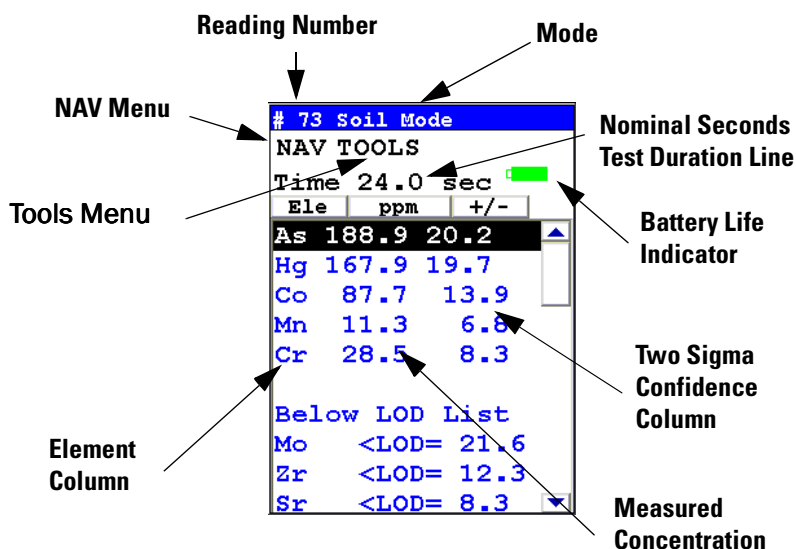


Figure 1-10. The Standard Bulk Measurement Screen

The Results Screen displays the following information:

- The Reading Number line shows a number automatically assigned by your NITON analyzer in order to uniquely identify each reading. The reading number automatically increments up by one with each successive reading.
- The Nominal Seconds Test Duration line shows the number of nominal seconds elapsing since the initiation of the reading. Nominal seconds are true, clock seconds slowed down to compensate for the electronic dead-time that occurs when the analyzer is taking a measurement.
- The Mode line displays the test mode in use during the measurement.
- The **Element** (left) column shows the elements that have been detected in the sample.
- The **Concentration Level** (central) column shows the concentration levels of the corresponding elements in percentages.
- The **Confidence** (right) column displays the 2 sigma (95%) confidence interval for the corresponding elements.

To Prepare or Not to Prepare - In Situ vs. Ex Situ

Bulk media are generally tested either on-site (*in situ*) for screening purposes, or removed and prepared (*ex situ*) to enhance the accuracy of the measurement. The degree of preparation may vary depending on the accuracy desired, the characteristics of the sample, and the characteristics of the site.

Understanding the advantages of *in situ* testing and of various degrees of preparation is crucial to obtaining useful data. *In situ* measurements should be used to profile an area, to locate areas of interest, to determine the boundaries of such areas, or to gather data that will subsequently be used to design a sampling plan.

In situ measurements are usually only approximations, though they may correlate very well with lab analysis if the site tested is highly homogeneous. If the site is non-homogeneous, as is often the case, then *in situ* measurement results may differ greatly from laboratory obtained results. Both sets of results may be correct. The difference arises from the fact that actual samples tested were different.

Analysis of Unprepared Samples – In Situ



Figure 1-1. In-Situ Soil Testing

♦ Screening Techniques

There are many techniques you can use in analyzing samples in-situ. None of them are correct or incorrect - the only thing that matters is if they suit your particular interests. Following are some typical sampling techniques used in the field.

Screening Techniques

Use direct measurement when you need to determine whether an element is present (rather than in accurately measuring how much is present). Use preliminary direct measurements to survey a site quickly even if you intend to take samples



WARNING! When taking samples from a site where toxic chemicals may be present, always use gloves and respiration equipment for your own protection. ♦

- 1. Select a measurement site, and clear away any surface debris and vegetation.**

Note Valid results will depend on a sufficient and appropriate selection of sites to sample. Lead-in-soil from paint, for instance, will usually be concentrated within a few feet of the painted structure.

2. **Choose an area to test where the measurement window of the analyzer will be flush with the test media. Position the nose against the surface to be analyzed and initiate a reading by squeezing the shutter release, and firmly pressing the instrument flat against the surface.**
3. **After the test, inspect the nose of the instrument for contamination, which may affect future analysis. If the nose appears to be soiled, clean it with a soft cloth or tissue.**



WARNING! Always treat radiation with respect. Do not hold your instrument near the measurement window during testing. Never point your instrument at yourself or anyone else when the tube is on. ♦

Note Never use in situ testing with field portable XRF when comparing field results with laboratory results to justify XRF usage. Always collect samples and prepare them before testing. Refer to the instructions on sample collection and preparation in *Ex Situ* Testing.

In Situ Depth Profiling

XRF analysis for soil is a surface technique. To perform a depth profile, remove a vertical slice of soil and test several samples taken from different depths. This procedure will yield information, rapidly, about the depth of contamination.



WARNING! Always treat radiation with respect. Do not hold your instrument near the measurement window during testing. Never point your instrument at yourself or anyone else when the shutter is open. ♦

Note Never use in situ testing with field portable XRF when comparing field results with laboratory results to justify XRF usage. Always collect samples and prepare them before testing. Refer to the instructions on sample collection and preparation in *Ex Situ* Testing. ♦

On-site vs. Lab Analysis

When comparing field screening to laboratory analysis, it is preferable to compare results obtained from the same samples. Start by collecting a sample large enough to be divided into two parts, with one portion stored

On-site vs. Lab Analysis

for future reference and the other submitted to a laboratory for independent analysis. For best results, follow the complete protocol for sample preparation, including drying and grinding of the sample. Grinding is essential for homogenizing the sample, ensuring that the portion sent to the lab is the sample as that analyzed on-site.

Analysis of Prepared Samples – Ex Situ



Figure 1-2. Ex-Situ Analysis of Prepared Samples

Sample Collection

Examine the site for differences in surface characteristics before sampling. Valid results depend on a sufficient and appropriate selection of sites to sample. Incorrect sample collection may give rise to misleading or meaningless results, regardless of the analysis method. Delineate sections with different characteristics and treat them as different areas. It may be desirable to subdivide larger areas even if they have the same characteristics to ensure a thorough examination.

Make certain to label each bag thoroughly. Common information included on each bag includes the person and/or the company who collected the sample, the location and area where the sample was taken, and the date the sample was collected.

Prepared sample analysis is the most accurate method for determining the concentration of elements in a bulk medium using the instrument. Sample preparation will minimize the effects of moisture, large particle size, variations in particle size and sample non-homogeneity.

Note More sample preparation (drying, milling and sifting) will yield greater accuracy. The drier, finer, and more homogeneous the particles, the better the measurements. ♦

Preparing Bulk Soil Samples

We recommends establishing a specific sample protocol. Following this protocol for preparing and testing samples is vital for achieving a level of accuracy comparable with laboratory results.

The equipment you need to prepare samples is included in your kit. Among these are a mortar and pestle, several different sized metal sieves, cups to hold the samples, and the soil test platform.



CAUTION All test equipment must be kept clean to prevent contamination of samples. ♦

Cleaning Your Equipment:

The mortar, pestle, and grinding mill may be cleaned with dry paper towels. You can also clean the mortar, pestle, and the mill's container with water, but be sure each is absolutely dry before using them on another sample. The mortar and pestle may be cleaned by grinding clean, dry sand in the mortar. Use the short bristle brushes (included in your Soil Testing Kit) to clean the sieves. If you have an electric soil grinder in your kit, when the soil grinder blades wear out, unbolt the worn blades and replace them. Call the Thermo Sales Department at 1-800-875-1578 for replacement blades.

Note Using the soil grinder may artificially increase the amount of Fe in soil samples. ♦

Sample Preparation

Prior to analysis, the material should be dry and well homogenized. Ideally, the entire sample should be dried to constant weight, sifted to remove gravel and debris, and ground or milled to a fine powder.

Dry the sample if it is moist and cohesive. The sample can be dried in any of several ways. Choose one of the following:

- Oven dry the sample for approximately 2 hours at 150° C, until the sample reaches a constant weight. Note: Oven drying is inappropriate when volatile compounds may be present in the sample. For example, lead present as tetraethyl lead would be driven off by the heat of drying. Some forms of mercury and arsenic are volatile. Air drying will preserve more of these volatile substances.
- Air dry the sample overnight at room temperature in a shallow pan.
- Stir gently and warm the sample in a pan over a hot plate or burner.

Coning and Quartering

You may need to divide your sample at various times during preparation. Coning and quartering is a method for dividing the sample into homogenous quarters.

- Pour the dry material slowly and carefully onto a flat sheet or pan, forming a symmetrical cone. Divide the cone into equal piles using a flat thin-bladed tool, such as a knife or ruler. Divide these in half again.
- Now you have four samples, each one-quarter the size of the original and each more homogenous than the original.
- Grind the sample to break up dirt clods and/or paint chips.



WARNING! Grinding and sifting dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth. ♦

Sift using the #10 (2mm) mesh and separate out the larger pieces (stones, organic matter, metallic objects, etc. Examine the larger particles by eye but do not include in the sample. Grind the sample again so its particles will be finer and more homogenous. Use mortar and pestle, or an electrically powered grinding mill. Sift at least 10 grams of the sample through #60 (250 µm) and #120 (125 µm) mesh. Re-grind the un-passed material until the entire fraction is able to pass. Mix the resulting sample.

Placing the Sample in an XRF Sample Cup

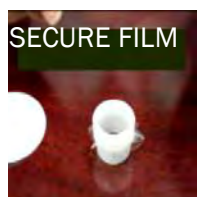
Note The sample container should be a sample cup of a type that can be filled from the rear; that is, the side opposite the window (e.g. Thermo NITON Part Number 187-466). Thermo recommends using a 1/4 mil Polypropelene film (e.g. Thermo NITON Part Number 187-461). A supply of cups and films are included.



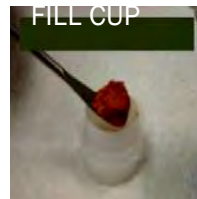
The container used to hold the sample will affect the accuracy of the measurement. Use a container with as thin-walled a window as is convenient and use the same kind of container and window for each sample. Consistency and careful attention to detail are keys to accurate measurement.



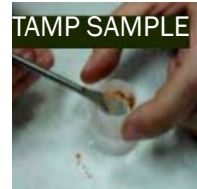
Place a circle of polypropylene film on top of an XRF sample cup. This film goes on the end of the cup with the indented ring. Thermo recommends preparing the cup ahead of time, if possible.



Secure the film with the collar. The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance.



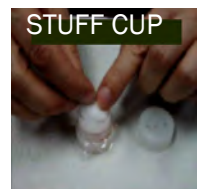
Set the cup on a flat surface film-window-side down. Fill it with at least five grams of the prepared sample, making sure that no voids or uneven layers.



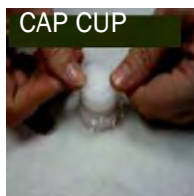
Lightly tamp the sample into the cup. The end of the pestle makes a convenient tamper.



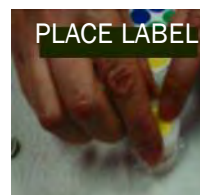
Place a filter-paper disk on the sample after tamping it.



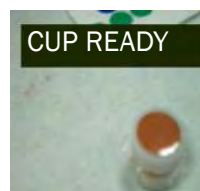
Fill the rest of the cup with polyester fiber stuffing to prevent sample movement. Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with your bulk sample kit.



Cap the cup.



Place a label on the cup. Using a pen with indelible ink, write identifying information on the cup. Keep a record of the sample designation, the site and location, the date of the sample, and any other relevant comments.



Cup is ready for testing.

Preparing Liquids and Sludge

Liquids

Fill an XRF sample cup with the liquid to be tested (do not pad the sample with cotton). The cup must be full so it is best if some liquid is allowed to overflow when the cap is put on.

Sludge

Sludge can be placed directly into an XRF cup for screening. This is considered in-situ testing because no attempt has been made to prepare the sample. For more accuracy, the sludge can be dried, sieved, and ground.

Prepare in an XRF sample cup and test the same way you would with a soil sample. For risk analysis, it is advisable to use a 60-mesh sieve to isolate and test only fine particles.

Cleaning Your Equipment:

The View Data Screen

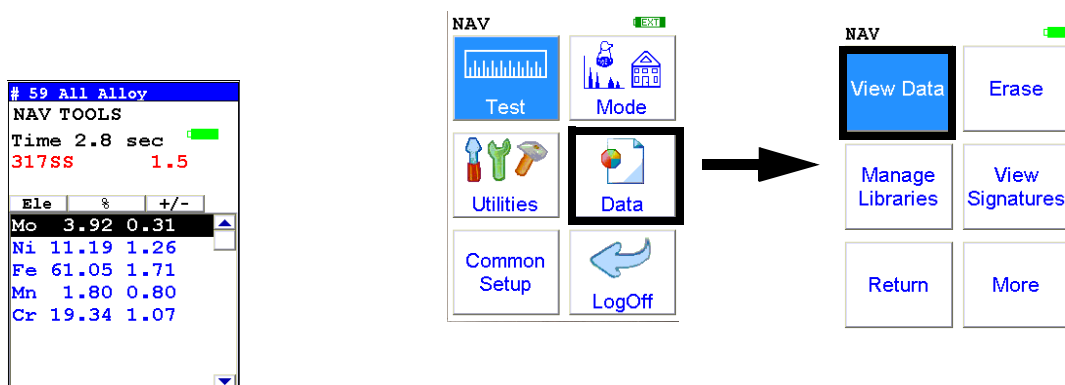


Figure 1-3. The View Data Menu Path

Use the Data Screen to view previously taken test result readings. When the **View Data** icon is selected, the Results screen of your most recent test is shown on the LCD display.

# 59 All Alloy		
NAV TOOLS		
Time 2.8 sec █		
317SS 1.5		
Ele	%	+/-
Mo	3.92	0.31
Ni	11.19	1.26
Fe	61.05	1.71
Mn	1.80	0.80
Cr	19.34	1.07

Using the buttons on the control panel, you may view different readings or additional data for individual readings.

Your analyzer will display the standard screen analysis. Pressing the "Down" arrow on the 4-way touch pad will display a complete scrolling elemental chemistry listing. Each press of the "Down" arrow scrolls the screen down to the next element. You can also use the scroll bar along the right side to scroll or page through the elements.

Scrolling Down Through the Complete Listing of Elements

Ele	%	+/-
Sb	0.909	0.371
Mo	0.276	0.033
Nb	0.360	0.033
Zr	0.376	0.034
Bi	1.96	0.14
Pb	1.27	0.16
Se	1.88	0.13
W	29.90	0.67
V	3.80	0.49
Ti	5.36	0.63
Fe	18.56	0.49
Mn	4.99	0.41
Cr	12.42	0.55
Sn	0.219	0.222
Pd	0.001	0.086
Pd	0.001	0.086
Ag	0.001	0.191
Al	0.001	40.000
Mo	0.276	0.033
Nb	0.360	0.033
Zr	0.376	0.034
Bi	1.96	0.14
Pb	1.27	0.16
Se	1.88	0.13
W	29.90	0.67
V	3.80	0.49
Ti	5.36	0.63
Fe	18.56	0.49
Mn	4.99	0.41
Cr	12.42	0.55
Sn	<LOD=	0.44
Pd	<LOD=	0.17
Ag	<LOD=	0.38
Al	<LOD=	80.0
Zn	<LOD=	0.35

Figure 1-4. Complete Listing of Elements

Pressing the "Left" arrow on the 4-way touch pad of your analyzer will display the previous reading, or if the first reading is currently displayed, the last reading. Pressing the "Right" arrow on the 4-way touch pad will display the next reading, or if the last reading is currently displayed, the first reading in memory. NITON Analyzers can store between 3000 to 6000 readings.

You can also look at the complete x-ray spectra for each reading stored in the analyzer's memory.

Sorting Elements

You can sort element rows by various criteria in order to view your data in the manner you prefer. The Sort Buttons, which double as column headings, can be used to re-sort the data in different ways. The Data Screen always begins as a Standard Sort, as you have defined it. Selecting the appropriate

sort button once toggles the sort order to High-to-Low. Selecting the sort button again toggles the sort order to Low-to-High. To return to the Standard Sort, view a different reading and return.

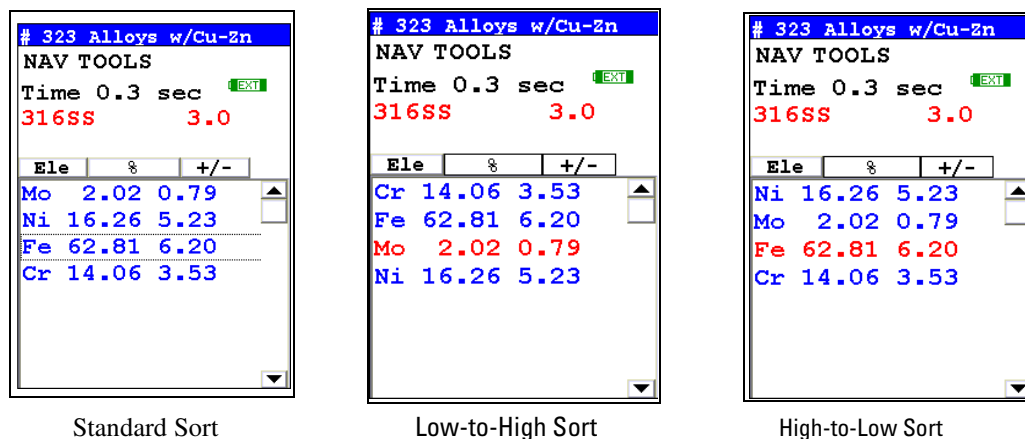


Figure 1-5. Element Sorts

Element Sorts Element sorts are performed alphabetically based on the element name.

Composition Sorts Composition sorts are performed numerically based on the percentage of composition.

Error Sorts Error sorts are performed based on the range of error in the reading.

Spectrum Graph For any reading result, simply use the **NAV Menu** to gain access to the reading's spectrum graph. Selecting Spectra will show a graphed spectrum of this reading, called SpectraView. SpectraView can be a useful tool for rapid, qualitative analysis of a sample. See "SpectraView" on [page Appendices-vii](#) for details.

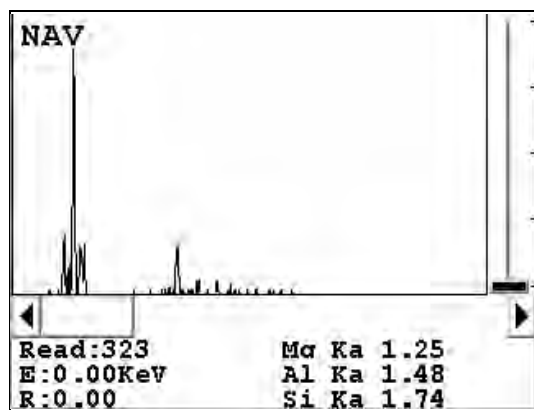


Figure 1-6. The SpectraView Screen

The Erase All Data Screen

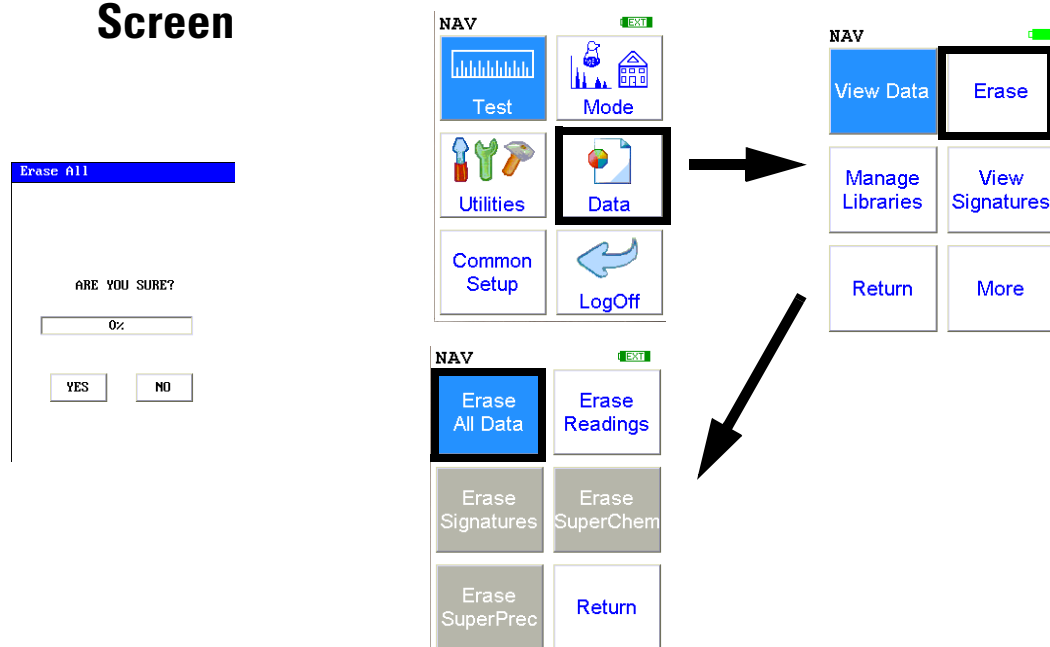


Figure 1-7. The Erase All Data Menu Path

Select the **Erase All Data** icon to erase all data, including signatures and SuperChem reference readings, from your analyzer. Selecting the **Erase All Data** icon will bring up a confirmation screen (see upper left) asking you “Are you sure?” with options to select “YES” or “NO”. Selecting “YES” will erase all reading data from your analyzer. Selecting “NO” will return you to the **Erase Menu**.



CAUTION Never turn off the analyzer while data is being erased! ♦



WARNING! Do not attempt to take measurements while downloading readings! This will generate an error requiring a system reset, and may corrupt your stored readings, requiring all stored readings to be erased. ♦

The Erase Readings Screen

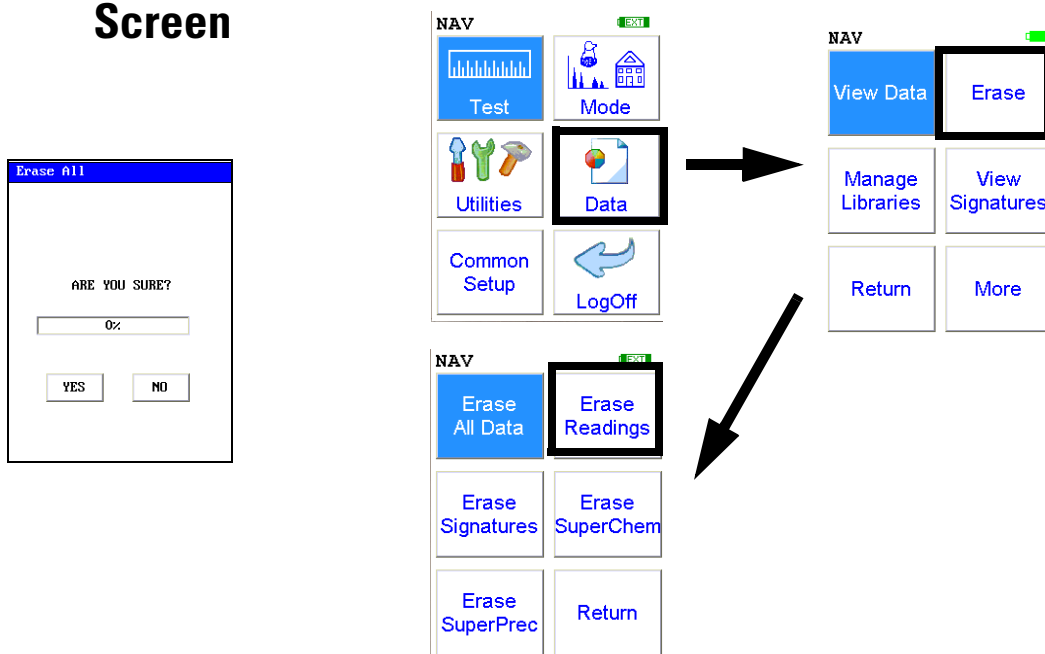


Figure 1-8. The Erase Readings Menu Path

Select the **Erase Readings** icon to erase all accumulated test readings from your analyzer. Selecting the **Erase Readings** icon will bring up a confirmation screen (see upper left) asking you “Are you sure?” with options to select “YES” or “NO”. Selecting “YES” will erase all test reading data from your analyzer. Selecting “NO” will return you to the **Erase Menu**.

Note We recommend that you download all your readings into an NDT file for recording purposes before erasing all data. ♦

Figure 1-9. Select the **Switch Libraries** icon to toggle between the standard library and the currently loaded alternate library. Select the **Switch Libraries** icon again to toggle back. **Main Library and Alternate Library**

Click OK to return to the **Manage Libraries Menu**.

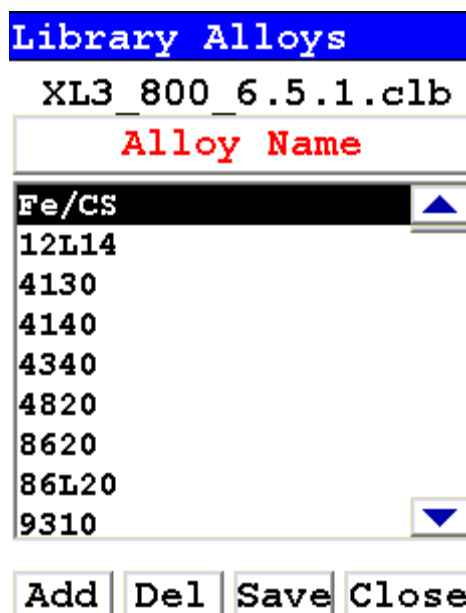


Figure 1-10. The Library Editor

Using the Library Editor

The Library Editor enables you to edit any library to conform to your specifications.

Alloy Name Button

Selecting this button sorts the list alphanumerically.

(Name in List)

Selecting the actual name of the alloy - i.e. "Fe/CS" - will bring up the **Element Specification Screen**.

Add

Selecting the Add button will add a new alloy to the Library. First the Alloy Name Editor will appear, enabling you to enter the name of the new alloy.

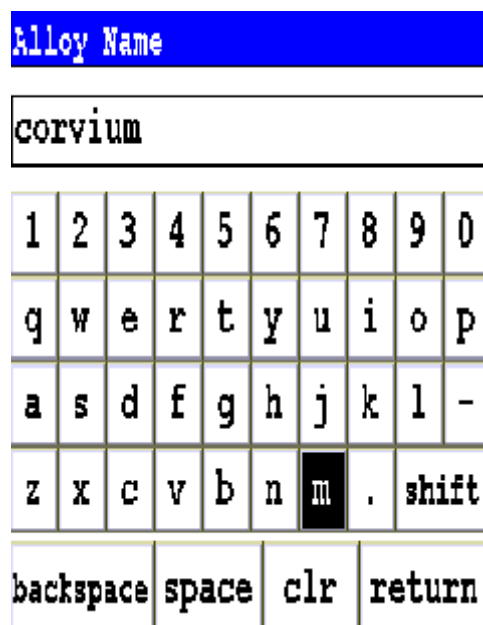


Figure 1-11. The Alloy Name Editor

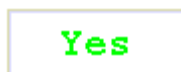
The **Alloy Name Editor** is a standard Virtual Keyboard. Use it as you would any Virtual Keyboard.

Hitting the return key enters the name into the alloy list. Select the name to enter the **Element Specification Screen** and enter the specification of the alloy.

Del Selecting the Del key will delete the currently selected alloy. First a confirmation screen appears.



Are you sure ?

**Figure 1-12. Confirmation Screen**

Selecting Yes will delete the alloy from the list. Selecting No will return you to the Alloy List.

Save Selecting the Save button will save the current Library.

Close Selecting the Close button will close the current Library without saving it.

The Element Specification Screen

The Element Specification Screen allows you to edit the elemental content of any alloy.

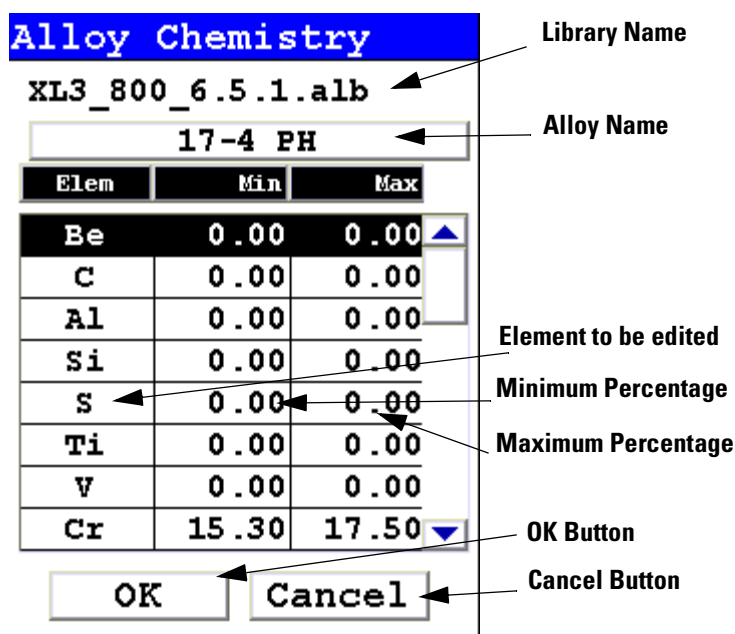


Figure 1-13. The Element Specification Screen

Library Name This is the name of the library you are editing. Make sure you are editing the correct library before proceeding further.

Alloy Name This is the name of the alloy you are editing. Make sure you are editing the correct alloy before proceeding further.

Element to be Edited This is the element you need to edit for this alloy.

Minimum Percentage This is the lowest amount of the element in question you want to be in the alloy. If the element in the analyzed sample is any lower, the sample will not be recognized as this alloy. Selecting the element minimum will open the Minimum Editor.

Be: Edit Min

7	8	9
4	5	6
1	2	3
C	0	E
	<	.

Figure 1-14. Minimum Editor

This is a standard numerical entry keypad. “C” = clear the current display, “<” means backspace one space, and “E” means enter this number as the minimum. After selecting “E”, you will be returned to the Element Specification Screen.

Maximum Percentage

This is the highest amount of the element in question you want to be in the alloy. If the element in the analyzed sample is any higher, the sample will not be recognized as this alloy. Selecting the element maximum will open the Maximum Editor.

Be: Edit Max

7	8	9
4	5	6
1	2	3
C	0	E
	<	.

0.00

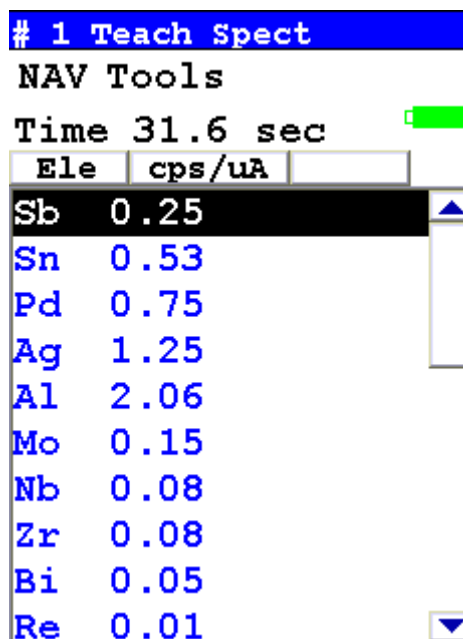
Figure 1-15. Maximum Editor

This is a standard numerical entry keypad. “C” = clear the current display, “<” means backspace one space, and “E” means enter this number as the maximum. After selecting “E”, you will be returned to the Element Specification Screen.

The Erase Readings Screen

OK Button Selecting this button will save the edited library.

Cancel Button Selecting this button will exit the Element Specification Screen for this alloy, returning you to the Library Editor.



# 1 Teach Spect	
NAV Tools	
Time 31.6 sec	
Ele	cps/uA
Sb	0.25
Sn	0.53
Pd	0.75
Ag	1.25
Al	2.06
Mo	0.15
Nb	0.08
Zr	0.08
Bi	0.05
Re	0.01

The Calibrate Detector Screen

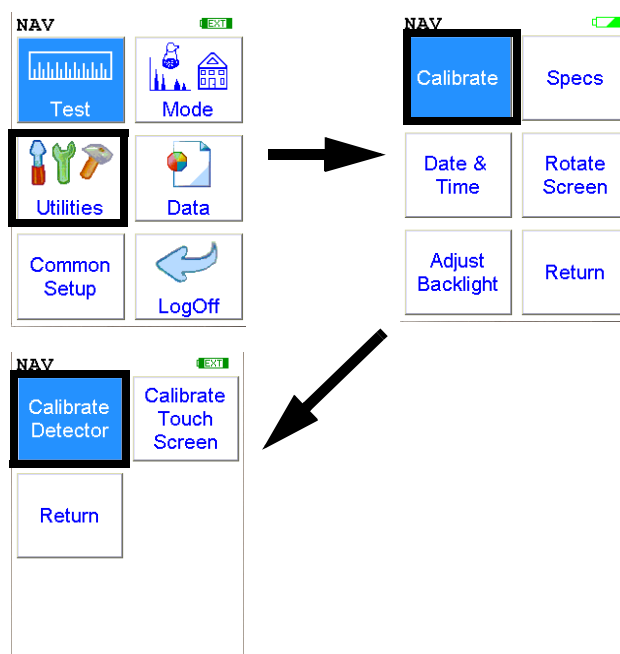
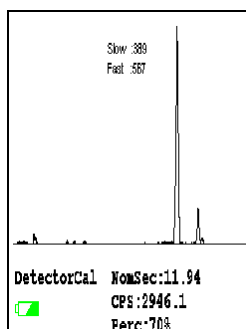


Figure 1-16. The Calibrate Detector Menu Path

Select the **Calibrate Detector** icon to begin a standard calibration of your analyzer's detector. Once you select the **Calibrate Detector** icon, calibration will begin immediately. The analyzer is programmed to calibrate for a specific, predetermined period in order to ensure proper operation of your NITONXL3 analyzer in the field.



CAUTION Avoid any vibration, loud noise, strong electronic fields, or other possible interference when your analyzer is calibrating its detector. ♦

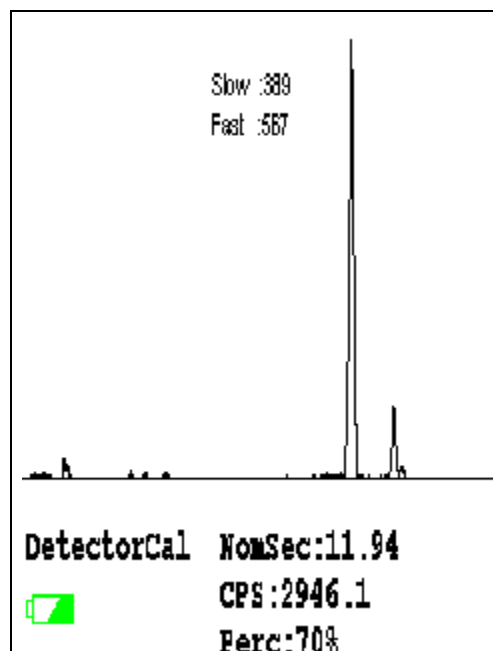


Figure 1-17. Detector Calibration Screen

The analyzer calibration screen will be displayed until calibration is complete. After the calibration has finished, the calibration results will be displayed.

Press the on/off/escape button or the **Return** icon to return to the **Main Menu**. In order to ensure good test results, it is essential that you calibrate your XL3 Analyzer's detector daily, and if a check sample test reveals discrepancies in the reading.

The Calibrate Touch Screen Screen

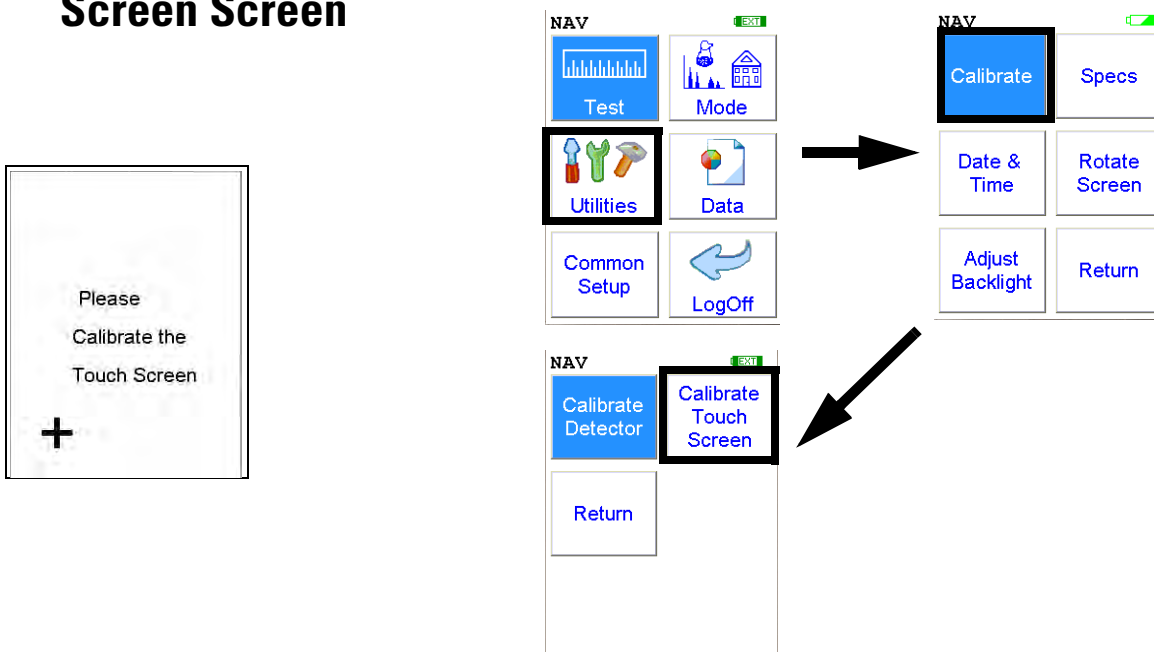


Figure 1-18. The Calibrate Touch Screen Menu Path

Select the **Calibrate Touch Screen** icon to re-calibrate the analyzer's touch screen display. This procedure establishes the display boundaries for the touch screen interface. When the **Calibrate Touch Screen** icon is selected, the display will show the message: "Calibrate Touch Screen". There will be a small cross in the upper left-hand corner of the display. Tap on this cross with the stylus, and the cross will disappear and reappear in the upper right-hand corner of the screen. Tap on the cross again, and it will reappear in the lower right-hand corner of the screen. Tap on the cross again and it will reappear in the lower left-hand corner of the screen. Tap on the cross once more, and you will be presented with the **Calibrate Menu**



Figure 1-19. The Touch Screen Calibration Screen

Calibrating the Touch Screen Without Using the Touch Screen

Because there may be a severe issue with the touch screen itself, you may need to use the buttons below the screen to complete this process. There are 3 single buttons and a 4 way switch located to the rear of the display screen. The button at the left is the On/Off/Escape button. The button to the right is the enter button and the center keypad is a 4 way switch.

The 4 way switch has 4 positions, Up, Down, Left and Right. The select and interlock buttons are not used in this procedure.



Figure 1-20. The Control Buttons for the XL3

1. Please, turn on your XRF analyzer using the On/Off button.

Note From this point please DO NOT touch the touch screen.

2. Press the enter button. You are now at the Radiation warning screen.
3. Using the 4 way touch pad on the on the cover of the instrument, move the cursor around the screen by pressing the appropriate Up down left or right button. Please move the cursor such that the Yes option is highlighted in green.
4. Press the “enter” button. You are now at the Enter Password Screen.

5. Move the cursor to the appropriate first number in your password and then using the enter button on the right (it has the arrow/enter key symbol on it) press this “enter” key. The first number of your password should appear in the lower left of the LCD screen.
6. Repeat step 5 until you have entered the entire password. Then move the cursor to the letter “E” and press the “enter” key to enter it.
7. You will now be at the main screen.
8. Again using the four way touch pad, move the cursor to highlight the “Utilities” icon and press the “enter” key to select.
9. You will now be at the Utilities screen
10. From the Utilities screen, move the cursor to highlight the “Calibrate” icon and press the “enter” key.
11. Now move the cursor to highlight “Calibrate Touch Screen” and press the enter key.
12. You are now at the Touch Screen Calibration screen.

Note You must now use the touch screen for the balance of this procedure

13. In the upper left hand corner you will see a crosshair “+”, using the stylus or a pen, tap the center of the “+”.
14. Repeat this for each “+” sign that appears, there should be one for each of the 4 corners.

Your touch screen should work properly after this and you may use it from this point forward. If it does not, please repeat the process.

The Specs Screen

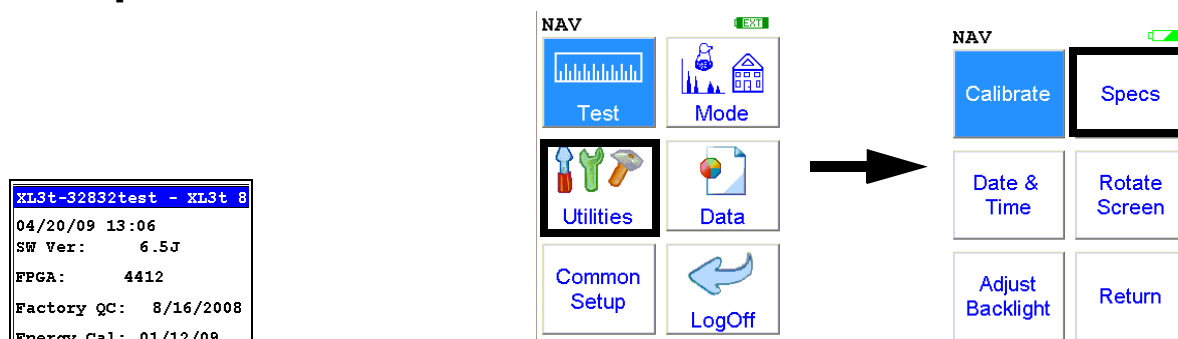


Figure 1-21. The Specs Menu Path

Select the **Specs** icon to display the analyzer's specifications. These specifications include your NITON analyzer's serial number, software and firmware versions, temperature, bias, and data coprocessors. Press the Close button to return to the Utilities Menu.

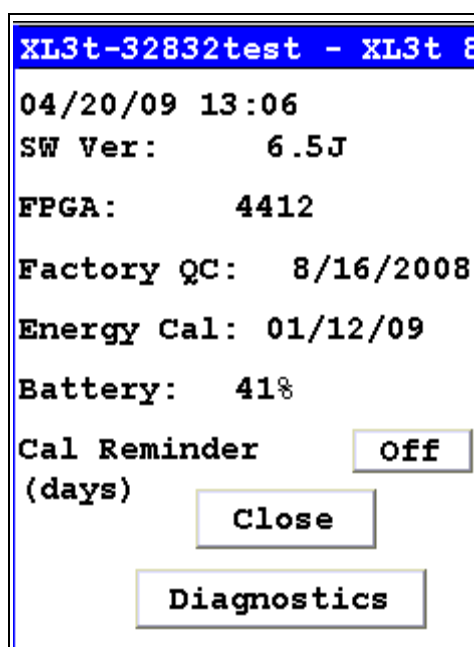
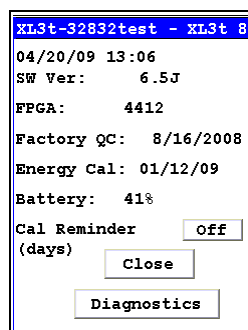


Figure 1-22. The Specs Screen

On the Specs Screen, standard information on the state of your analyzer is shown for your reference. This information should be reported to Service if there is a problem.

Specs Information

The following is the information supplied on the Specs Screen:

Instrument Specific Serial Number

This is located in the left part of the blue band at the top of the screen.

Model Number

This is located in the right part of the blue band at the top of the screen.

Date And Time

This is the current Date and Time. This is particularly important for date stamping.

SW Version

This is the currently loaded software version, which should be reported to Service if there is any problem.

FPGA

This is the currently loaded FPGA software version, which should be reported to Service if there is any problem. FPGA versions are always a four digit number. Any other number of digits may be a sign of a problem in the FPGA code.

Factory QC

This is the date that the machine was QCed at the factory.

Energy Cal

This line notes the last time a user detector calibration was performed.

Battery

This line gives the proportional charge remaining to the battery.

Cal Reminder

Select the Cal Reminder Button to set a reminder to calibrate your analyzer. Selecting the button will open the Cal. Reminder Editor. Select the number of days you want between reminders with the numeric keys. Of the other keys, C = Clear All, E = Enter, and OFF shuts off the Reminder Function. Selecting E will enter the current value as the reminder interval and return to the Specs Screen.

Cal. Reminder (Days)

7	8	9
4	5	6
1	2	3
C	0	E
OFF	<	

0

Figure 1-23. Cal Reminder Edit Screen

Diagnostics

Select the Diagnostics Button to load the Diagnostics Screen. the Diagnostics Screen shows Detector Temperature, Bias, Cooler Voltage, SubBias, Energy Scale, and Temperature in C and F scales.

The Diagnostics Screen can be of great utility in assuring proper operation of your analyzer.

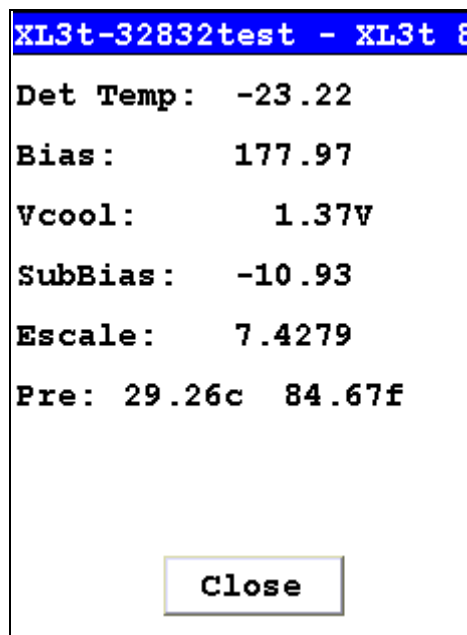


Figure 1-24. Diagnostics Screen

The proper ranges of operational values on the Diagnostics Screen follow.

Det Temp:

Detector Temperature should be within these ranges:

Standard 6 mm Detector:

-25 ± 5 degrees F

GOLDD SDD Detector:

-27 ± 3 degrees F

Bias: Bias should be within these ranges:

Standard 6 mm Detector: 175 ± 10

GOLDD SDD Detector: -220 ± 15

VCool: VCool will vary with the ambient temperature.

SubBias: SubBias should be within these ranges:

Standard 6 mm Detector: -11 ± 3

GOLDD SDD Detector: -8 ± 3

Escale: Escale should be within these ranges:

**Standard 6 mm Detector or
GOLDD SDD Detector:** 6.6 - 9

Preamp: Preamp value should only be noted, and reported to Service if there is a problem.

The Date and Time Screen

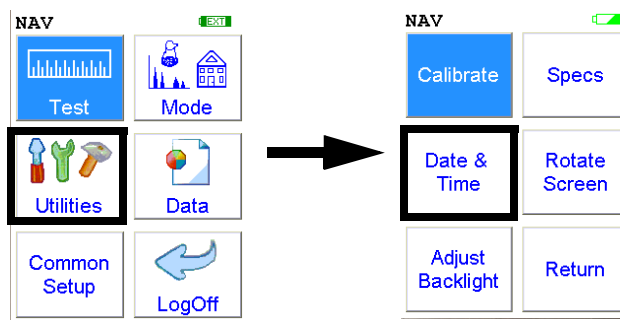
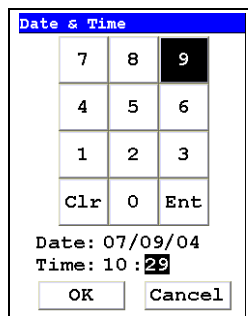


Figure 1-25. The Date and Time Menu Path

Select the **Date & Time** icon to set the date and time as needed for different time zones, daylight savings time, or any other reason. The date and time are factory preset prior to shipping. The format used is month/day/year - MM/DD/YY, and hour/minute - HH/MM, for the 24 hour clock.

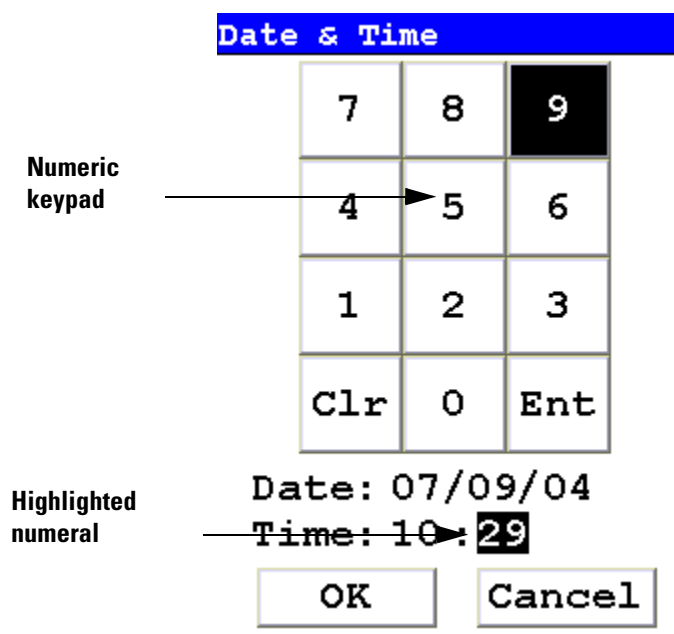


Figure 1-26. Setting the Date & Time

When the **Date & Time** icon is selected, the **Date & Time Screen** comes up on your analyzer's LCD Screen. Initially, the first character of the month is highlighted in reverse video (white on black), as in the sample display shown here. To change a character, select the digit you want to replace the character with from the virtual numeric keypad displayed on the screen,

then select the Enter (Ent) character from the virtual numeric keypad. Your analyzer will then accept the entry and automatically advance to the next digit. To skip a character, simply select the Enter (Ent) character from the virtual numeric keypad without selecting a replacement character.

For example, on the sample display, if you wish to change the "06" of the month to "07", the display appears with the first character (0) highlighted. Select the Enter (Ent) character to skip the zero. The "6" will now be highlighted. Select the "7" digit from the virtual numeric keypad, then select the Enter (Ent) key from the virtual numeric keypad. The change is accepted and the next digit is highlighted. Continue to select the Enter (Ent) symbol from the virtual numeric keypad to skip over the remaining characters of the date and time until the last character is reached. When you select the Enter (Ent) key from the virtual numeric keypad to confirm the last character, the word "SUCCESS" will appear beneath the Time field, and you will be returned to the Main Menu. The date is given in month/day/year format.

Note The analyzer will automatically return you to the **Main Menu** when the entry is complete. ♦

The Rotate Screen 180 Toggle

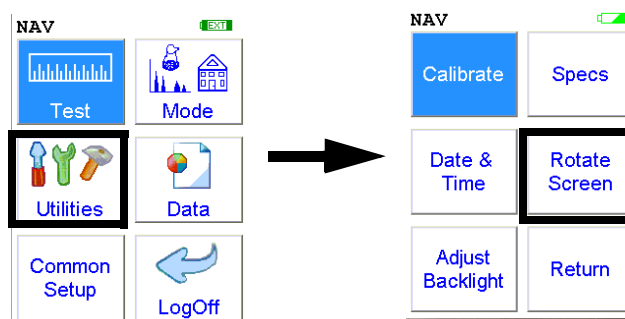


Figure 1-27. The Rotate Screen 180 Menu Path

Select the **Rotate Screen 180** icon to toggle the orientation of the screen between right side up and upside down.

The Adjust Backlight Screen

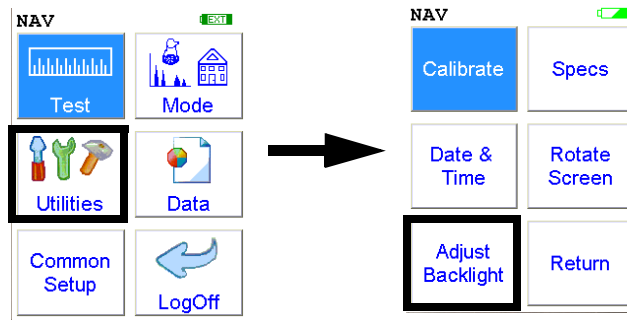
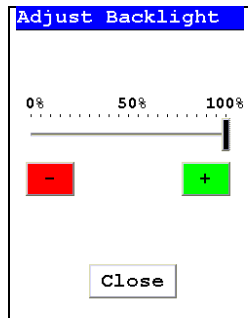
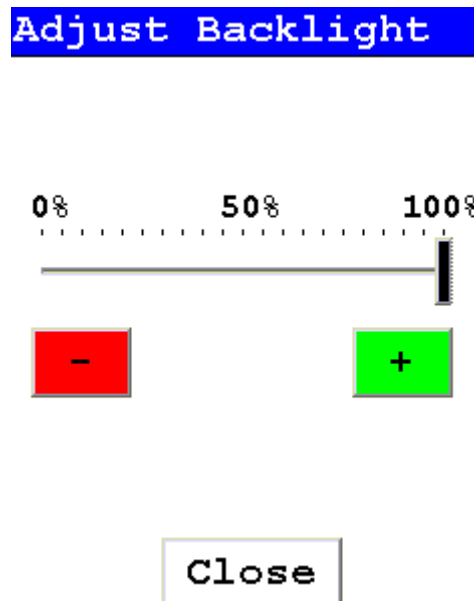


Figure 1-28. The Adjust Backlight Menu Path

Select the **Adjust Backlight** icon to adjust the brightness of the analyzer screen.



Selecting the red [-] box will cause the slider to move some to the left and the screen to dim a bit. Selecting the green [+] box will cause the slider to move a bit to the right and the screen to brighten somewhat. Find the setting most harmonious with the ambient lighting. Selecting Close saves the backlight setting in the current state, and returns you to the Utility Menu.

The Hardware Setup Screen

Instrument Setup

☒ Proximity Start

☐ Interlock Start

☐ Remote Trigger

Max. Time 36000.0

Save

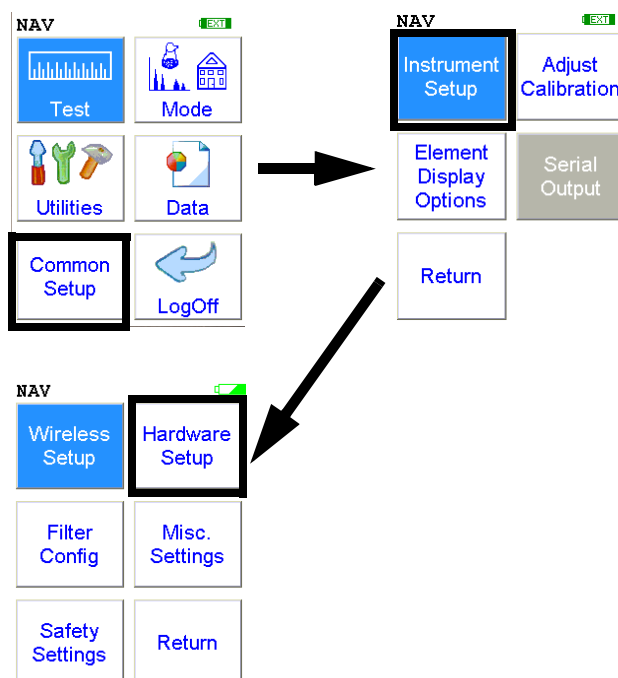


Figure 1-29. The Hardware Setup Menu Path

The **Hardware Setup Screen** enables you to toggle various options on or off, as well as select certain hardware dependant modes. Selecting an empty checkbox enables the option and places a check in the box. Selecting a checked box disables the option and clears the box.

Instrument Setup

☒ Proximity Start ← Select

☐ Interlock Start

☐ Remote Trigger

Max. Time 36000.0

Save

Figure 1-30. Selecting Options

Select the Proximity Start checkbox to toggle the use of the front proximity button. This enables the proximity button to be used to start taking a sample on contact. Some nations have laws or regulations which prohibit use of this feature. In this case, the feature will be disabled before shipping.

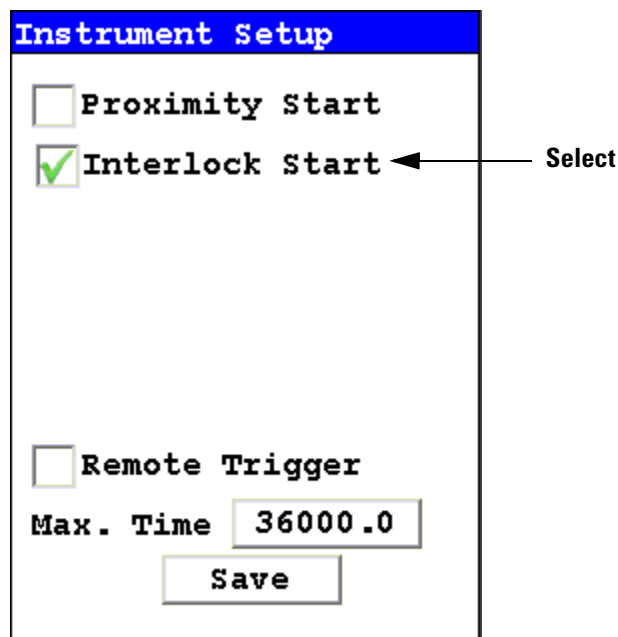
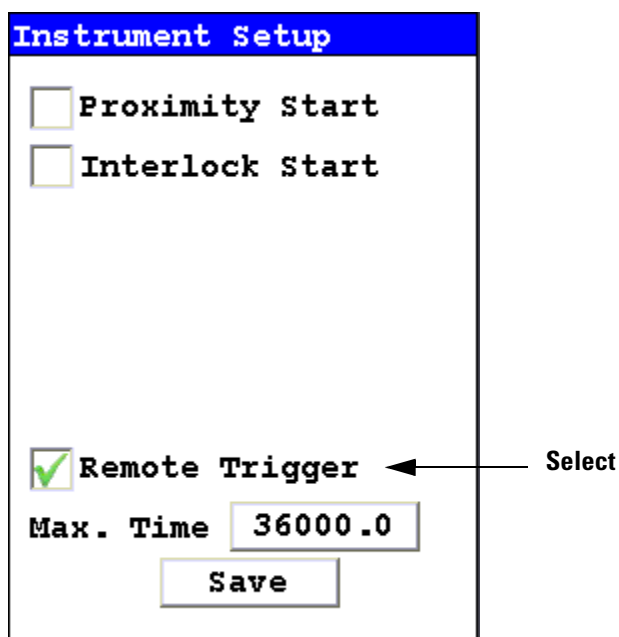


Figure 1-31. Selecting Interlock Start

Select the Interlock Start checkbox to toggle the use of the rear interlock button. This requires the interlock button to be used to start taking a sample on contact. Enabling the "Interlock Start" feature allows the user to start an analysis by depressing the rear interlock button on the analyzer.



The screenshot shows a window titled "Instrument Setup" with a blue header. Inside the window, there are three checkboxes: "Proximity Start", "Interlock Start", and "Remote Trigger". The "Remote Trigger" checkbox is checked with a green checkmark. To the right of the "Remote Trigger" checkbox, there is an arrow pointing to it with the word "Select" next to it. Below the "Remote Trigger" checkbox, there is a label "Max. Time" followed by a text box containing the value "36000.0". At the bottom of the window, there is a "Save" button.

Figure 1-32. Selecting Remote Trigger

Select the Remote Trigger checkbox to toggle the use of the Remote Trigger. This is used when your XL3 is in a test stand or with the Extend-a-Pole. Enabling the "Remote Trigger" feature allows you to start an analysis by remote control.

The screenshot shows a window titled "Instrument Setup" with a blue header. Inside the window, there are three checkboxes: "Proximity Start" (checked), "Interlock Start" (checked), and "Remote Trigger" (unchecked). To the right of the first two checkboxes, there are arrows pointing to them from the word "Select". Below these checkboxes is a "Max. Time" label followed by a text box containing "36000.0". At the bottom of the window is a "Save" button.

Option	Status
Proximity Start	Selected
Interlock Start	Selected
Remote Trigger	Not Selected

Max. Time: 36000.0

Save

Figure 1-33. Selecting Option Combinations for Multiple Effects

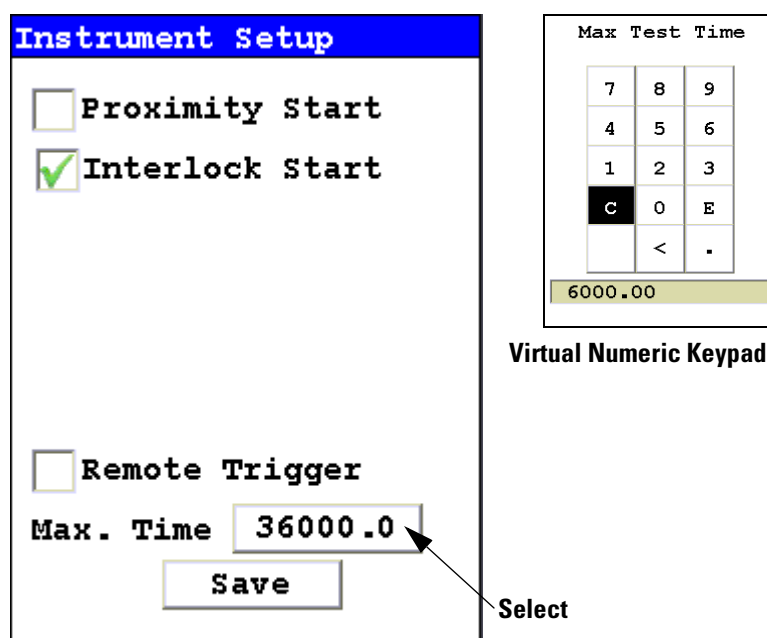


Figure 1-34. Changing the Max Time Parameter

Select the numbers box in the Max Time field to change the maximum seconds per reading. A virtual numeric keypad will appear, allowing you to set the number to whatever value you want, up to the maximum of 36000. When the max testing time is reached during an analysis, the analyzer reading will be automatically ended. Your analyzer will continue switching filters as needed until you terminate the reading or the Max Time is reached.

The Filter Config Screen

Filter Configuration	
Mode Mining Mode	
☒ Main Range	Time 60.0
☐ Low Range	30.0
☒ High Range	60.0
☐ Light Range	30.0
Save	

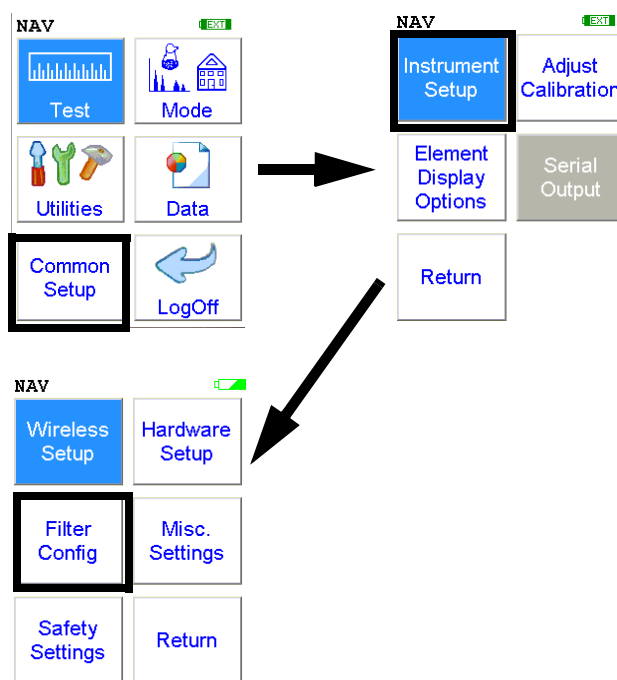


Figure 1-35. The Filter Config Menu Path

Multi-Filter tests are used to either preferentially excite specific elements for increased sensitivity, or to cover a wider element range than one filter alone can provide. Most modes, when enabled, will use two filters in sequence to produce a combined analysis result. In typical alloy analysis applications, Main Range is used for the analysis of most elements, and Low Range is utilized for the subsequent high sensitivity analysis of V, Ti, and Cr. Multi-filter switching can be set to activate off time alone, or, when time switching is disabled, off settings in the alloy grade library. In environmental modes, Low Range adds the capability to analyze light elements which cannot be efficiently excited by Main Range.

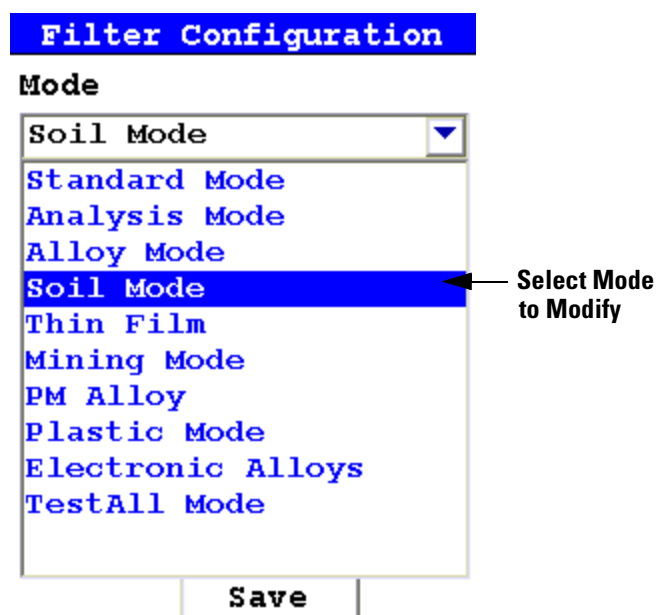


Figure 1-36. Selecting the Mode

Select the mode you wish to configure. You can set different configurations for different modes.

The **Filter Config Screen** enables you to directly enable or disable any filter, or control the time that a filter alters the irradiation of the sample before auto-switching to another filter. Not all filters are available in all modes.

Filter Configuration		
Mode		
Mining Mode		
		Time
Main Range Filter checkbox	☒ Main Range	60.0
Filter Element List Button	☐ Low Range	30.0
Low Range Filter checkbox	☒ High Range	60.0
High Range Filter checkbox	☐ Light Range	30.0
Light Range Filter checkbox		

Save

Figure 1-37. The Filter Checkboxes In Mining Mode

Select the checkbox next to the filter you want to use to determine exactly which of the filters contained in your NITON Analyzer is used for sample testing. Selecting an empty checkbox will enable that filter and place a check into the box as an indicator. Selecting a checked box will disable the filter and clear the box.

In typical alloy analysis applications, Main Range is used for the analysis of most elements

Low Range is utilized for the subsequent high sensitivity analysis of V, Ti, and Cr.

High Range is not used in alloy and plastic analysis.

Light Range is available only with He-purged and 900 series GOLDD technology analyzers, and is typically used in light element analysis.

Filter Change on Time Only

In Alloy and Electronic Alloy modes, there is an additional option which enables you to control whether the time you set or the alloy library controls the switching of the filters.

Select the Filter Change on Time Only checkbox to override the alloy library's settings. When this box is checked, your analyzer will ignore the alloy library settings and change filters only according to the time intervals you have set for each filter.

Filter Configuration

Mode
Electronic Alloys ▼

Time

+ ☒ Main Range 30.0

+ ☒ Low Range 30.0

☒ Filter Change on Time Only

Save

Figure 1-38. The Filter Checkboxes In Electronic Alloy Mode

Element List	Element List	Element List
Mode: Soil Mode	Mode: Soil Mode	Mode: Soil Mode
Filter: Main Filter	Filter: Low Filter	Filter: High Filter
Mo, Zr, Sr, U, Rb, Th, Pb, Se, As, Hg, Zn, W, Cu, Ni, Co, Fe, Mn	Cr, V, Ti, Sc, Ca, K, S	Ba, Cs, Te, Sb, Sn, Cd, Ag, Pd
Close	Close	Close

Figure 1-39. The Filter Element Lists

The Filter Config Screen

Select the Filter Element List Button to display the Element List for that filter. This list shows the elements that the filter is best designed to detect.

The screenshot shows the 'Filter Configuration' screen. At the top is a blue header bar with the text 'Filter Configuration'. Below this is a 'Mode' section with a dropdown menu currently showing 'Mining Mode'. To the right of the mode dropdown is the word 'Time'. Below the mode dropdown are four filter ranges, each with a plus icon in a box, a checkbox, a label, and a time field. The 'Main Range' is checked and has a time of 60.0. The 'Low Range' is unchecked and has a time of 30.0. The 'High Range' is checked and has a time of 60.0. The 'Light Range' is unchecked and has a time of 30.0. An arrow points from the text 'Filter Time Field' to the '60.0' value in the 'Main Range' time field. At the bottom center is a 'Save' button.

Filter Range	Time
☒ Main Range	60.0
☐ Low Range	30.0
☒ High Range	60.0
☐ Light Range	30.0

Figure 1-40. The Filter Time Fields

Select the Time field for the intended filter to change the filter switch time for that Filter. The Filter Time Editor will appear. This enables you to set the number of seconds each enabled filter is allotted before auto-switching will occur when needed during sample testing. Your analyzer will auto-switch from one filter to another when the testing time for that filter is greater than or equal to the time you have chosen, and the identified alloy is flagged as needing the switch in the NITON Alloy Library.

Main Range Time

7	8	9
4	5	6
1	2	3
C	0	E
	<	.

Figure 1-41. The Filter Time Editor

Select the “C” key to clear the current time, then from the virtual numeric key pad, select each digit you want to input, then select “E” to enter.

The Language Settings Screen

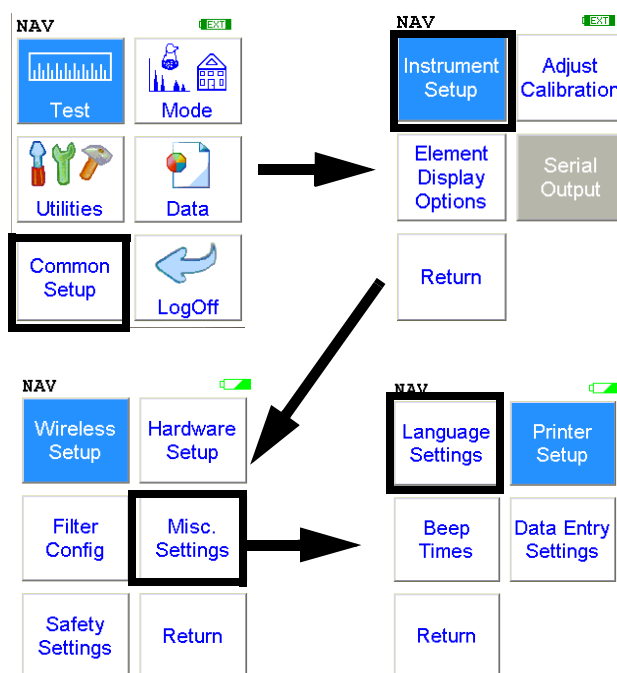
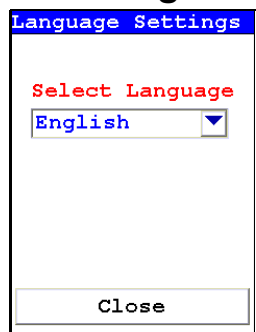


Figure 1-42. The Language Settings Menu Path

Selecting the “**Language Settings**” icon will load the **Language Screen**, allowing you to change the language from the default English to French, Spanish, Portuguese, or German.

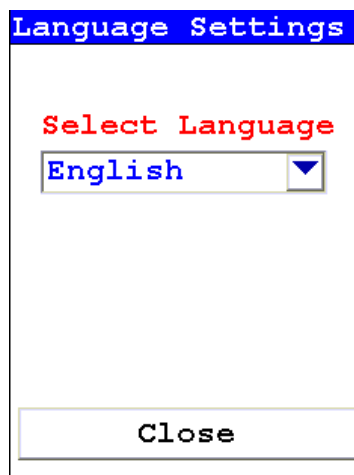


Figure 1-43. The Language Setting Screen

Select the down-pointing triangle, and then select the language you want from the drop down menu. The Menu system will now show on screen in the language you have selected.

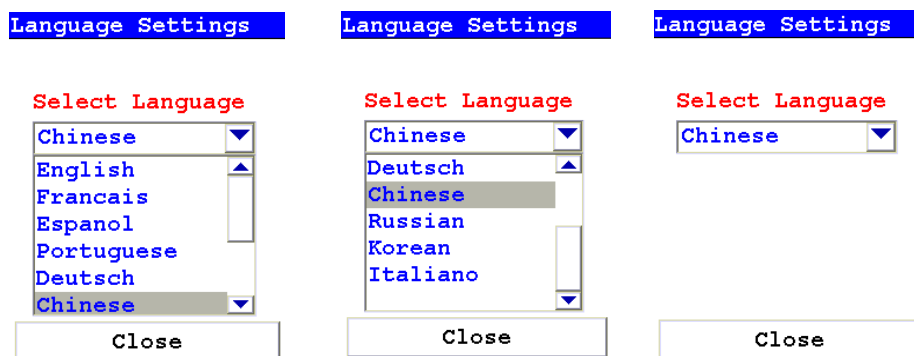


Figure 1-44. Selecting Language From the Drop Down Menu



Figure 1-45. The Main Menu in Chinese

The Printer Setup Screen

Printer Output

☐ Print <LOD

☒ Print Complete

☐ Print Data Fields

☐ Print Date & Time

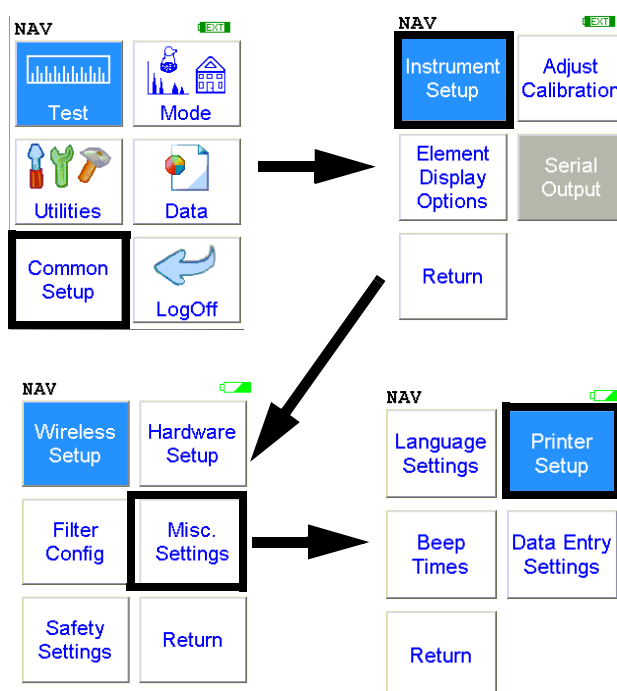


Figure 1-46. The Printer Setup Menu Path

The Printer Setup Screen allows you to adjust which sections of your reading data are sent to your optional printer. By default, your analyzer prints the detected list, reading number, reading length, reading mode and any applicable measurement data such as Alloy match grade names. You can select any combination of options on the Printer Setup Screen to change what is printed.

Printer Output

☐ Print <LOD

☒ Print Complete

☐ Print Data Fields

☐ Print Date & Time

Close

Figure 1-47. The Printer Setup Screen

Print < LOD	Selecting this option will enable printing of readings which are lower than the Limit of Detection.
Print Complete	Selecting this option will enable printing of all the data fields in the reading.
Print Data Field	Selecting this option will enable printing of all entered data fields.
Print Date & Time	Selecting this option will enable printing of the Date and Time.

The Beep Setup Menu

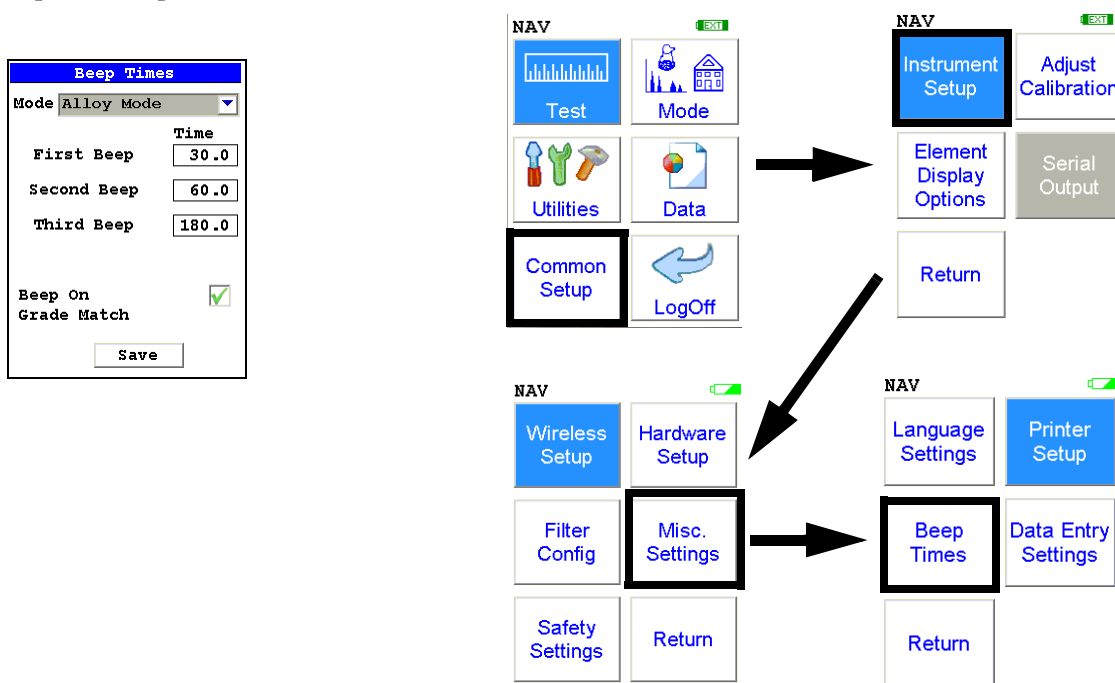


Figure 1-48. The Beep Setup Menu Path

Selecting the Beep Times icon opens the Beep Setup Screen, enabling changes to the beep settings for various modes. The beeps sound as follows:

Beep Times	
Mode	Alloy Mode
	Time
First Beep	30.0
Second Beep	60.0
Third Beep	180.0
Beep On Grade Match ☒	
Save	

Figure 1-49. The Beep Setup Screen

- Mode** This option allows you to change the beep settings for different modes independently. Select the down arrow to access the list of modes.
- First Beep** This option allows you to change the delay before the First Beep.
- Second Beep** This option allows you to change the delay before the Second Beep.
- Third Beep** This option allows you to change the delay before the Third Beep.
- Beep on Grade Match** Selecting this option will enable a special beep when the reading chemistry matches and alloy grade.

The Data Entry Settings Menu

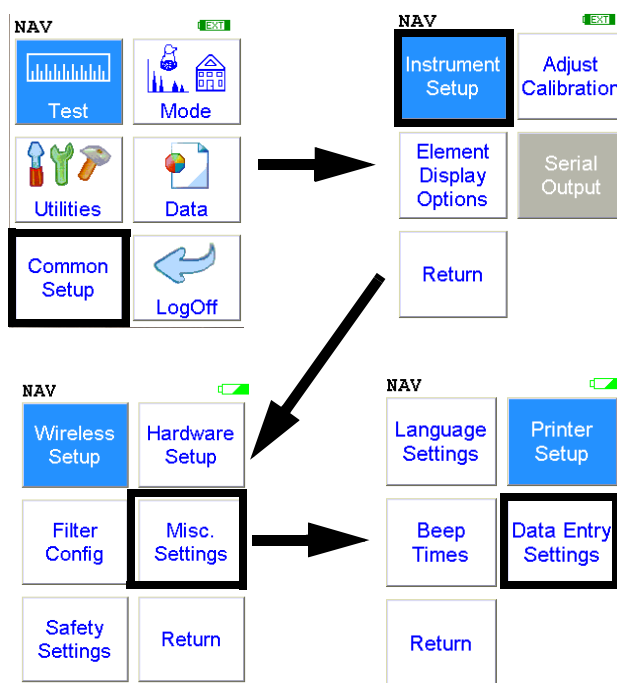
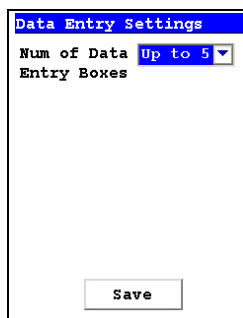


Figure 1-50. The Data Entry Settings Menu Path

Selecting the **Data Entry Settings** icon opens the **Data Entry Settings Screen**, enabling changes to the data entry settings for various modes.

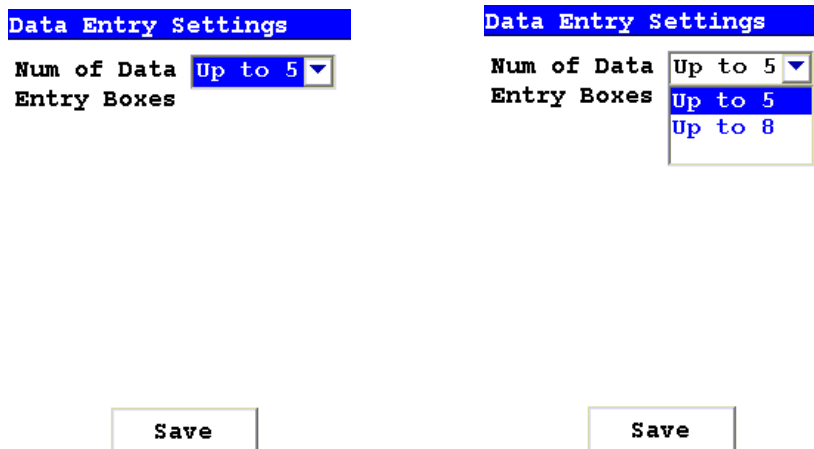


Figure 1-51. The Data Entry Settings Screen

By selecting the down arrow at the right of the “Num of Data Entry Boxes” field, you may choose between Up to 5 or Up to 8 from the drop down menu, changing the number of data entry boxes in the Data Entry Screen.

The Safety Settings Menu

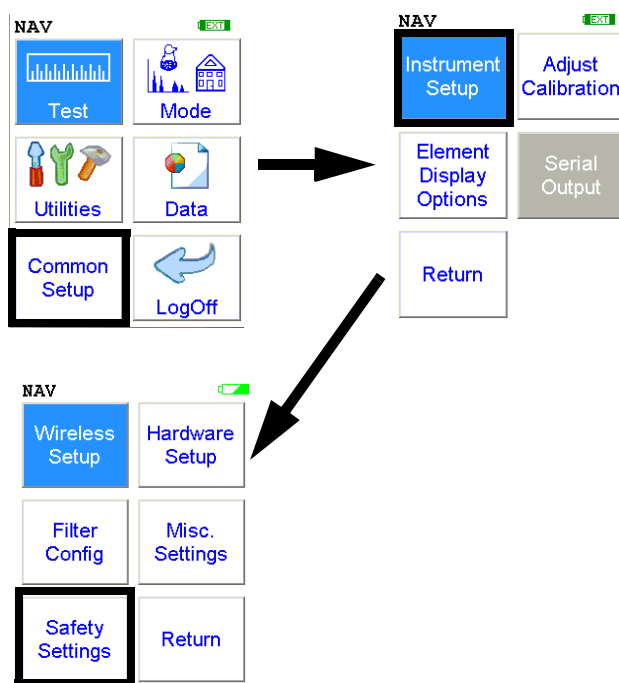
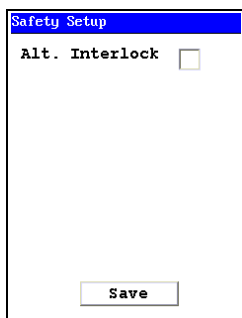
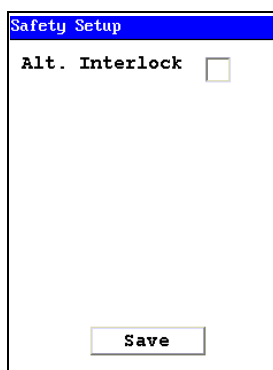
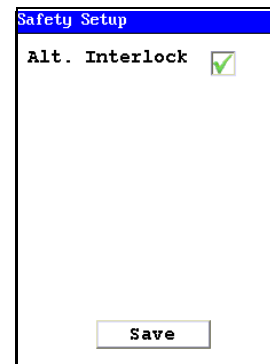


Figure 1-52. The Safety Settings Menu Path

Selecting the **Safety Settings** icon opens the **Safety Settings Screen**, enabling changes to the location of the rear interlock button.



Alt Interlock Disabled (Default)



Alt Interlock Enabled

Figure 1-53. The Safety Settings Screen

By selecting the checkbox, you can toggle between the rear interlock button's normal location, and its alternate location as the center "Select" button on the four-way touch pad.

The Adjust Calibration Screen

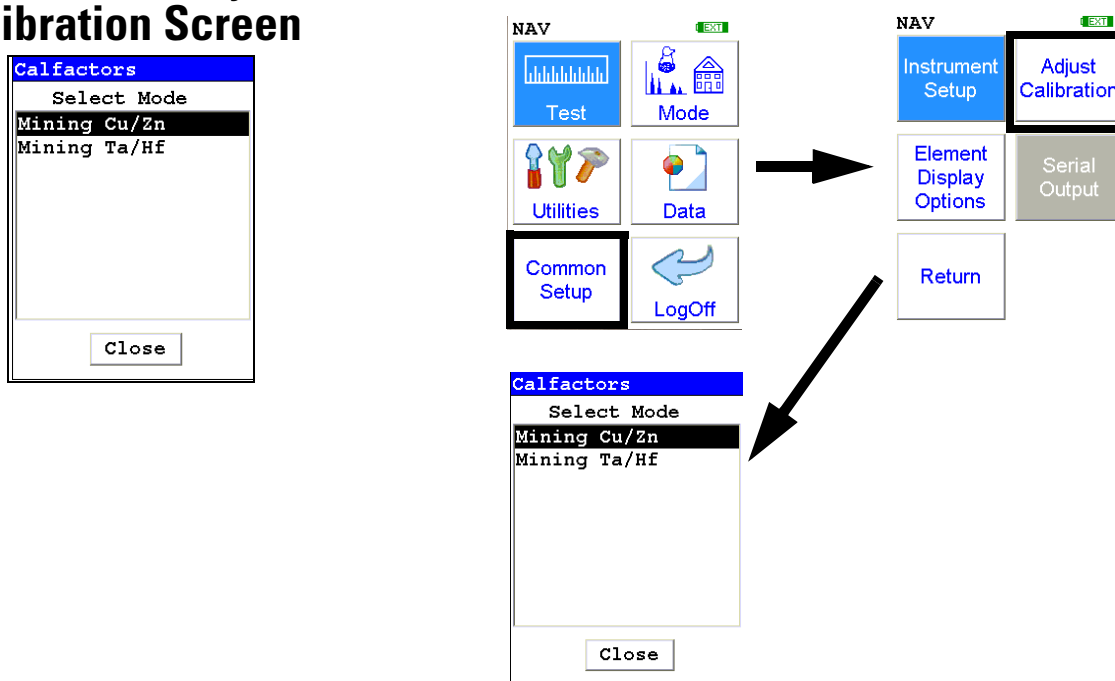


Figure 1-54. The Adjust Calibration Menu Path

The **Adjust Calibration Screen** enables you to change calibrations for Mining Modes. Select the mining mode you are using from the list.

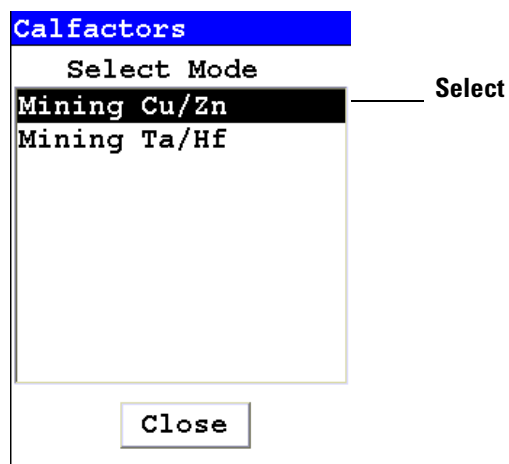


Figure 1-55. Select Mode Screen

The Calfactors Screen will now appear.

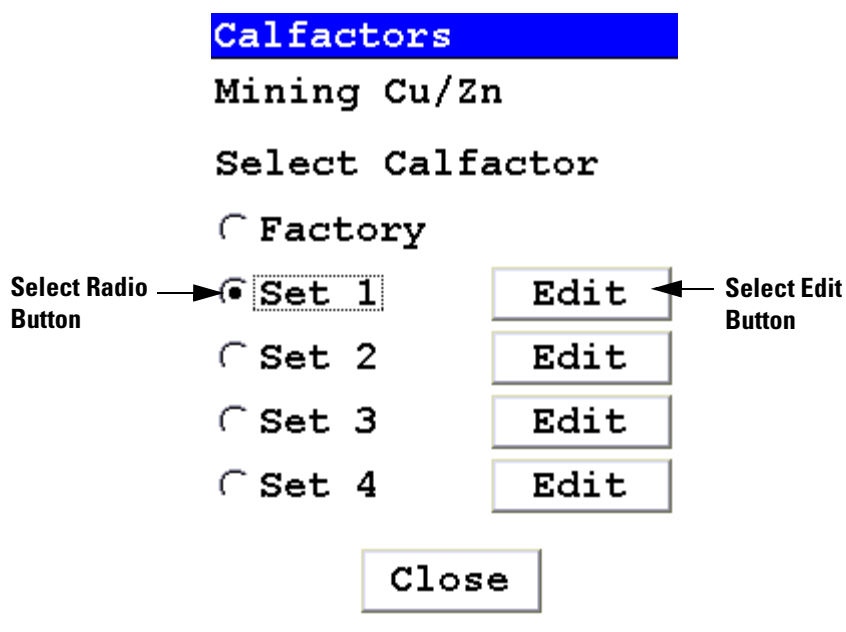


Figure 1-56. The Calfactors Screen

Select the radio button of the Calibration Factor you wish to edit, then select the appropriate Edit Button. The Calibration Edit Screen will open.

You cannot edit the Factory Calibration. You may edit and store up to four alternate calibrations per Mode.

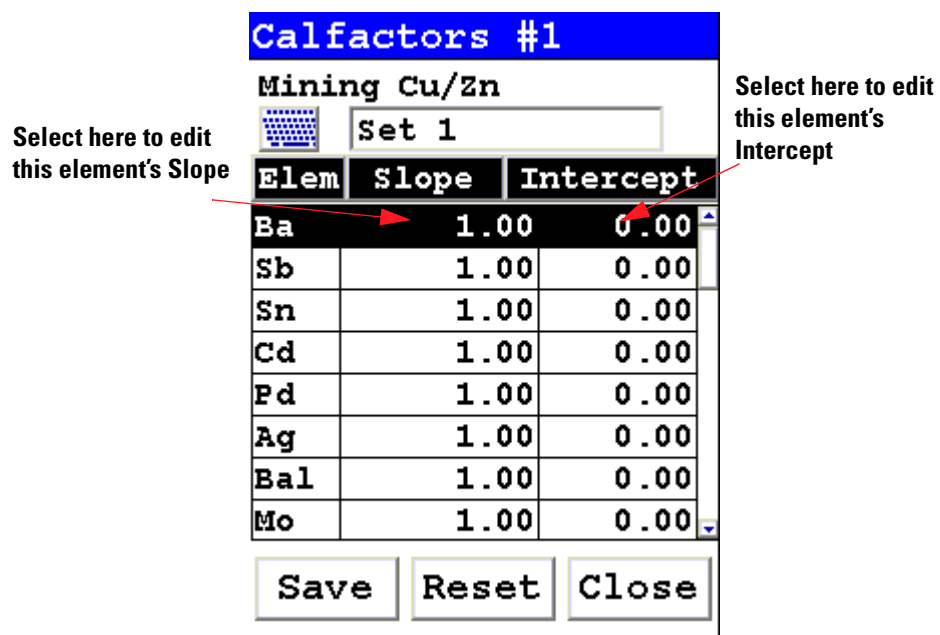


Figure 1-57. The Calibration Edit Screen

Calibration Factors

Although the FP software automatically corrects for most inter-element matrix effects, NITON tube-based analyzers cannot currently detect elements lighter than magnesium. As a result, the oxidation state of elements can bias measurements of other elements. In many cases, this bias is small, and uncorrected results provide sufficient accuracy, especially when data is for screening purposes only. For cases when more accurate results are required, NITON has provided slope/intercept calibration software with the instrument to improve the quality of the data. The calibration software is element specific, and calibration factors can be entered for individual elements, independent of the other elements. A user may choose to correct a single element or a suite of elements.

The degree of severity of the bias should be evaluated before proceeding with routine measurement. A few test samples should be carefully measured by another technique, or by an outside lab. These samples should then be analyzed using the analyzer. If the agreement is good enough to provide the accuracy required for the application, the instrument can be operated as shipped. If it is determined that a bias correction is necessary, the procedure for establishing calibration factors should be followed. As site characteristics change, it is good practice to run a few check standards to ensure that the instrument results are still within an acceptable error range.

Note With the exception of Mining Mode, Calibration Factors cannot be changed at the User Log-in level. This must be done while logged in at Supervisor level. See the NDT manual for details.

Oxides vs. elemental concentrations

Labs and other XRF instruments often report data as oxides. We can only report data as elemental concentration. Therefore, oxide data must be converted to elemental concentration for comparison with NITON results using the conversion factors and equation below. This factor can be multiplied by oxide concentration to convert to elemental.

Formula $\text{Conc. (metal)} = \text{Conc. (oxide)} * \text{Mol.Wt. (metal)} / \text{Mol.Wt. (compound)}$.

Table 1-1. Oxide Conversion

Oxide	Conversion Factor
MgO	0.603
Al ₂ O ₃	0.529
SiO ₂	0.467
SO ₃	0.400
K ₂ O	0.825
CaO	0.715
TiO ₂	0.5995
V ₂ O ₅	0.5602
Cr ₂ O ₃	0.6842
Mn ₃ O ₄	0.7203
MnO	0.7745
Fe ₂ O ₃	0.6994
FeO	0.7773
Co ₃ O ₄	0.7342
NiO	0.7858
CuO	0.7988
ZnO	0.8034
PbO	0.9283
Fe ₂ O ₃	0.6994
Bi ₂ O ₃	0.8970
ZrO ₂	0.7403
MoO ₃	0.6665
W ₂ O ₅	0.7930
Ta ₂ O ₅	0.8190
Nb ₂ O ₅	0.6990
SnO ₂	0.7876

The Sort Element Display Menu

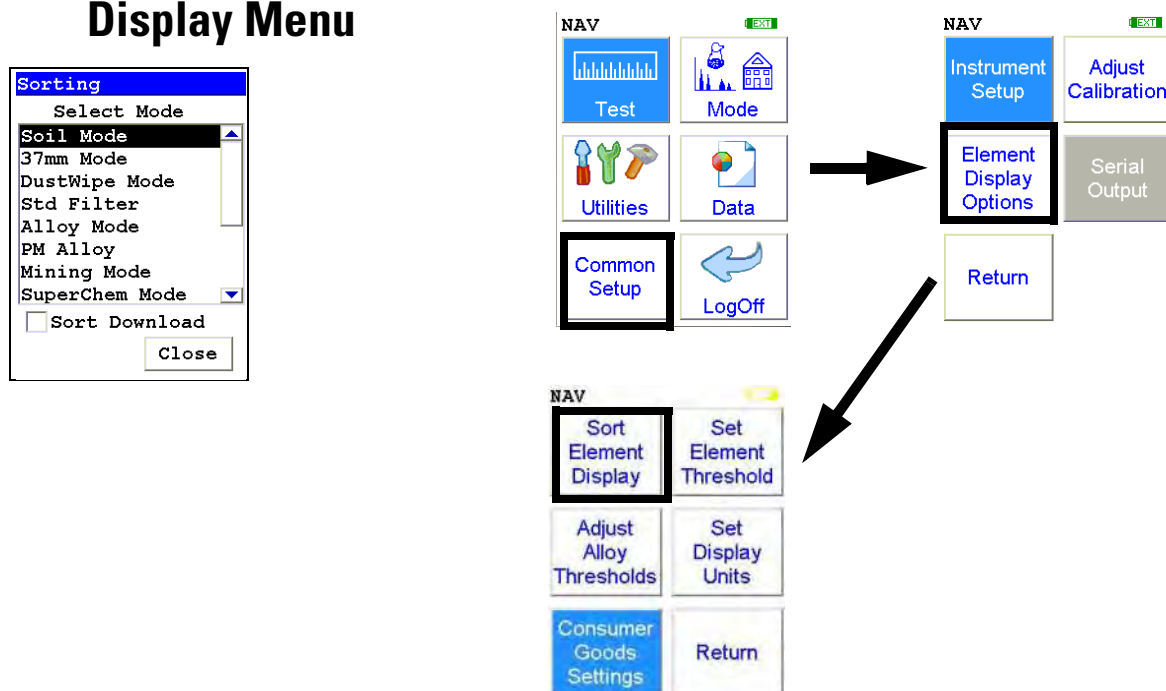


Figure 1-58. The Sort Element Display Menu Path

Select the **Sort Element Display** icon to configure sorting criteria used for analysis display. Selecting the **Sort Element Display** icon opens up the **Sort Criteria Screen**.

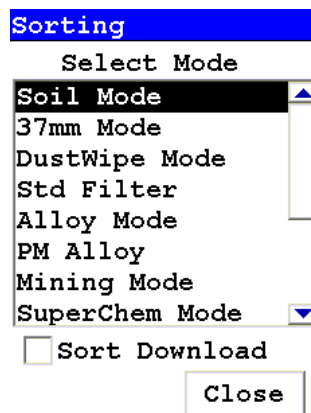


Figure 1-59. Selecting the Mode from the Sort Element Display screen

Select the mode you wish to change, and the **Sorting Options Screen** will appear.

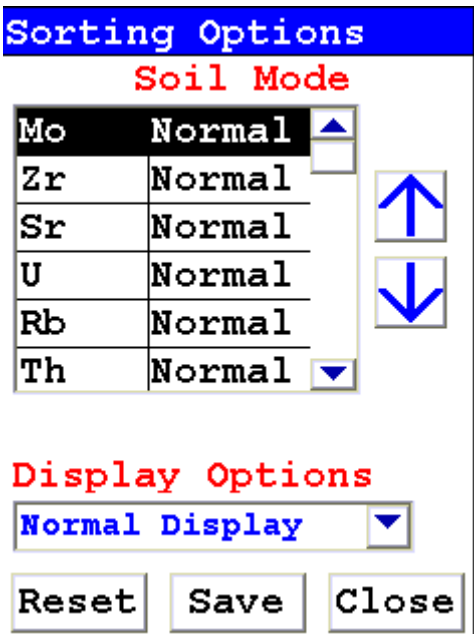


Figure 1-60. The Sort Element Display

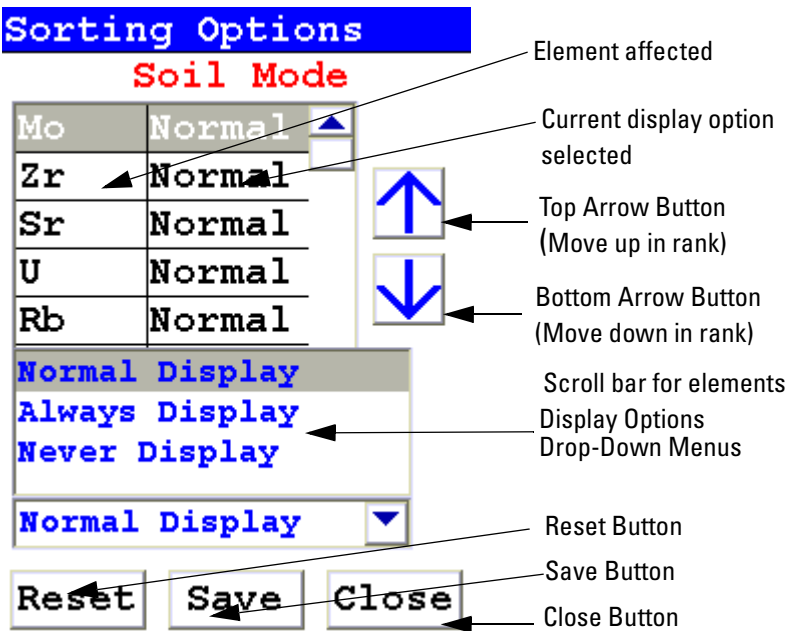


Figure 1-61. The Sorting Options Screen

On the left of the display are elements, each with its currently selected display option beside it to the right. The element list is ranked by importance, with the most important element on top, and each one lower down of less importance than the one above it.

By selecting an element and using the arrow buttons to the right of the list, you can change its ranking. Use the Top Arrow Button to move an element one rank closer to the top with each click. Use the Bottom Arrow Button to move an element one rank closer to the bottom with each click.

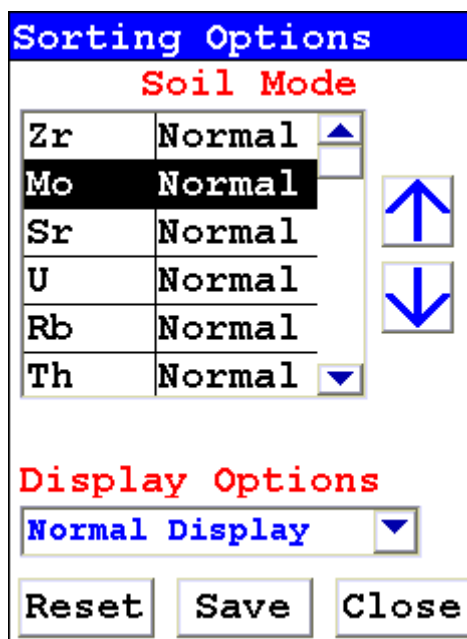


Figure 1-62. Changed Sort Order

Display Options

The Display Options Drop Down Menu allows you to change the display status of any element to one of three states:

- Normal - The standard state. Element displays only when the elemental value is greater than the limit of detection.
- Always - Always display the results for this element. Use this state for elements critical to all of your analyses.
- Never - Never display the results for this element. Use this state for elements which are unimportant to your work. This makes your instrument display less complex.

Select the element you want to change, then select the menu option corresponding to your choice of display status. The currently selected element is displayed in white on black.

Sorting Options

Soil Mode

Zr	Never	▲
Mo	Normal	
Sr	Normal	
U	Normal	
Rb	Normal	
Th	Normal	▼

▲

▼

Display Options

Never Display ▼

Reset Save Close

Figure 1-63. Changed Display Options

Select the Save Button to save your current status as the new default. After saving, you will go back to the **Element Display Menu**.

Close Button

Select the Close Button to exit without saving. When you select the Close Button after changing the display state of any element, a screen will open asking you if you want to save the changes you made. Selecting “Yes” will save these changes as the new default. Selecting “No” will return you to the **Element Display Menu** without saving the changes.

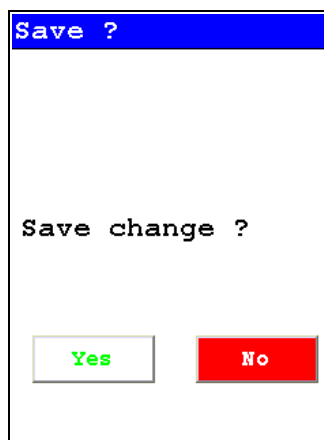


Figure 1-64. Save Changes

The Set Element Threshold Menu

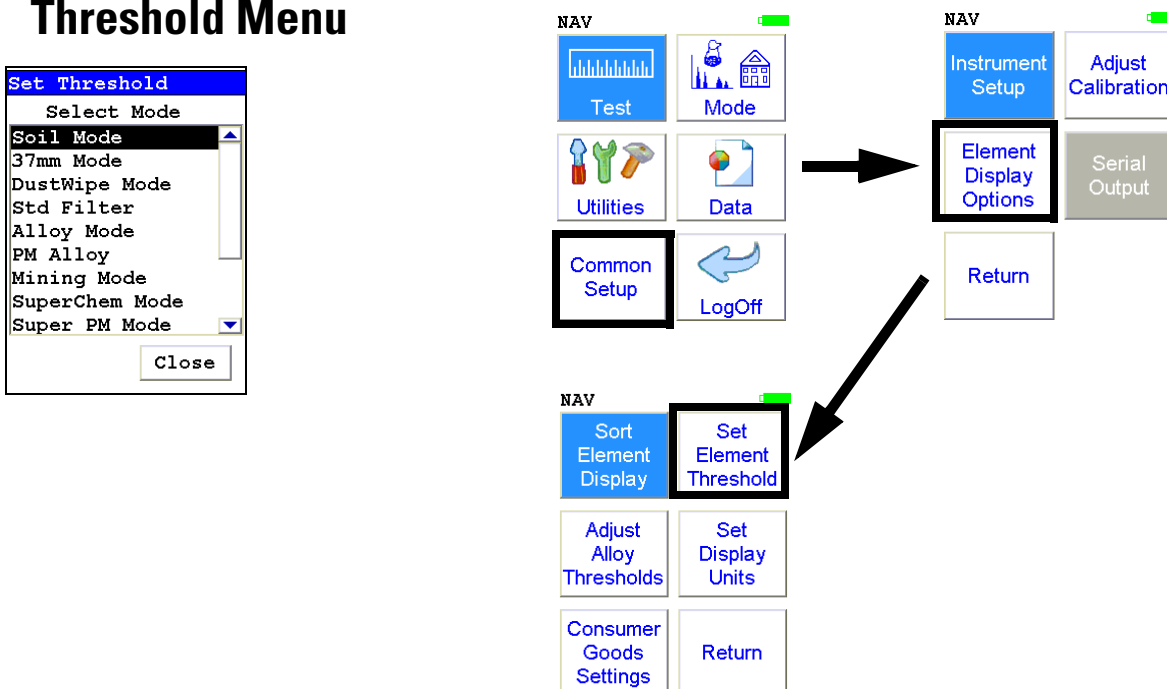


Figure 1-65. The Set Element Threshold Menu Path

Select the **Set Element Threshold** icon to configure pass and fail criteria for elemental analysis. Selecting the **Set Element Threshold** icon opens the **Set Threshold Screen**.

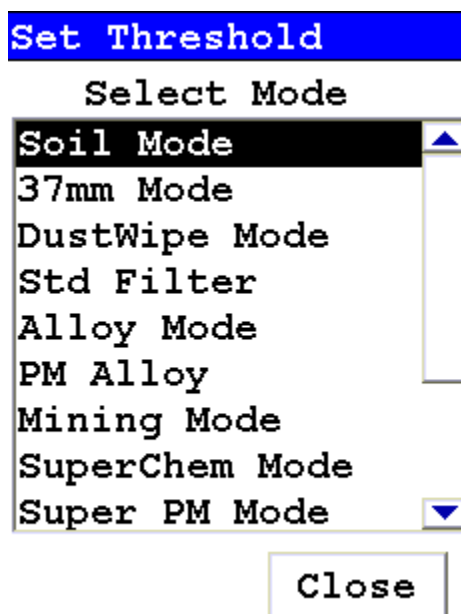


Figure 1-66. Set Threshold Screen

Select the mode you wish to work with from the scrollable list. This will open up the **Settings Screen** for that mode.

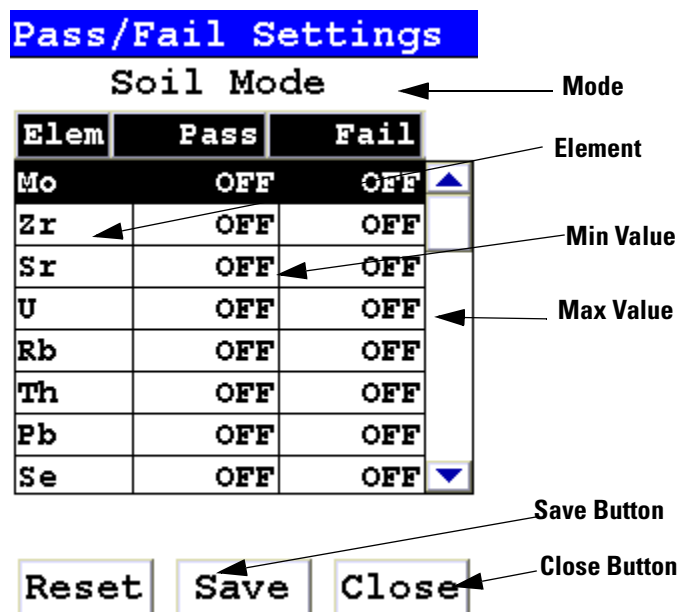


Figure 1-67. Pass/Fail Settings Screen

Selecting the Pass Value will open up the Pass Editor for the selected element.

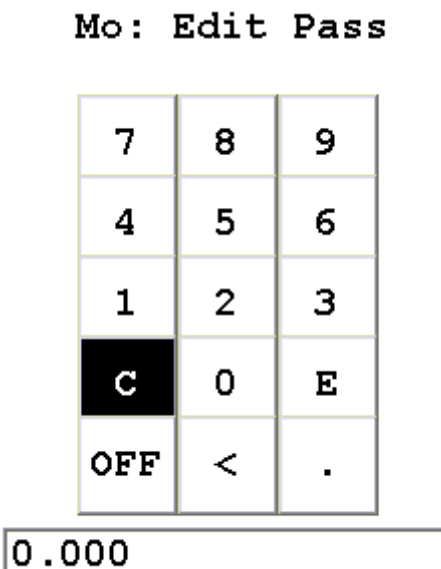


Figure 1-68. The Pass Editor

The Editor is very similar to the Logon Screen. The “C” button clears the field, and the “<” button clears the last numeral. Select the numerals you want, then press “E” to enter the number. “OFF” resets the value to “OFF”

Selecting the Fail Value will open up the Fail Editor for the selected element.

Mo: Edit Fail

7	8	9
4	5	6
1	2	3
C	0	E
OFF	<	.

0.000

Figure 1-69. The Fail Editor

The Fail Editor works the same as the Pass Editor.

When you press the “E” button in either editor, you are returned to the Pass/Fail Settings Screen, with your new values in place.

Selecting the “OFF” button not only sets the value to “OFF” but also saves the new value.

Pass/Fail Settings		
Soil Mode		
Elem	Pass	Fail
Mo	0.006	0.012
Zr	OFF	OFF
Sr	OFF	OFF
U	OFF	OFF
Rb	OFF	OFF
Th	OFF	OFF
Pb	OFF	OFF
Se	OFF	OFF

Reset
Save
Close

Figure 1-70. The Settings Screen with new parameters

Select the Save Button to save your current status as the new default. After saving, you will go back to the **Element Display Menu**.

Select the Close Button to exit without saving. When you select the Close Button after changing the display state of any element, a screen will open asking you if you want to save the changes you made. Selecting “Yes” will save these changes as the new default. Selecting “No” will return you to the **Element Display Menu** without saving the changes.

Need Saving	
Save Changes ?	
Yes	No

Figure 1-71. Save Changes Screen

Selecting the triangle next to the Analysis Options Field will open a pop up menu allowing you to choose between the three Analysis Option Modes. Select the mode you wish to edit.

Pass/Fail Settings	
Plastic Mode	
Elem	Pass/Fail
Pb	ON ▲
Cd	ON
Hg	ON
As	ON
Ba	ON
Rohs	
Detection	
Consumer Products	
Detection ▼	
Reset	Save
Close	

Figure 1-72. The Analysis Options Pop-up Menu

Changing the settings for one mode will not affect the settings for other modes, and the configurations can be saved independently.

The Set Display Units Menu

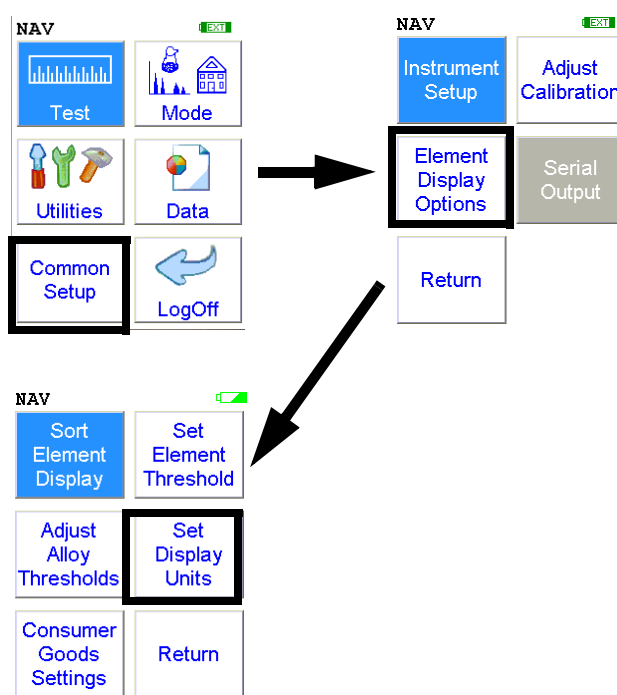
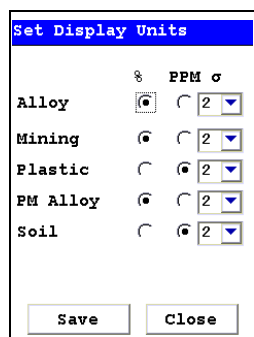


Figure 1-73. The Set Display Units Menu Path

Select the **Set Display Units** icon to choose between ppm (parts per million) and percentage (hundredths of whole) displays when taking readings, and to change the Sigma value you want for the reading. Selecting the **Set Display Units** icon opens the **Set Display Units Screen**.

Setting Display Units

In the Set Display Units Screen, you can select between Percent composition and Parts per Million as the units displayed in a measurement, and you can change this setting independently for Alloy, Mining, Plastic, Precious Metal, and Soil modes. You can also change the Sigma for each of these modes independently. See . Note that you can now set display units for Mining and Plastic modes.

Set Display Units			
	%	PPM	σ
Alloy	☒	☐	2 ▼
Mining	☐	☐	2 ▼
Plastic	☐	☒	2 ▼
PM Alloy	☐	☐	2 ▼
Soil	☐	☒	2 ▼

Figure 1-74. The Set Display Units Screen

Changing Sigma

Set Display Units			
	%	PPM	σ
Alloy	☒	☐	2 ▼
Mining	☐	☐	1
			2
Plastic	☐	☒	3
			4
Prec. Metal	☐	☐	
Soil	☐	☐	2 ▼

Figure 1-75. Selecting new Sigma values

Sigma

Sigma is the symbol used for Standard Deviation, a measure of how much a set of numbers deviates from the mean. For example, each of the three data sets {0, 0, 14, and 14}, {0, 6, 8, and 14} and {6, 6, 8, 8} has a mean of 7. Their standard deviations are 7, 5, and 1, respectively. The third set has a much smaller standard deviation than the other two because its values are all close to 7. In a loose sense, the standard deviation tells us how far from the mean the data points tend to be.

The number of standard deviations between the process mean and the nearest specification limit is given in sigmas. As process standard deviation goes up, or the mean of the process moves away from the center of the tolerance, the sigma number goes down, because fewer standard deviations will then fit between the mean and the nearest specification limit.

Confidence Intervals

Confidence intervals assume that the data are from an approximately normally distributed population - generally, sums of many independent, identically distributed random variables tend towards the normal distribution as a limit. Using this assumption, about 68 % of the values must be within 1 standard deviation of the mean, about 95 % of the values must be within two standard deviations, about 99.7 % must lie within 3 standard deviations, and about 99.99% of the values must lie within 4 standard deviations.

The greater the sigma value of the test, the more confident you can be that the sample is as it appears, but the more difficult and time consuming the testing must be to verify this. That's why it's important to use the most appropriate sigma value for the test. By adjusting the sigma value for each type of test, you can optimize the process for your needs.

Adjusting the Sigma Values

The sigma values are listed in the column headed " -- ". The default value is 2 sigma. You can change this value by selecting the down arrow next to the value, which opens up a drop-down menu from which you can select the desired sigma value by clicking on it.

When you have changed the sigma values to the appropriate number, select the Save button to save these settings for use. Select the Close button to return to the previous screen without saving any changes.

Camera and Small Spot Video

The Camera feature is only usable with properly configured analyzers, and the Small Spot feature is only available on Small Spot analyzers.

If your analyzer is equipped with an internal video camera, you can turn that camera on and off, and turn the saving of images with the readings on and off through an interface. When the camera is on, the image will show in the Ready to Test screen, as in [Figure 1-4](#). If the camera is off, saving of images will also be off. If the camera is on and the image saving function is also on, the images will automatically be saved with the reading. Saving images will curtail the maximum number of readings stored.

How to Use the Camera

When a Camera equipped XL3 analyzer is in the Ready to Test screen, the video feed appears live on the analyzer's touch screen. This is the image that can be saved with the sample analysis. When you take a measurement, if you choose to do so, the bitmap image will be saved on the analyzer along with the analysis results. The interface is accessible through the Instrument Setup/Hardware Setup menu, as in [Figure 1-2](#).

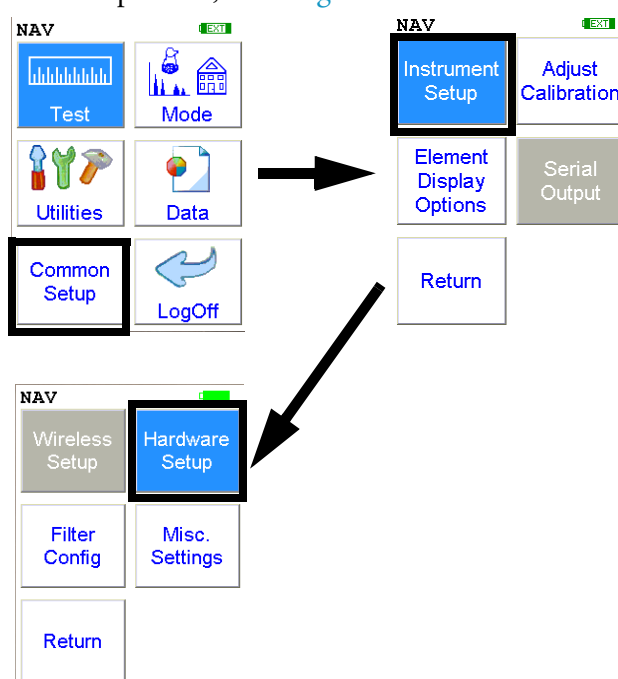


Figure 1-1. The Hardware Setup Menu Path

The screenshot shows a menu titled "Instrument Setup" with a blue header. Below the header, there are four settings:

- Proximity Start** with an unchecked checkbox.
- Interlock Start** with an unchecked checkbox.
- Camera** with a checked checkbox (indicated by a green checkmark).
- Save Image** with a checked checkbox (indicated by a green checkmark).
- Max. Time** with a text box containing the value **36000.0**.
- A **Save** button at the bottom.

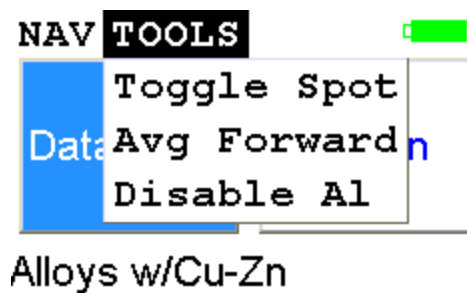
Figure 1-2. Setting Up the Camera View and Image Saving

Stored camera images from previous measurements can be viewed on the analyzer.

How to Use the Small Spot Technology

With a properly equipped Small Spot analyzer, you can restrict the analysis to a small spot within the camera view. You can toggle the Spot on and off from the Tools Menu as in [Figure 1-3](#).

A red circle with a small hash mark (#) will appear on the display. The small hash marks the center of the x-ray analysis spot, while the larger circle marks the area analyzed.



Lib:Std 5_22.alb

Figure 1-3. Toggling the Small Spot from the TOOLS Menu



Figure 1-4. Camera View

Using the Small Spot

The Small Spot can be used in several different modes.

Mining

3mm spot size allows analysis of veins and inclusions in mineral samples

Initiate from Tools - Small Spot

He Purged

Helium purge allows analysis of light elements (Mg, V and Ti)

Small spot enables analysis of light elements in welds and inclusions

Helium and Small Spot modes can be used simultaneously for Alloy and Mining modes

Chapter 2 Routine Maintenance Guidelines

Battery Pack and Battery Charger

Each NITON Analyzer is shipped with two lithium ion battery packs. When fully charged, the battery pack provides approximately 6-8-12 hours of use, depending on duty cycle.

Replacement battery packs (NITON part number 420-002) may be ordered from NITON in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or from your local Authorized NITON Analyzers Service Center.

Note Before beginning a test, be certain that the battery has sufficient charge. ♦



CAUTION Do not leave the battery pack connected to the charger for excessive periods of time. Overnight recharging is recommended. ♦



CAUTION Store the analyzer and the spare battery packs in a cool place, away from direct sunlight. ♦

Replacing The Battery Pack

1. Slide back the catch on the bottom of your analyzer's pistol grip and drop the battery out into your hand.
2. Place the old battery aside and slide the new battery up into the cavity in the bottom of the pistol grip. The battery is keyed, and will only insert fully one way.
3. Press in until the latch resets.

Recharging The Battery Pack

Fully recharging a battery pack takes approximately 2 hours.

1. Remove the battery pack from the analyzer.
2. Place the battery pack upside down into the charger. The battery pack is keyed, and will only fit into the charger fully one way. If your battery pack is resting on the back of the back of the charger rather than sliding all the way to the bottom, remove the battery pack, turn it around, and re-insert it into the charger.
3. The red light is on when the charger is plugged in. This is the power indicator light.

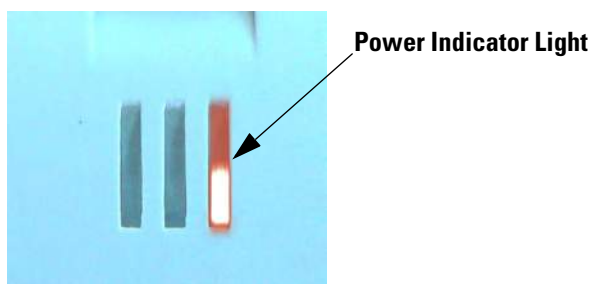


Figure 2-1. Power Indicator Light

4. The yellow light indicates that the battery pack is currently being charged..

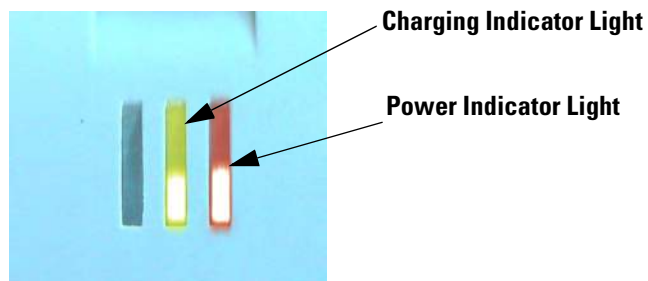
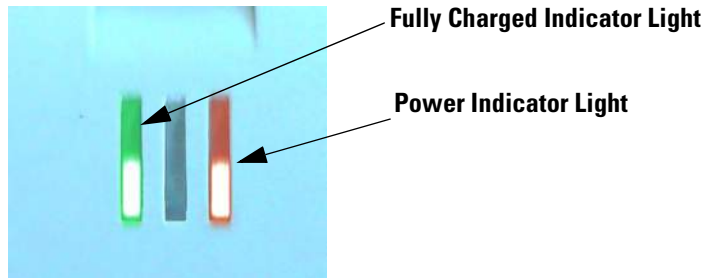


Figure 2-2. Charging Light

5. The green light indicates that the battery pack has finished charging and is ready for use.



6. If there is a fully seated battery pack in the charger and only the red light is on, there is a fault with the battery pack or charger.

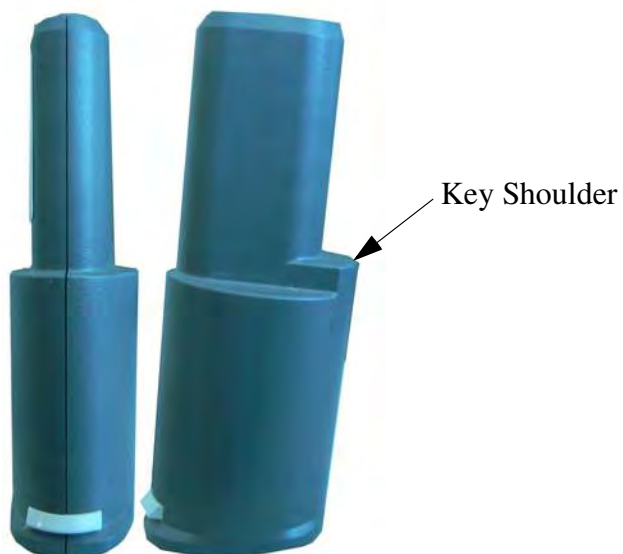
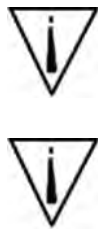


Figure 2-3. Rear and Side views of Battery Pack showing key



CAUTION Do not store battery packs or charger in direct sunlight. ♦

CAUTION Do not let the battery pack recharge for excessive periods of time. ♦

Figure 2-4. Battery Pack in the Charger



Maintenance, Cleaning and Repairs

To ensure the reliability, durability, and performance of your NITON Analyzer, keep it clean—especially the transparent measurement window covering the analysis window. Clean the measurement window gently with a cotton swab. Clean the body of the analyzer with a soft cloth. Never use detergents, or solvents on your analyzer, or immerse your analyzer in water. If the measurement window becomes frayed, ripped, or contaminated with metal particulates, replace it with a new window. measurement windows (Standard Window Niton P/N 187-1555 or Helium Purge Window Niton P/N 187-1454) may be ordered from Thermo Fisher Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 or from your local Authorized NITON Analyzers Service Center.

From time to time, your touch screen will need cleaning. NITON recommends that you use a lens cleaning solution with a soft cloth. Do not use water to clean your NITON Analyzer.



WARNING! All Service, except exterior cleaning and measurement window replacement, must be performed by Thermo Scientific or an Authorized NITON Analyzers Service Center. Do not attempt to make repairs yourself. Opening the case of your NITON will void the analyzer Warranty in its entirety. ♦



CAUTION Always obtain a Return Authorization (RA) number from Thermo Fisher Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 before returning your analyzer to the NITON Service Department or local Authorized NITON Analyzers Service Center. ♦

Replacing the Measurement Window

1. Remove the two Phillips head screws.



Figure 2-5. View of Face Plate and measurement window

2. Remove the face plate and place it face down.



Figure 2-6. Face Plate Removed showing measurement window on Reverse

3. Remove the old measurement window.
4. Clean the back surface of the face plate and install the new Window.

5. Turn the face plate over and replace it on the analyzer's front end, fitting the plate carefully over the Proximity Button.



Figure 2-7. Fitting Face Plate over Proximity Button

6. Reinstall the two screws, being careful not to over-tighten them.



Figure 2-8. Replacing the Screws.

Storing and Transporting Your XL3 Analyzer

All NITON Analyzers are transported in waterproof, drop-resistant, fully padded carrying cases with padlocks. In most countries, NITON XRF analyzers may be transported by car or plane or shipped as an *ordinary* package. For most courier services, no special labels are required on the outside of the NITON analyzer case or on additional packaging.



Figure 2-9. The NITON Carrying Case

All padlocks are shipped with a default combination of “0-0-0”. If you change this combination, please inform Thermo of the new combination if you return the unit for service.

To change the combination:

1. **Dial the default combination to open the lock, and pull out the shackle.**
2. **Rotate the shackle 180 degrees and push it down as far as it can go.**
3. **While holding the shackle down, rotate it 90 degrees back in either direction and release shackle.**

4. **Change the dial settings to the desired combination, record the combination, and without disturbing the dials, rotate the shackle back 90 degrees to the position it had in step 2.**
5. **Pull shackle out and rotate it 180 degrees and secure it. Your lock now has its own secret combination.**



CAUTION Always transport the unit in its padded carrying case, and store the NITON Analyzer in its case whenever it is not being used. ♦



CAUTION In most cases, no notification is required if transporting within state boundaries. This may not be the case when entering federal properties. ♦



CAUTION Within the United States, always keep a copy of the US DOT compliance statement in your NITON analyzer case at all times. A copy is included with your analyzer. ♦



CAUTION Always follow all pertinent local and national regulations and guidelines, wherever your analyzer is transported or used. ♦



CAUTION Always obtain a Return Authorization (RA) number from Thermo Fisher Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 before returning your analyzer to the Service Department or to your local Authorized NITON Analyzers Service Center. ♦



CAUTION If you return your NITON analyzer without the carrying case, you will void your warranty in its entirety. You will be billed for a replacement case plus any repairs resulting from improper shipping. ♦



CAUTION Always remove the battery pack when transporting or storing your analyzer. ♦

Routine Maintenance Guidelines
Storing and Transporting Your XL3 Analyzer

Networking and Connectivity

Setting up Wireless Networking

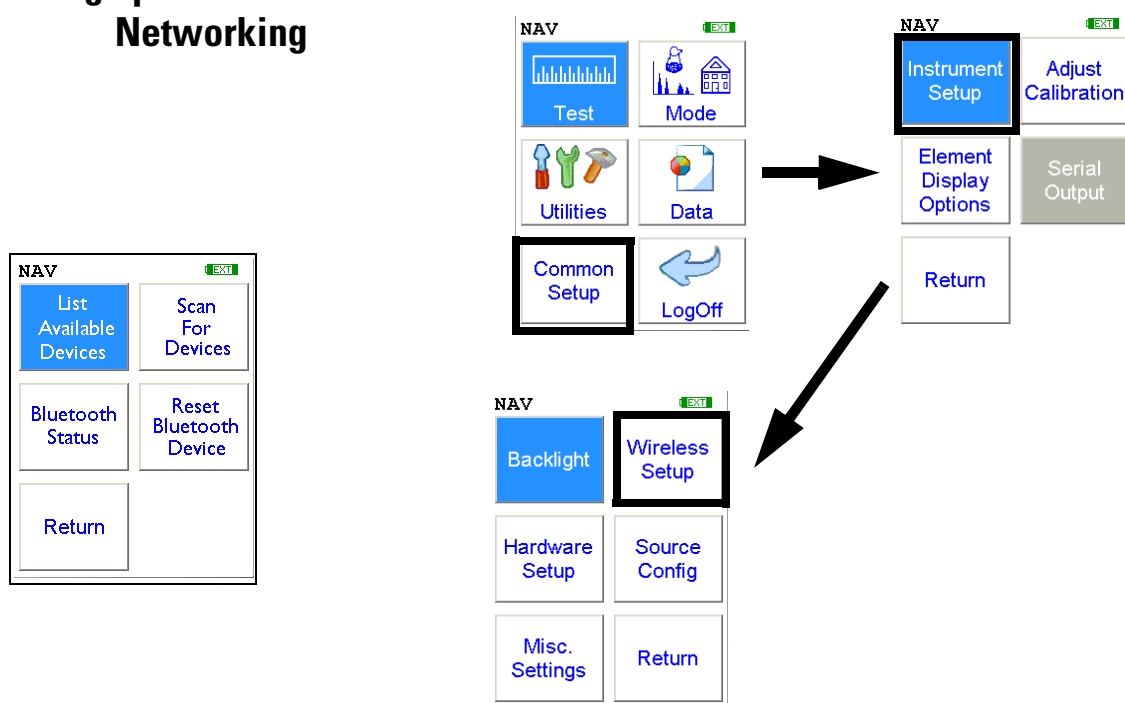
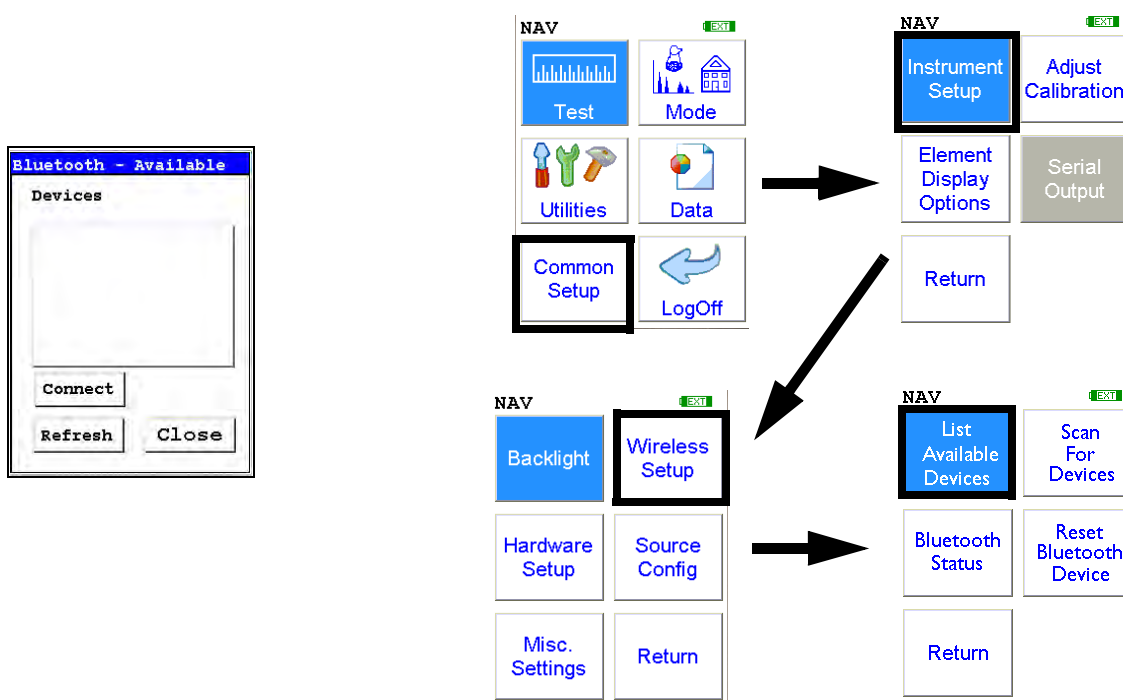


Figure 2-10. Wireless Networking Menu Path

Bluetooth Wireless Networking enables you to connect to your computer and other Bluetooth-enabled devices such as printers and GPS devices without the need of cabling, ports, or hubs.

Available Devices Screen



Select the List Available Devices icon to show a list of Bluetooth devices previously discovered. The Bluetooth devices listed are only those which were present at the last time you ran a discovery scan for Bluetooth devices, as the list is not automatically updated. Selecting the List Available Devices icon brings up the Available Devices screen. From the list, you can connect your analyzer to those devices.

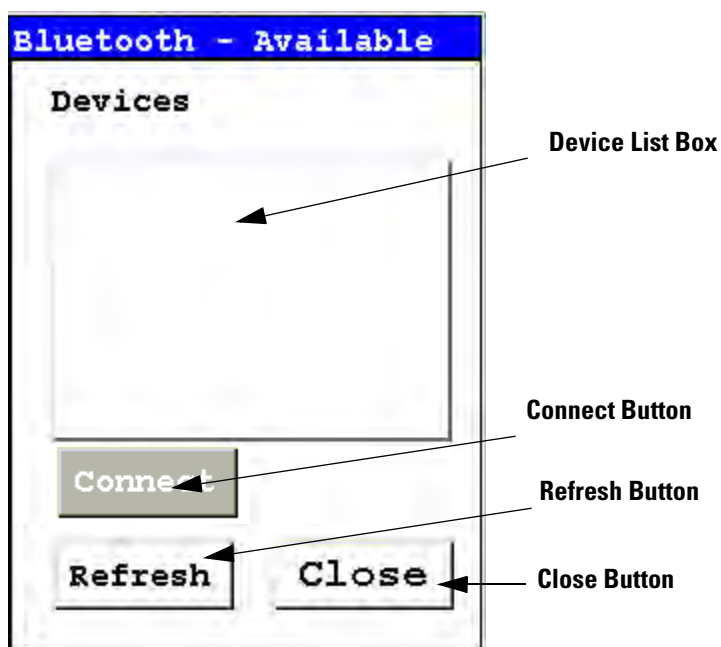


Figure 2-11. Available Devices Screen

Under “Devices,” in the Device List Box, the Available Devices Screen lists all known applicable Bluetooth devices in the area found during the last refresh or scan.



Figure 2-12. Example Device List

- Selecting the Refresh Button initiates a scan of the area for new Bluetooth devices. Devices no longer present are removed.

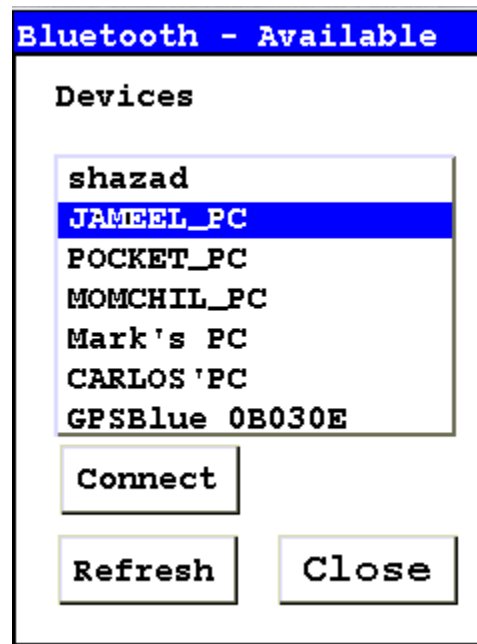
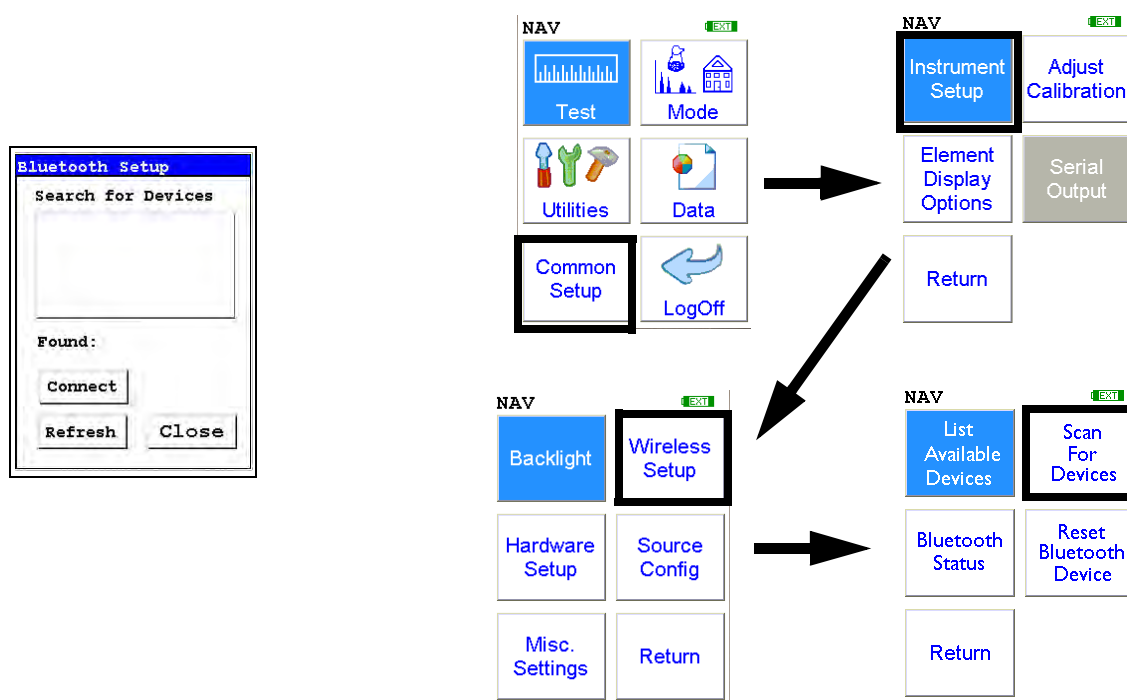


Figure 2-13. Available Device Refresh

- Selecting a listed Bluetooth Device enables the Connect Button.
- Selecting the Connect Button will connect your analyzer to the selected device. See the Connected Screen.

Bluetooth Search Screen



Select the Scan For Devices icon bring up the Bluetooth Search Screen, enabling you to initiate a discovery scan of Bluetooth devices in the operational area. This scan will find all appropriate Bluetooth devices in the operational area, enabling you to connect to those devices.

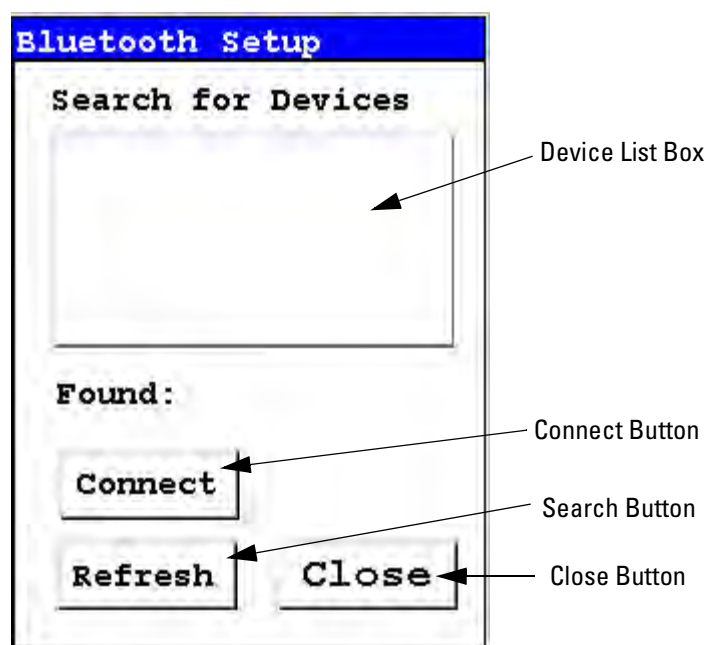


Figure 2-14. Bluetooth Search Screen

The Bluetooth Search Screen does not retain information about previously detected Bluetooth Devices. Each time the Bluetooth Search Screen is opened, the Device List Box is empty.

- Selecting the Search Button initiates a scan for Bluetooth Devices in the area.

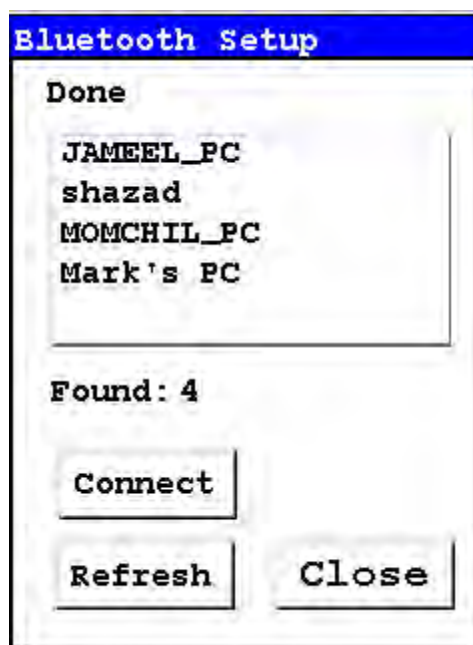


Figure 2-15. Example Search List

Depending on where and when the Search Scan is conducted, certain devices may or may not be detected. You can select a device and connect to that device in exactly the same manner as in the Available Devices Screen, once the search is finished.



Figure 2-16. Search List with New Device Found

The Connected Screen

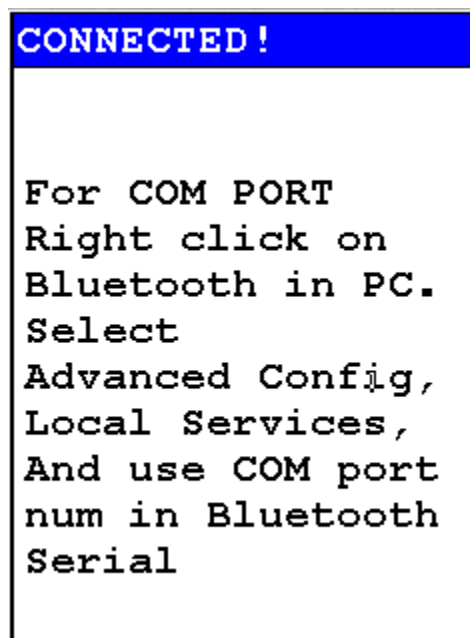


Figure 2-17. The Connected Screen

When you have connected your analyzer to a Bluetooth Device, you get the Connection Screen. The Connection Screen serves as a reminder of what needs to be done to use the connection. With simple devices like GPS devices, a notification that you are connected is given, and everything just works, but working with a PC is a bit more complex.

In order to use a Bluetooth Serial Connection with a PC, you need to know which COM port Bluetooth is connected through. To determine this, right click on the Bluetooth logo in your system tray on your PC. From the popup menu which appears, select Advanced Config., then select Local Services.

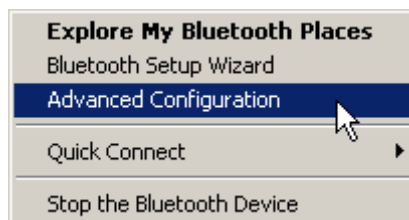


Figure 2-18. Advanced Configuration selection on PC

Service Name	Startup	Secure Connection	COM Port
Audio Gateway	Auto...	Not Required	
Headset	Auto...	Not Required	
PIM Synchronization	Manu...	Required	
Fax	Manu...	Required	
File Transfer	Auto...	Required	
PIM Item Transfer	Manu...	Not Required	
Dial-up Networking	Manu...	Required	
Network Access	Auto...	Required	
Bluetooth Serial Port	Auto...	Not Required	COM3

Figure 2-19. Bluetooth Service Listing on PC

In the Bluetooth Serial Port row, the COM port used by Bluetooth is identified. Use this port for any interactions between your analyzer and your computer, such as NDT or NDT_r.

Make sure that the Secure Connection setting for the Bluetooth Serial Port is set to “Not Required.”

Service Name	Startup	Secure Connection	COM Port
Audio Gateway	Auto...	Not Required	
Headset	Auto...	Not Required	
PIM Synchronization	Manu...	Required	
Fax	Manu...	Required	
File Transfer	Auto...	Required	
PIM Item Transfer	Manu...	Not Required	
Dial-up Networking	Manu...	Required	
Network Access	Auto...	Required	
Bluetooth Serial Port	Auto...	Not Required	COM3

Figure 2-20. Selecting Bluetooth Serial Port on PC

To edit the setting, double click the row.

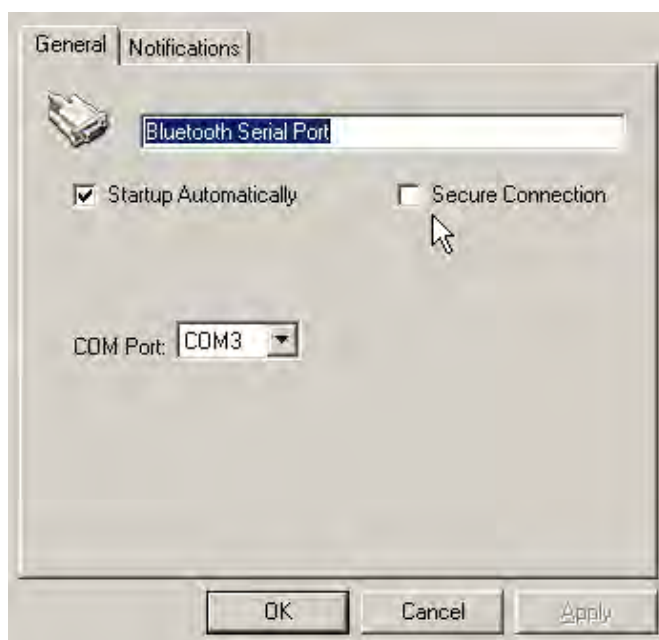
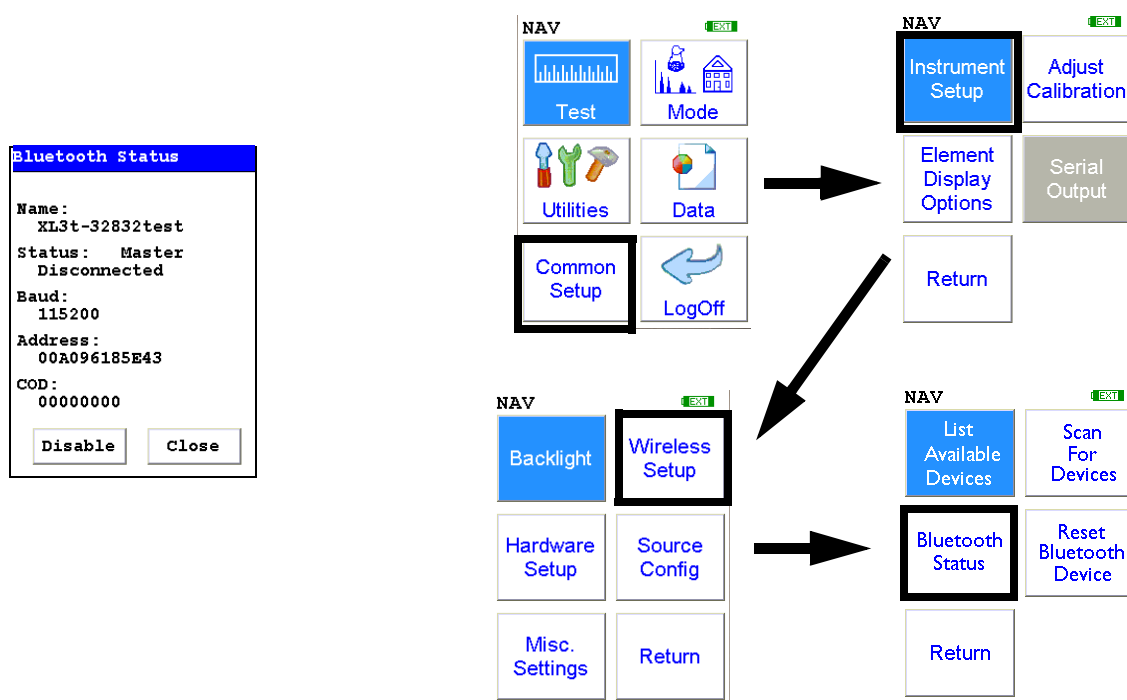


Figure 2-21. Changing the Bluetooth Secure Connection Checkbox on PC

Unselect the Secure Connections checkbox if it is already selected, then select the “OK” button.

Bluetooth Status Screen



The Bluetooth Status Screen enables you to see at a glance if and how your analyzer is connected to your computer.

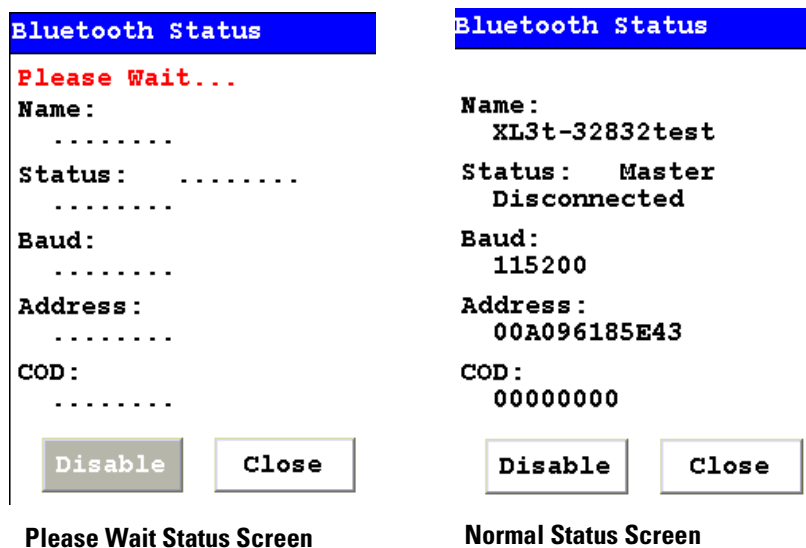


Figure 2-22. Example Bluetooth Status Screen

Select the Bluetooth Status icon to view the current status of your Bluetooth connections on the Bluetooth Status Screen. The Bluetooth Status Screen will display your analyzer's serial number, connection status, the transfer rate, and your analyzer's address

In [Figure 2-22](#), the first screen shown is the Please Wait screen. This screen is shown while the status inquiry is in process. When the inquiry is complete, the normal Status Screen will show.

The Bluetooth Status Screen shows your analyzer's identification label, its connection state, the speed of the communication port setting, your analyzer's network address, and the COD.

In [Figure 2-22](#), the analyzer "XL3t-32832test" is not connected to any computer, was last in Master state - i.e. the last connection was initiated by the computer and not by the analyzer, has a com port set to communicate at 115200 baud, has the unique network (MAC) address of 00A096185E46, and has a COD (Class Of Device) of 00000000.

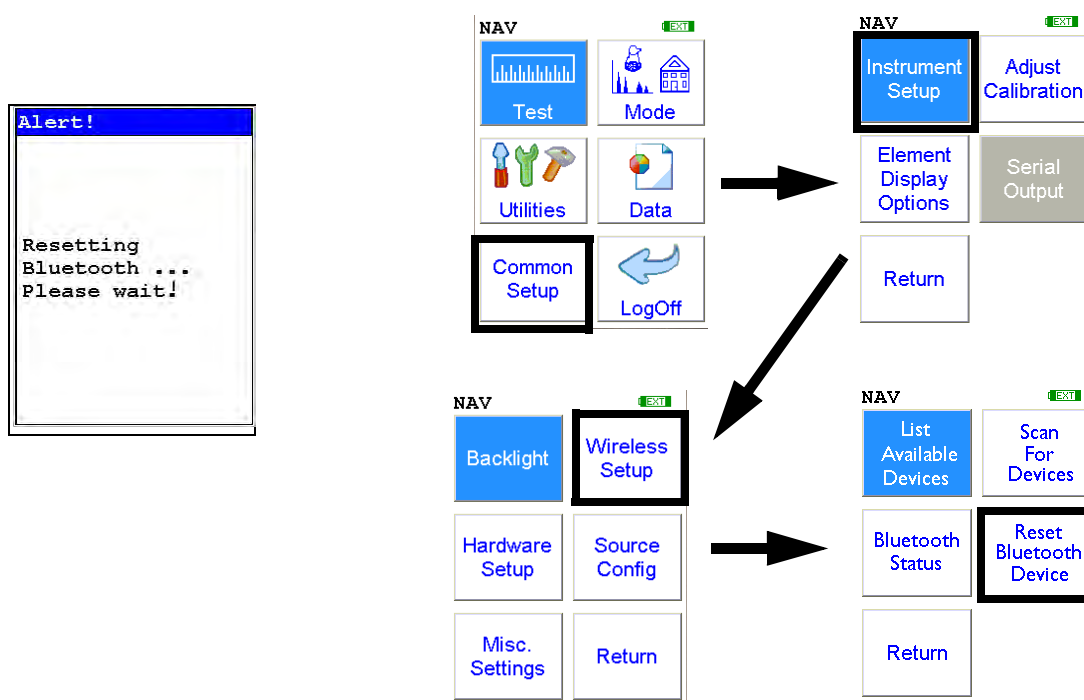
Selecting the Disable Button will shut down the Bluetooth device entirely. A "Bluetooth Disabled" message appears, and the Disable Button changes to "Enable".

The Close screen button will return you to the Wireless Setup Menu.



Figure 2-23. Bluetooth Status Screen Showing Bluetooth Disabled

Reset Bluetooth Device



Select the **Reset Bluetooth Device** icon to initiate an immediate reset of the Bluetooth Wireless Networking. Selecting the **Reset Bluetooth Device** icon will clear out old settings and data, as well as enabling you to switch between Bluetooth and standard serial cable. While resetting, your analyzer will show the following screen:



Figure 2-24. Bluetooth Reset Alert

GPS Data Tracking

Bluetooth equipped NITON XRF Analyzers are capable of communicating with GPS modules and saving GPS coordinates with every reading. Follow the Bluetooth connection instructions found in the Users Manual to scan for and connect to a Bluetooth enabled GPS device.

Once connected, the GPS unit sends out a number of signals that can be read. The analyzer will display the relevant information from the GPS after connection, as shown in [Figure 2-25](#)

As shown in [Figure 2-26](#), these coordinates can be viewed in the Data screen in entry positions eight, nine, and ten. (Scroll down to reach these fields.) When the results are downloaded using the NDT software the GPS coordinates are also stored and downloaded in data entry fields eight, nine and ten.

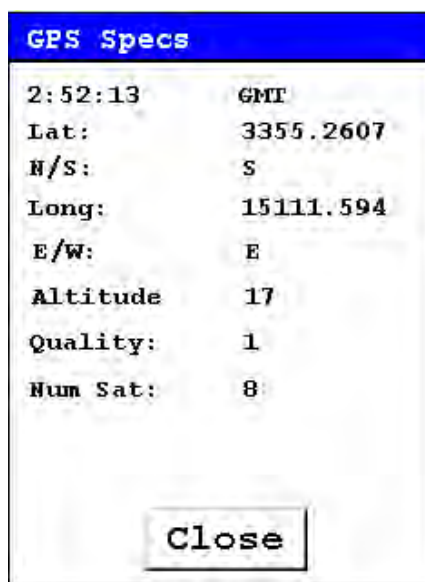


Figure 2-25. Example of GPS Data

Example of GPS Data

- 2:52:13 GMT - Greenwich Mean Time obtained from the GPS satellites.
- Lat: 3355.2607 -Latitude coordinate of current location. This should be read as:
 - All digits to the right of the decimal point are seconds.
 - First two digits to the left of the decimal point are minutes.

- The next two or three digits to the left of the decimal point are degrees.
- Thus 3355.2607 is read 33 degrees 55 minutes 26.07 seconds.
- N/S: S - Compass direction of Latitude.
- Long: 15111.594 - Longitude coordinate of current location.
- All digits to the right of the decimal point are seconds.
- First two digits to the left of the decimal point are minutes.
- The next two or three digits to the left of the decimal point are degrees.
- Thus 15111.594 is read 151 degrees 11 minutes 59.4 seconds.
- W/E: E - Compass direction of Longitude.
- Altitude: 17 - Height above sea level in meters.
- Quality: 1 - Quality of signal strength.
- Num Sat: 8 - Number of satellites signals being received by GPS.
This number varies depending on your position, the current position of the satellites, and the signal strength.

Data	
NAV Tools	
6	MISC
7	NOTE
8	LATITUDE
9	LONGITUDE
10	ALTITUDE

Figure 2-26. GPS Data Integrated Into Reading Data

GPS Options

The communication system standard required for compatibility is NMEA0182 ver. 3.0, using GPGGA, GPGSA, GPRMC, and GPGSV formats. This type of GPS is most commonly used for motor and marine directional mapping systems.

Tested Units include:

Copilot BTGPS3

<http://www.alk.com/copilot/pocketpc.asp>

RoyalTek Star111

<http://www.royaltek.com/index.php/content/view/98/80/>

IOGEAR Bluetooth GPS

<http://www.iogear.com/main.php?loc=product&Item=GBGPS201W6>

Note These GPS systems have an accuracy of about 10 meters.

Haicom HI-408BT GPS

http://www.haicom.com.tw/hi_408bt.aspx

Note Claimed accuracy is 3 meters

Entering Data with a Barcode reader

You can also use Bluetooth barcode readers with your analyzer. Connect your reader to your analyzer in the usual way, see See Chapter 2 page 11 for details. Once the reader is connected, you can use it to input data into your analyzer.

- On the data entry screen, highlight the desired field.
- While pressing the button on the Barcode Pencil, swipe the desired barcode. If the pencil successfully reads the barcode, it will beep.
- The barcoded data will show up in the data field after the beep. There is a short delay while the information is being transmitted
- You may also use the Virtual Keyboard Screen to enter barcoded data.

Data	
NAV Tools	
SAMPLE	9781565922785
HEAT	065030820219
LOT	GL30
BATCH	
MISC	

You can replace, append or clear any field with a custom barcode:

- R05TEXT replaces field 5 with the TEXT
- A05C – appends field 5 with the letter C
- C05 – clears field 5
- C00 – clears all fields

Supported Barcode Readers

At the time of publication, supported readers include:

- The Baracoda Barcode Pencil

The Baracoda Barcode Pencil supports these barcodes for use with the XL3 system.

- Code 96
- Code 128/EAN 128
- EAN13/UPCA
- UPCE/EAN8
- Code 39
- Codabar
- Interleaved 2 of 5
- Standard 2 of 5
- Code 11
- MSI RSS14
- RS Limited

Consult your Baracoda Pencil Users Manual for more information and information on successful barcoding.

Setting Up and Using the USB port

The USB port is the narrow inverted trapezoidal port on the back of your XL3 Analyzer. You can use this port, along with the supplied cable, to communicate with your analyzer.

Mini USB Port



Figure 2-27. Location of Mini-USB port

Insert the smaller end of your USB cable into the Mini-USB port on the back of your XL3, and the larger end into any USB port on your computer.

When you turn your analyzer on after it is connected, or if you connect it while the analyzer is on, a "Found New Hardware" Wizard will open, as in [Figure 2-28](#).



Figure 2-28. Found New Hardware Wizard

Note If, after installation, you plug your USB cable into a different USB port on your computer, you will get this Wizard again.

The Installation Wizard

Place the installation CD in the drive, select "No, not this time" then select "Next." The Wizard will now ask you what you want it to do, as in [Figure 2-29](#). Select "Install the software automatically."

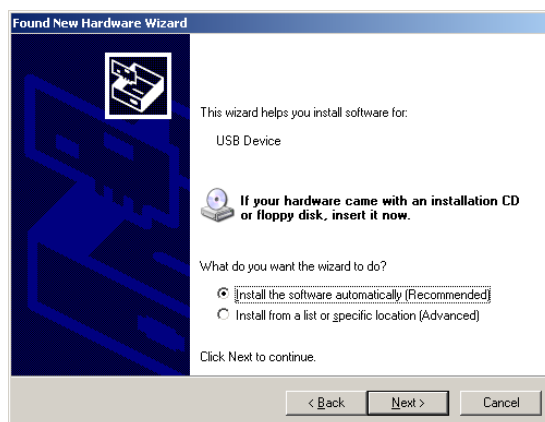


Figure 2-29. Wizard Choice

The Wizard will now search the CD for the proper software, as in [Figure 2-30](#). When the Hardware Installation window comes up stating that the software has not passed XP logo certification, don't worry. The driver is from Microsoft. Select "Continue Anyway."



Figure 2-30. Installation Wizard Search

The Wizard will now install the software. This may take several minutes. At the end of this process, you will see the final Wizard screen, as in [Figure 2-31](#), informing you the process is complete. Select "Finish."

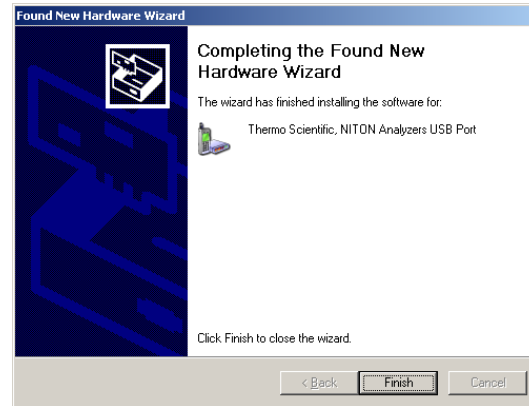


Figure 2-31. Final Installation Wizard Screen

The driver will install as the next free COM device - for example, if you have devices installed as COM1 through COM 5, the driver will install as COM 6. You can find how the software has been installed by starting up NDTi and selecting Settings. The Connect Using box shows you to which Comm port you are using - as in [Figure 2-32](#).

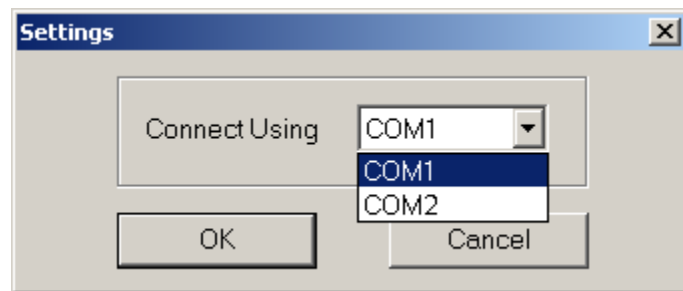


Figure 2-32. The Settings Pop-up Window

Entering Data with a Barcode reader

Chapter 3 Radiation and General Safety

This chapter covers topics related to radiation safety and general safety when using a Thermo Scientific NITON XL3t analyzer. At a minimum all operators of the XL3t should be familiar with the instructions provided in this chapter in order to handle the XL3t in a safe manner. In addition to reading the information presented on the following pages, Thermo Fisher Scientific recommends that instrument users participate in a radiation safety and operational training class.



WARNING! Always treat radiation with respect. Do not hold your analyzer near the measurement window during testing. Never point your analyzer at yourself or anyone else when the shutter is open. ♦

Radiation and General Safety

This chapter covers topics related to radiation safety and general safety when using a Thermo Scientific NITON XL3t analyzer. At a minimum all operators of the XL3t should be familiar with the instructions provided in this chapter in order to handle the XL3t in a safe manner. In addition to reading the information presented on the following pages, Thermo Fisher Scientific recommends that instrument users participate in a radiation safety and operational training class.

Radiation Protection Basics

The NITON Model XL3t analyzer contains an x-ray tube which emits radiation only when the user turns the x-ray tube on. When the x-ray tube is on and the shutter is open, as during a measurement, the analyzer emits a directed radiation beam (See Figures 0-6 and 0-7). Reasonable effort should be made to maintain exposures to radiation as far below dose limits as is practical. This is known as the ALARA (As Low as Reasonably Achievable) principle. For any given source of radiation, three factors will help minimize your radiation exposure: Time, Distance, and Shielding.

Time

The longer you are exposed to a source of radiation the longer the radiation is able to interact in your body and the greater the dose you receive. Dose increases in direct proportion to length of exposure.

Distance The closer you are to a source of radiation, the more radiation strikes you. Based on geometry alone, dose increases and decreases with an inverse-squared relation to your distance from the source of radiation (additional dose rate reduction comes from air attenuation). For example, the radiation dose one foot from a source is nine times greater than the dose three feet from the source. Remember to keep your hands and all body parts away from the front end of the analyzer when the shutter is open to minimize your exposure.

Shielding Shielding is any material that is placed between you and the radiation source. The more material between you and the source, or the denser the material, the less you will be exposed to that radiation. Supplied or optional test stands are an additional source of shielding for analysis. A backscatter shield accessory is also available and may be appropriate in some applications.

Exposure to Radiation

Human dose to radiation is typically measured in rem, or in one-thousandths of a rem, called millirem (mrem), 1 rem = 1000 mrem. Another unit of dose is the Sievert (Sv), 1 Sv = 100 rem. The allowable limit for occupational exposure in the U.S (and many countries internationally) is 5,000 mrem/year (50 mSv/year) for deep (penetrating) dose and 50,000 mrem/year (500 mSv/year) for shallow (i.e., skin) dose or dose to extremities. Deep, shallow, and extremity exposure from a properly used NITON XL3t analyzer should be less than 200 mrem per year, (2.0 mSv per year) even if the analyzer is used as much as 2,000 hours per year, with the shutter open continuously. The only anticipated exceptions to the 200 mrem maximum annual dose are: 1) routine and frequent analysis of plastic samples without use of a test stand, backscatter shield, or similar additional protective measures, or 2) improper use where a part of the body is in the primary beam path. NEVER OPERATE THE DEVICE WITH A PART OF YOUR BODY IN THE PRIMARY BEAM PATH OR WITH THE PRIMARY BEAM PATH DIRECTED AT ANYONE ELSE. Also, consider the use of protective accessories such as a shielded test stand or backscatter shield (or equivalent) when performing routine and/or frequent analysis of any of the following:

- plastic (or similarly low density) samples,
- thin samples (such as foils, circuit boards, and wires), or
- samples that are smaller than the analysis window.

Shown in [Table 3-1](#) below are the typical background radiation doses received by the average member of the public. The radiation dose limits for radiation workers in the US are also shown in [Table 3-2](#).

Table 3-1. Typical Radiation Doses Received (Source: NCRP 1987)

Category	Dose in mrem	Dose in mSv
Average total dose in US (annual)	360	3.6
Average worker exposure (annual)	210	2.1
Average exposure for an underground miner	400	4.0
Exposure for airline crew (1,000 hours at 35,000 ft)	500	5.0
Additional from living in Denver at 5300' (annual)	25	.25
Additional from 4 pCi/l radon in home	1,000	10.0
Typical Chest X-Ray	6	0.06
Typical Head or Neck X-Ray	20	0.2
Typical pelvis/hip x-ray	65	0.65
Typical lumbar spine x-ray	30	0.3
Typical Upper G.I. x-ray	245	2.45
Typical Barium enema x-ray	405	4.05
Typical CAT scan	110	1.10

Table 3-2. Annual Occupational Dose Limits for Radiation Workers (Source: Code of Federal regulations Title 10, Part 20)

Category	Dose in mrem	Dose in mSv
Whole Body	5000	50
Pregnant Worker (during gestation period)	500	5
Eye Dose Equivalent	15,000	150
Shallow dose equivalent to the skin or any extremity or organ	50,000	500
Maximum allowable dose for the general public (annual)	100	1.0
For a Minor	500	5.0

Monitoring your radiation exposure

Individuals can be monitored for the radiation dose they receive by use of radiation dosimetry devices (dosimeters). Monitoring dose using a dosimeter can be a way of identifying improper use and at the same time demonstrating proper use. In some locations, dosimetry is required by regulations and in others it is optional. It is normally required when the user could reasonably be expected to receive in excess of 10% of the annual dose limit. Thermo Fisher Scientific recommends that you determine and obey the local regulatory requirements concerning radiation monitoring of occupational workers.

Two common types of dosimeters are whole-body badges and ring badges. Whole body badges are often attached to the user's torso (e.g., clipped to the collar, shirt pocket, or waist as appropriate). A ring badge is worn on the finger as a measure of maximum extremity dose. When worn, the specific location of the dosimeter should be that part of the body that is expected to receive the highest dose. This location will depend on how the analyzer is used and so it may not be the same for all users. Dosimetry services are offered by many companies. Two companies offering dosimetry services in the USA and much of the world are:

Global Dosimetry Solutions

2652 McGaw Avenue

Irvine, CA 92614

www.dosimetry.com

(800) 251-3331

Landauer, Inc.

2 Science Road

Glenwood, IL 60425-9979

www.landauerinc.com

(800) 323-8830

Note Wearing a dosimeter badge does not protect you against radiation exposure. A dosimeter badge only measures your exposure (at the dosimeter location). ♦

Pregnancy and Radiation Exposure

International guidance documents (e.g., ICRP Publication 60 and NCRP Publication 116*) recommend that the radiation dose to the embryo/fetus of a pregnant woman should not exceed a total of 500 mrem (10% of normal radiation worker limit) during the gestation period. While this dose limit exceeds the dose limit to a trained operator, pregnant workers may want to take special precautions to reduce their exposure to radiation. For more information see the U.S. NRC Regulatory Guide 8.13 "Instruction Concerning Prenatal Radiation Exposure" which can be found on the resource CD.

* The International Commission on Radiological Protection, ICRP, is an independent Registered Charity, established to advance for the public benefit the science of radiological protection, in particular by providing recommendations and guidance on all aspects of protection against ionizing radiation.

* The National Council on Radiation Protection and Measurements (NCRP) was chartered by the U.S. Congress in 1964 as the National Council on Radiation Protection and Measurements.

How to Use the NITON XL3t Analyzer Safely

The NITON XL3t analyzer is designed to be safe to operate provided that it is used in accordance with manufacturers' instructions. Under conditions of normal use, monitored operators seldom receive a measurable dose and have not been known to receive in excess of 10% of the annual occupational dose limits (a criteria that would require monitoring under regulation in the U.S.). In addition to proper use of the XL3t, it is recommended that you follow these precautions to ensure your safety and the safety of those around you.

Know where the beam is

The primary beam is a directed beam out of the front of the analyzer that can have high dose rates. The secondary beam, or scattered beam, has much lower dose rates.

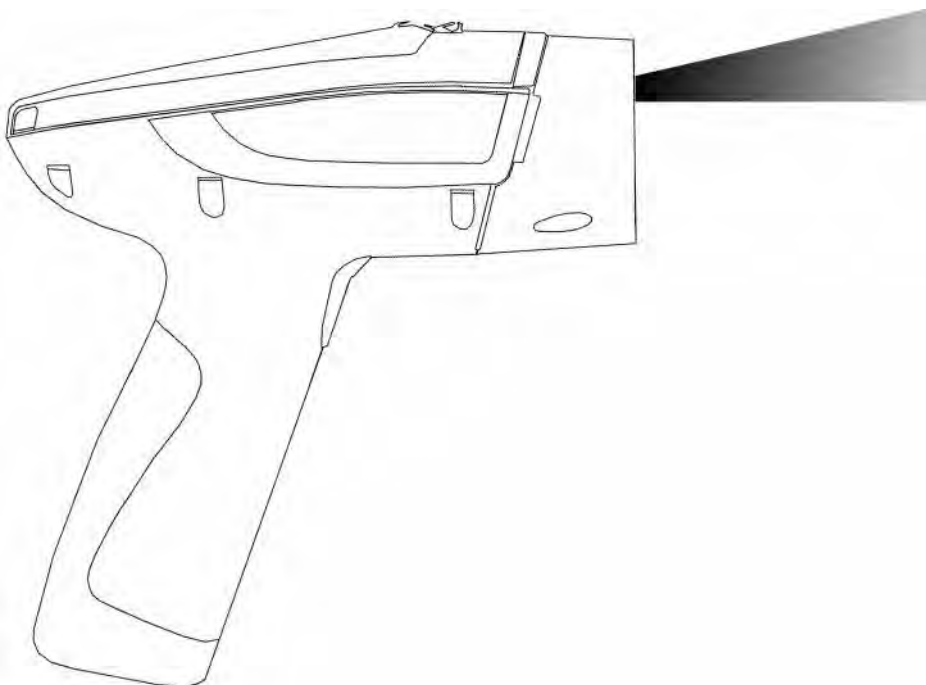


Figure 3-1. . Primary Beam

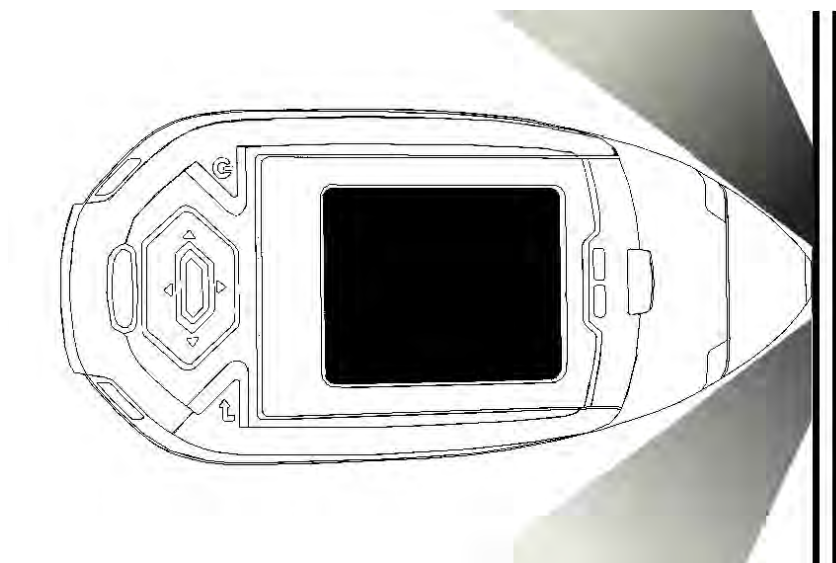


Figure 3-2. Secondary (Scattered) Beam

The Shutter-Open Indicator Lights

When the lights are flashing, the primary beam is on, the shutter is open, and radiation is being emitted from the front of the analyzer. (This does not include the brief flash of the lights when first turning the analyzer on.)

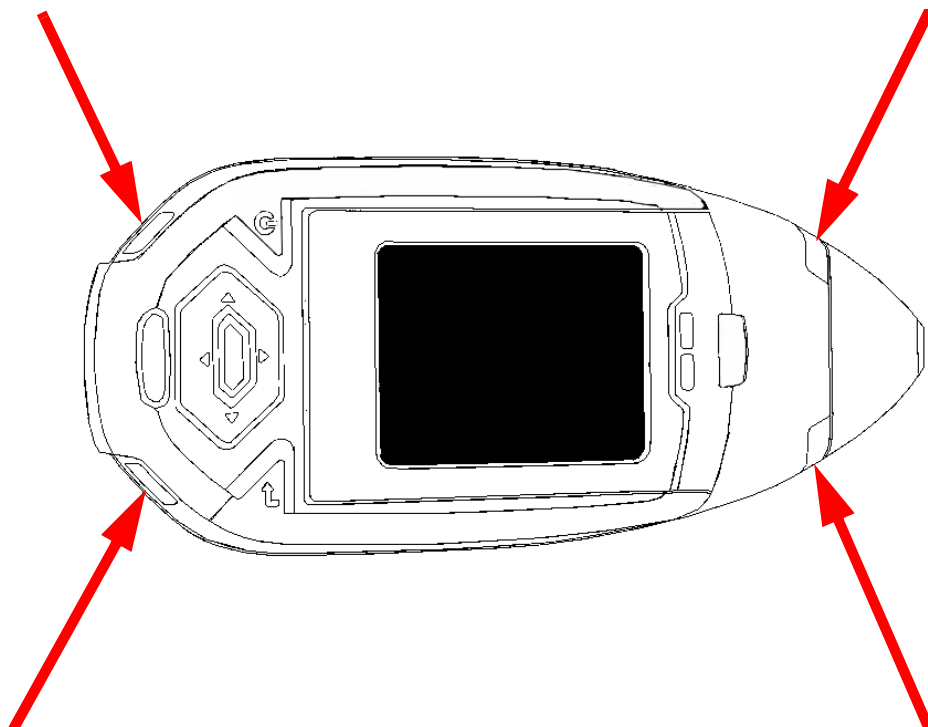


Figure 3-3. X-ray Beam Shutter Open Indicator Lights

Handle and Use with Respect

Avoid holding the front of the analyzer when the x-ray tube is energized and the shutter is open. Never point the instrument at yourself or anyone else when the shutter is open and the x-ray tube is energized. Never look into the path of the primary beam.

Follow a Radiation Protection Program

Your organization should establish, document, and follow a Radiation Protection Program. An example of such a program can be found on the resource CD (provided with the instrument).

Take Proper Care of your NITON XL3t Analyzer

Keeping your analyzer maintained in good condition will help minimize the risk of accidental exposure. Mechanical malfunction of the shutter can be avoided by maintaining the measurement window, as described in the User Guide. This prevents foreign objects from entering your XL3t.

Avoid Over-Exposures

Direct contact with the window could result in overexposures in the times indicated in Table 0-4 below.

Table 3-3. Potential Exposure Limit Times

Location of Dose	Limit	Time to Reach Limit
Deep Dose / Whole Body	5 rem (50 mSv)	2.1 minutes
Shallow Dose / Extremities	50 rem (500 mSv)	0.95 minutes
Member of Public (i.e. untrained operator)	0.1 to 5 rem (1 to 50 mSv)	2.5 to 9.5 seconds

Extremity is defined by the NRC as the hand, elbow, arm below the elbow, foot, knee, or leg below the knee. Whole Body is defined by the NRC as the head, trunk (including male gonads), arms above the elbow, or legs above the knee.

Safe Handling of Samples

As mentioned many times in this chapter, never place any part of your body in the path of the x-ray beam. There is always a safe way to handle samples whether they are small, irregularly shaped, or of low density. Never look into the path of the primary beam.

Small Samples

A small sample would be any sample that is smaller than the measurement window. Small samples present a unique risk because they don't block the entire beam path. The difficulty with placing small samples down on a work surface to analyze them is that you may get readings from the work surface that interfere with analytical results. A test stand is an effective way of analyzing small samples accurately and safely. Never hold samples during analysis or look into the path of the primary beam.

Irregularly Shaped Samples

Irregularly shaped samples may not allow the proximity button to be depressed, or they may not entirely cover the primary beam and cause additional scattering. A back scatter shield is a safe way of reducing your radiation exposure while effectively analyzing an irregularly shaped sample.

Low Density Materials (such as plastics)

X-rays are attenuated more through denser materials and less through low density materials such as plastic. This causes higher dose rates in the scattered radiation. If you are frequently handling low density samples, you should consider the use of test stands, backscatter shields, or the equivalent.

Radiation Profile

Table 3-4, Table 3-5, Table 3-6 and Table 3-7 below describes the external radiation dose rates that are present at various points in space around the NITON XL3t analyzer when it is being used. Figure 3-4 illustrates where these dose rate points are relative to the analyzer.

Table 3-4. Primary Beam Dose Rates in mSv/hr

Max Power Settings	Max Power Settings		Window Contact Deep	Window Contact Shallow	5 cm Deep	30 cm Deep
kVp	μA	Max in Following Modes* (Filter)	(mSv/hr)	(mSv/hr)	(mSv/hr)	(mSv/hr)
40	50	G, D, E, A, P, F, M, J (Main Filter)	1,410	1,410	50.00	6.3
40	50	B (Main Filter)	750	2,250	40.00	5.4
50	40	H (Main Filter), D, E, M, J (High Filter)	1,090	4,060	84.0	12.2
20	100	D, H, E, M, J (Low Filter)	1,450	31,717	5.2	0.5
15	100	A, B (Low Filter)	133	10,567	4.3	0.42

Table 3-5. Primary Beam Dose Rates in Rem/hr

Max Power Settings	Max Power Settings		Window Contact Deep	Window Contact Shallow	5 cm Deep	30 cm Deep
kVp	μA	Max in Following Modes* (Filter)	(Rem/hr)	(Rem/hr)	(Rem/hr)	(Rem/hr)
40	50	G, D, E, A, P, F, M, J (Main Filter)	141	141	5.00	0.63
40	50	B (Main Filter)	75	225	4.00	0.54
50	40	H (Main Filter), D, E, M, J (High Filter)	109	406	8.4	1.22
20	100	D, H, E, M, J (Low Filter)	145	3,171.7	0.52	0.05
15	100	A, B (Low Filter)	13.3	1,056.7	0.43	0.042

* G = Alloy, B = Alloy Electronics, F = Dental Alloy, P = Precious Metals, M = Mining, D = Soil, J = Exploration, A = Lead Paint, E = Thin Sample, H = Plastic

Table 3-6. Secondary (Scatter) Dose Rates ($\mu\text{Sv/hr}$)

kVp	μA	Max in Following Modes* (Filter)	Substrate	Max @ 5cm ($\mu\text{Sv/hr}$) Point A	Max @ 30 cm ($\mu\text{Sv/hr}$) Point A'	Max @ Trigger ($\mu\text{Sv/hr}$) Point B
40	50	G, D, E, A, P, F, M, J (Main Filter)	Aluminum	25	2	0.5
40	50	G, D, E, A, P, F, M, J (Main Filter)	Stainless	16	1.2	0.1
40	50	B (Main Filter)	Aluminum	4	0.4	0.1
40	50	B (Main Filter)	Stainless	1.4	0.1	0.1
50	40	H (Main Filter), D, E, M, J (High Filter)	Plastic	400	35	20
50	40	H (Main Filter), D, E, M, J (High Filter)	Soil	80	4	0.7
20	100	D, H, E, M, J (Low Filter)	Aluminum	0.15	0.1	0.1
20	100	D, H, E, M, J (Low Filter)	Stainless	0.15	0.1	0.1
20	100	D, H, E, M, J (Low Filter)	Plastic	1.3	0.15	0.15
20	100	D, H, E, M, J (Low Filter)	Soil	0.15	0.15	0.15
15	100	A, B (Low Filter)	Aluminum	0.15	0.15	0.15
15	100	A, B (Low Filter)	Stainless	0.15	0.15	0.15

* G = Alloy, B = Alloy Electronics, F = Dental Alloy, P = Precious Metals, M = Mining, D = Soil, J = Exploration, A = Lead Paint, E = Thin Sample, H = Plastic.

Table 3-7. Secondary (Scatter) Dose Rates (mRem/hr)

kVp	uA	Max in Following Modes* (Filter)	Substrate	Max @ 5cm (mRem/hr) Point A	Max @ 30 cm (mRem/hr) Point A'	Max @ Trigger (mRem/hr) Point B
40	50	G, D, E, H, A, P, F, M, J (Main Filter)	Aluminum	2.5	0.2	0.05
40	50	G, D, E, H, A, P, F, M, J (Main Filter)	Stainless	1.6	0.12	0.01
40	50	B (Main Filter)	Aluminum	0.4	0.04	0.01
40	50	B (Main Filter)	Stainless	0.14	0.01	0.01
50	40	H (Main Filter), D, E, M, S, J (High Filter)	Plastic	40	3.5	2
50	40	H (Main Filter), D, E, M, S, J (High Filter)	Soil	8	0.4	0.7
20	100	D, H, E, M, S, J (Low Filter)	Aluminum	0.015	0.01	0.01
20	100	D, H, E, M, S, J (Low Filter)	Stainless	0.015	0.01	0.01
20	100	D, H, E, M, S, J (Low Filter)	Plastic	0.13	0.015	0.015
20	100	D, H, E, M, S, J (Low Filter)	Soil	0.015	0.015	0.015
15	100	A, B (Low Filter)	Aluminum	0.015	0.015	0.015
15	100	A, B (Low Filter)	Stainless	0.015	0.015	0.015

* G = Alloy, B = Alloy Electronics, F = Dental Alloy, P = Precious Metals, M = Mining, D = Soil, J = Exploration, A = Lead Paint, E = Thin Sample, H = Plastic.

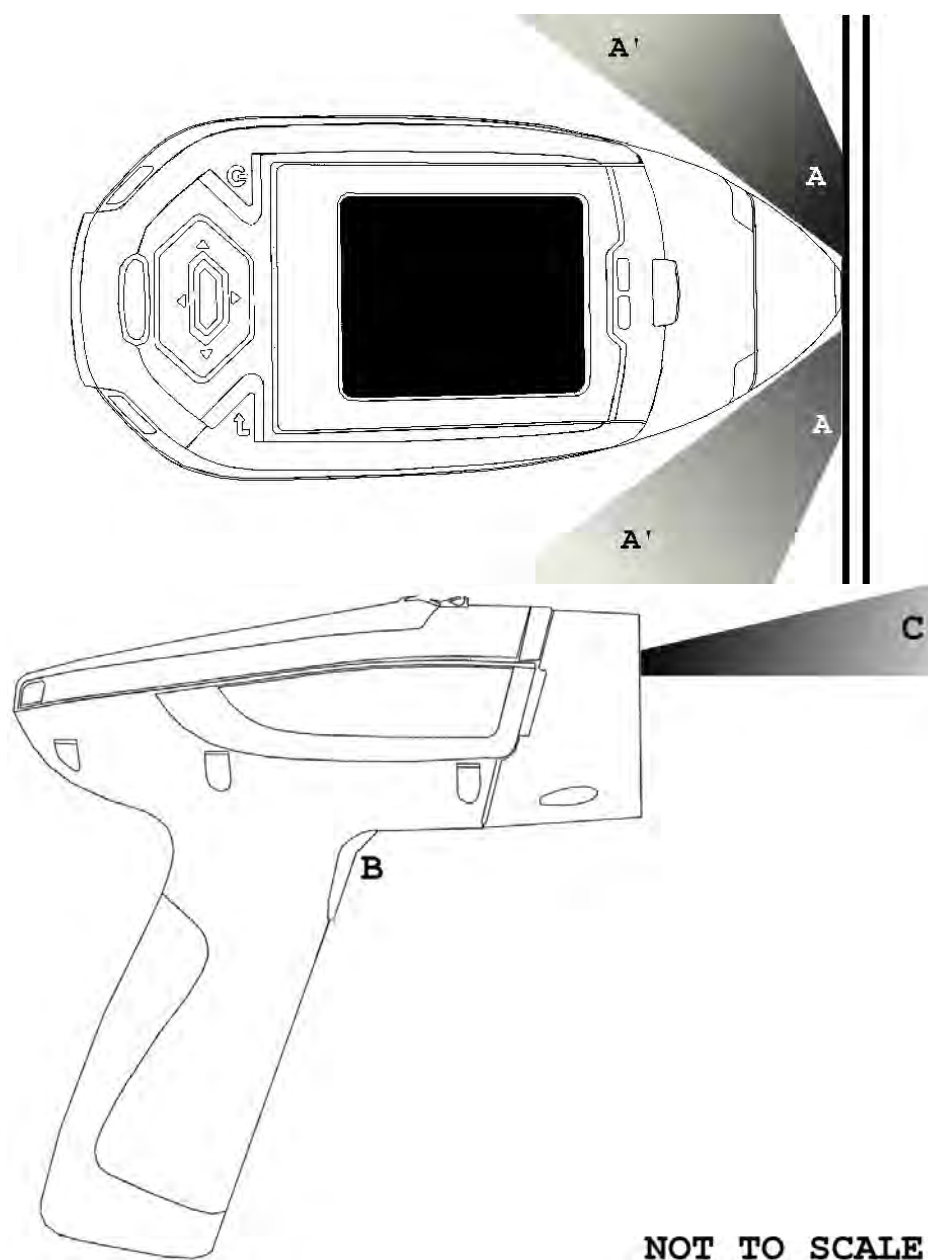


Figure 3-4. Primary & Secondary Dose Rate Locations

Primary Radiation

Primary radiation is radiation that is produced by the analyzer and emitted out through the kapton measurement window. Individuals should never place any part of their body in the primary beam path when the x-ray tube is on. There should always be a sample in contact with the measurement window when the x-ray tube is on. The sample will absorb most of the primary-beam radiation unless it is smaller than the instrument's

measurement window or of low density and/or thickness. Caution should be taken when analyzing samples that are small, thin, and/or low in density as they may allow much more of the primary beam to escape. In-beam primary radiation dose rates are listed in [Table 3-4](#) and [Table 3-5](#) and their location identified relative to the analyzer in [Figure 3-4](#) as Dose Point C.

Secondary Radiation

Under conditions of normal and proper use, individuals can be exposed to secondary (or "scattered") radiation. Secondary radiation is low-level radiation that emanates from the sample being analyzed as a result of primary beam radiation scattering in the sample or primary beam radiation inducing fluorescent x-rays in the sample. Dose points A, A' and B in [Figure 3-4](#) are examples of where you can encounter secondary radiation. The magnitude of this secondary radiation is sample dependent. Higher density samples such as steel will emit the lowest levels as they absorb most primary and secondary radiations. Lower density samples such as aluminum, wood, and especially plastic, will produce higher levels of secondary radiation. Secondary radiation dose rates are listed in [Table 3-6](#) and [Table 3-7](#) for a few common sample types over a wide range of densities.

The operator is reminded that one should never hold samples during analysis, doing so will result in higher than necessary exposure to secondary radiation and could expose the operator directly to the much higher primary-beam dose rates.

Deep and Shallow Dose

You will find in [Table 3-4](#) and [Table 3-5](#) that shallow dose rates are listed for some dose points. All dose rates listed in [Table 3-4](#) and [Table 3-5](#) are deep dose unless they are specifically identified as shallow dose. Deep dose is dose from penetrating radiation that is delivered to both skin and underlying tissues and organs and is the type most commonly referred to when describing external radiation hazards. Occupational deep dose is limited to a maximum of 5 rem (50 mSv) per year in the United States and most countries internationally. Deep dose is measured at 1.0 cm below the skin surface.

Shallow dose is often referred to as "skin dose" because it is a result of low penetrating radiation that only interacts with the skin. Shallow dose is limited to a maximum of 50 rem (500 mSv) per year in the United States and most countries internationally. Shallow dose is listed below for primary in-beam dose points only because the low penetrating radiation that causes shallow dose is nearly all absorbed by a sample and does not produce any significant secondary radiation. Shallow dose is measured at a point 0.007 cm below the surface.

Storage & Transportation

Storage

Regulations in nearly all locations will require that you store your analyzer locked in a secured area to prevent access, use, and/or removal by unauthorized individuals. Storage requirements will vary by location, particularly with regard to storage at temporary job sites or away from your primary storage location such as hotels and motels and in vehicles. You should contact your local Radiation Control Authority to identify the specific storage requirements in your jurisdiction.

Transportation

There are no specific US Department of Transportation (DOT) or International Air Transport Association (IATA) radiation regulations regarding shipping the NITON XL3t analyzer. It is recommended that you ship the XL3t in its carrying case and an over-pack to protect the sensitive measuring equipment inside the analyzer.

Do NOT ship the analyzer with the battery pack connected to the analyzer.

EMERGENCY PROCEDURES

THIS PAGE CONTAINS EMERGENCY CONTACT INFORMATION THAT SHOULD BE AVAILABLE TO THE OPERATOR AT ALL TIMES.

Lost or Stolen Instrument

If the NITON XL3t analyzer is lost or stolen, notify your Radiation Safety Officer (RSO) or the equivalent responsible individual at your company or institution immediately. Your company's RSO, as well as other important emergency contacts, are listed below. Your company RSO may need to notify the x-ray tube regulatory authority and the local police. It is also recommended that a notification is made to Thermo Fisher Scientific.

Damaged Instrument

Minor Damage

If the instrument is intact but there is indication of an unsafe condition such as a cracked case, a shutter mechanism failure, or the lights remain flashing after a measurement is terminated, follow these steps:

1. **Stop using the instrument**
2. **Remove the battery, the x-ray tube can not produce radiation when the battery is disconnected. The instrument is now safe to handle.**
3. **Place the instrument securely in the holster**
4. **Place the instrument in the carrying case that came with the instrument.**
5. **Notify your Radiation Safety Officer (RSO) or the equivalent responsible individual at your company or institution immediately.**
6. **You or your RSO should call Thermo Fisher Scientific at one of their contact numbers listed below for additional instructions and guidance.**

Major damage

If the instrument is severely damaged:

1. **Perform the same steps as described above for minor damage. There will be no radiation hazard as long as the battery is removed from the instrument.**
2. **Place all components in a plastic bag and contact Thermo Fisher Scientific.**

**Emergency Response
Information**

Please Complete the Following Emergency Response Information and Keep with the Analyzer at All Times

NITON ANALYZER EMERGENCY CONTACT INFORMATION

The Company RSO is:_____

RSO Telephone Number:_____

Regulatory Agency Emergency Number:_____

Local Fire Department:_____

Local or State Police Department:_____

Thermo Fisher Scientific's NITON Analyzer Contact Numbers

Main Number (USA): (800) 875-1578

Additional Radiation Emergency #'s: (978) 790-8269 or (617) 901-3125

Outside the USA - Local NITON Service Center:_____

For assistance with your NITON XL3t analyzer outside the United States, please contact your nearest manufacturer's service center identified below:

Europe

NITON Analyzers Europe

Munich, Germany

Phone: +49 89 3681 380

Fax: +49 89 3681 3830

Email: niton.eur@thermo.com

Asia NITON Analyzers Asia

Hong Kong

Phone: +852 2869-6669

Fax: +852 2869-6665

Email: niton.asia@thermo.com

Registration and Licensing

As a user of a NITON XL3t analyzer, you may be required to register or obtain a license with your local radiation control authority. In the US, if you intend to do work with your XL3t in states other than your own, you may be required to register there as well. Below is a list of commonly asked questions that come up when filling out registration forms.

FAQ What is the max mA, max kVp, and max power?

Maximum mA is 0.1 mA

Maximum kVp is 50 kVp

Maximum power: 2 watts

What is the accelerator voltage or MeV?

This should be filled out as not applicable N/A as it does not apply to XL3t analyzers.

What is the radioisotope?

There are no radioactive isotopes in XL3t analyzers.

What category is the XL3t?

States differ greatly in their categories; the following is a list of common categories:

- o X-Ray Fluorescence
- o Analytical or Analytical XRF
- o Open Beam or Open Beam Analytical
- o Portable Gauge or Portable XRF
- o Industrial Analytical or Non-Destructive Testing

When selecting the category make sure that you don't select medical or radiographic.

How many tubes are in the XL3t?

One.

What is the analyzer serial number?

The serial number is a 5 digit number located on the yellow sticker on the underside of your analyzer.

What is the tube serial number?

The serial number on the tube is different from the serial number on the analyzer itself. If your jurisdiction asks for this number please call us at 1-800-875-1578 and ask to speak with someone regarding X-Ray tube registrations and we can look this number up for you.

What is the type of X-Ray Processing?

None. XL3t analyzers do not use film.

How often do I need to perform leak tests on the XL3t?

Never. Leak tests are only required for analyzers with radioactive isotopes. XL3t analyzers do not have radioactive isotopes.

**Regarding Safety Devices
for the Open Beam
Configuration:**

In the US, you may be required to file for an exemption, "variance letter", with your state if there is a requirement for a safety device that would prevent entry of an extremity into the primary beam. If you need assistance with the exemption letter, you may contact the radiation safety group.

Contact Information

If you have additional questions, please feel free to contact the Radiation Safety Group. If you have questions about regulatory requirements, we recommend that you contact your local radiation control authority. Contact information is listed below.

Thermo Fisher Scientific Contact Information

Radiation Safety Group

By phone: +1 978-670-7460

By fax: +1 978-670-7430

By e-mail: Radsafety.Billerica@thermofisher.com

Radiation Emergency Numbers (Call only if there is a radiation emergency)

Phone: +1 617-901-3125

Phone: +1 978-790-8269

Service Departments

USA Phone: +1 800-875-1578

Fax: +1 978-215-6127

Germany Phone: +49 89 368138-0

Fax: +49 89 368138-30

Hong Kong Phone: +852 2869-6669

Fax: +852 2869-6665

United States Regulatory Authority Contact Information

A list of states and their contacts can be found at the following website:

<http://www.hsrdo.ornl.gov/nrc/asdirectr.htm>

Appendices

Appendix A: X-ray Emission Energies Arranged by Element, by Increasing Atomic Number, in KeV

Table 4-1. X-ray Emission Energies Arranged by Element, by Increasing Atomic Number, in KeV

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
potassium	K	19	39.10	3.3	3.6			
calcium	Ca	20	40.08	3.7	4.0			
scandium	Sc	21	44.96	4.1	4.5			
titanium	Ti	22	47.87	4.5	4.9			
vanadium	V	23	50.94	4.9	5.4			
chromium	Cr	24	52.00	5.4	5.9			
manganese	Mn	25	54.94	5.9	6.5			
iron	Fe	26	55.85	6.4	7.1			
cobalt	Co	27	58.93	6.9	7.6			
nickel	Ni	28	58.69	7.5	8.3			
copper	Cu	29	63.55	8.0	8.9			
zinc	Zn	30	65.41	8.6	9.6			
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.64	9.9	11.0			
arsenic	As	33	74.92	10.5	11.7			
selenium	Se	34	78.96	11.2	12.5			
bromine	Br	35	79.90	11.9	13.3			
krypton	Kr	36	83.80	12.6	14.1			
rubidium	Rb	37	85.47	13.4	15.0			
strontium	Sr	38	87.62	14.2	15.8			
yttrium	Y	39	88.91	15.0	16.7			
zirconium	Zr	40	91.22	15.8	17.7			
niobium	Nb	41	92.91	16.6	18.6			
molybdenum	Mo	42	95.94	17.5	19.6			
technetium	Tc	43	98.00	18.4	20.6	2.4	2.5	2.8
ruthenium	Ru	44	101.07	19.3	21.7	2.6	2.6	3.0

Table 4-1. X-ray Emission Energies Arranged by Element, by Increasing Atomic Number, in KeV

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
rhodium	Rh	45	102.91	20.2	22.7	2.7	2.8	3.1
palladium	Pd	46	106.42	21.2	23.8	2.8	3.0	3.3
silver	Ag	47	107.87	22.2	25.0	3.0	3.2	3.5
cadmium	Cd	48	112.41	23.2	26.1	3.1	3.3	3.7
indium	In	49	114.82	24.2	27.3	3.3	3.5	3.9
Tin	Sn	50	118.71	25.3	28.5	3.4	3.7	4.1
antimony	Sb	51	121.76	26.4	29.7	3.6	3.8	4.3
tellurium	Te	52	127.60	27.5	31.0	3.8	4.0	4.6
iodine	I	53	126.90	28.6	32.3	3.9	4.2	4.8
xenon	Xe	54	131.29	29.8	33.6	4.1	4.4	5.0
cesium	Cs	55	132.91	31.0	35.0	4.3	4.6	5.3
barium	Ba	56	137.33	32.2	36.4	4.5	4.8	5.5
lanthanum	La	57	138.91	33.4	37.8	4.7	5.0	5.8
cerium	Ce	58	140.12	34.7	39.3	4.8	5.3	6.0
praseodymium	Pr	59	140.91	36.0	40.7	5.0	5.5	6.3
neodymium	Nd	60	144.24	37.4	42.3	5.2	5.7	6.6
promethium	Pm	61	145.00	38.6	44.0	5.4	6.0	6.9
samarium	Sm	62	150.36	40.1	45.4	5.6	6.2	7.2
europium	Eu	63	151.96	41.5	47.0	5.8	6.5	7.5
gadolinium	Gd	64	157.25	43.0	48.7	6.1	6.7	7.8
terbium	Tb	65	158.92	44.5	50.4	6.3	7.0	8.1
dysproium	Dy	66	162.50	46.0	52.2	6.5	7.3	8.4
holmium	Ho	67	164.93	47.5	53.9	6.7	7.5	8.7
erbium	Er	68	167.26	49.1	55.7	6.9	7.8	9.1
thulium	Tm	69	168.93	50.7	57.6	7.2	8.1	9.4
ytterbium	Yb	70	173.04	52.4	59.4	7.4	8.4	9.8
lutetium	Lu	71	174.97	54.1	61.3	7.7	8.7	10.1
hafnium	Hf	72	178.49	55.8	63.2	7.9	9.0	10.5
tantalum	Ta	73	180.95	57.5	65.2	8.1	9.3	10.9
tungsten	W	74	183.84	59.3	67.2	8.4	9.7	11.3
rhenium	Re	75	186.20	61.1	69.3	8.7	10.0	11.7
osmium	Os	76	190.23	63.0	71.4	8.9	10.4	12.1
iridium	Ir	77	192.22	64.9	73.6	9.2	10.7	12.5

Table 4-1. X-ray Emission Energies Arranged by Element, by Increasing Atomic Number, in KeV

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
platinum	Pt	78	195.09	66.8	75.7	9.4	11.1	12.9
gold	Au	79	196.97	68.8	78.0	9.7	11.4	13.4
mercury	Hg	80	200.59	70.8	80.3	10.0	11.8	13.8
thallium	Tl	81	204.38	72.9	82.6	10.3	12.2	14.3
lead	Pb	82	207.20	75.0	85.9	10.5	12.6	14.8
bismuth	Bi	83	208.98	77.1	87.3	10.8	13.0	15.2
polonium	Po	84	(209.0)	79.3	89.8	11.1	13.4	15.7
astatine	At	85	(210.0)	81.5	92.3	11.4	13.9	16.2
radon	Rn	86	(222.0)			11.7	14.3	16.8
francium	Fr	87	(223.0)			12.0	14.8	17.3
radium	Ra	88	(226.0)			12.3	15.2	17.8
actinium	Ac	89	(227.0)			12.7	15.7	18.4
thorium	Th	90	232.04			13.0	16.2	19.0
protactinium	Pa	91	(231.0)			13.3	16.7	19.6
uranium	U	92	238.03			13.6	17.2	20.2
neptunium	Np	93	237.00			13.9	17.7	20.8
plutonium	Pu	94	244.00			14.3	18.3	21.4

Appendix B: X-ray Emission Energies Arranged Alphabetically by Element, by name

Table 4-2. X-ray Emission Energies Arranged Alphabetically by Element, by name

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
actinium	Ac	89	(227.0)			12.7	15.7	18.4
antimony	Sb	51	121.76	26.4	29.7	3.6	3.8	4.3
arsenic	As	33	74.92	10.5	11.7			
astatine	At	85	(210.0)	81.5	92.3	11.4	13.9	16.2
barium	Ba	56	137.33	32.2	36.4	4.5	4.8	5.5
bismuth	Bi	83	208.98	77.1	87.3	10.8	13.0	15.2
bromine	Br	35	79.90	11.9	13.3			
cadmium	Cd	48	112.41	23.2	26.1	3.1	3.3	3.7
calcium	Ca	20	40.08	3.7	4.0			
cerium	Ce	58	140.12	34.7	39.3	4.8	5.3	6.0
cesium	Cs	55	132.91	31.0	35.0	4.3	4.6	5.3
chromium	Cr	24	52.00	5.4	5.9			
cobalt	Co	27	58.93	6.9	7.6			
copper	Cu	29	63.55	8.0	8.9			
dysproium	Dy	66	162.50	46.0	52.2	6.5	7.3	8.4
erbium	Er	68	167.26	49.1	55.7	6.9	7.8	9.1
europium	Eu	63	151.96	41.5	47.0	5.8	6.5	7.5
francium	Fr	87	(223.0)			12.0	14.8	17.3
gadolinium	Gd	64	157.25	43.0	48.7	6.1	6.7	7.8
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.64	9.9	11.0			
gold	Au	79	196.97	68.8	78.0	9.7	11.4	13.4
hafnium	Hf	72	178.49	55.8	63.2	7.9	9.0	10.5
holmium	Ho	67	164.93	47.5	53.9	6.7	7.5	8.7
indium	In	49	114.82	24.2	27.3	3.3	3.5	3.9
iodine	I	53	126.90	28.6	32.3	3.9	4.2	4.8
iridium	Ir	77	192.22	64.9	73.6	9.2	10.7	12.5
iron	Fe	26	55.85	6.4	7.1			
krypton	Kr	36	83.80	12.6	14.1			
lanthanum	La	57	138.91	33.4	37.8	4.7	5.0	5.8
lead	Pb	82	207.20	75.0	85.9	10.5	12.6	14.8
lutetium	Lu	71	174.97	54.1	61.3	7.7	8.7	10.1

Table 4-2. X-ray Emission Energies Arranged Alphabetically by Element, by name

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
manganese	Mn	25	54.94	5.9	6.5			
mercury	Hg	80	200.59	70.8	80.3	10.0	11.8	13.8
molybdenum	Mo	42	95.94	17.5	19.6			
neodymium	Nd	60	144.24	37.4	42.3	5.2	5.7	6.6
nickel	Ni	28	58.69	7.5	8.3			
niobium	Nb	41	92.91	16.6	18.6			
osmium	Os	76	190.23	63.0	71.4	8.9	10.4	12.1
palladium	Pd	46	106.42	21.2	23.8	2.8	3.0	3.3
platinum	Pt	78	195.09	66.8	75.7	9.4	11.1	12.9
polonium	Po	84	(209.0)	79.3	89.8	11.1	13.4	15.7
potassium	K	19	39.10	3.3	3.6			
praseodymium	Pr	59	140.91	36.0	40.7	5.0	5.5	6.3
promethium	Pm	61	145.00	38.6	44.0	5.4	6.0	6.9
protactinium	Pa	91	(231.0)			13.3	16.7	19.6
radium	Ra	88	(226.0)			12.3	15.2	17.8
radon	Rn	86	(222.0)			11.7	14.3	16.8
rhenium	Re	75	186.20	61.1	69.3	8.7	10.0	11.7
rhodium	Rh	45	102.91	20.2	22.7	2.7	2.8	3.1
rubidium	Rb	37	85.47	13.4	15.0			
ruthenium	Ru	44	101.07	19.3	21.7	2.6	2.6	3.0
samarium	Sm	62	150.36	40.1	45.4	5.6	6.2	7.2
scandium	Sc	21	44.96	4.1	4.5			
selenium	Se	34	78.96	11.2	12.5			
silver	Ag	47	107.87	22.2	25.0	3.0	3.2	3.5
strontium	Sr	38	87.62	14.2	15.8			
tantalum	Ta	73	180.95	57.5	65.2	8.1	9.3	10.9
technetium	Tc	43	98.00	18.4	20.6	2.4	2.5	2.8
tellurium	Te	52	127.60	27.5	31.0	3.8	4.0	4.6
terbium	Tb	65	158.92	44.5	50.4	6.3	7.0	8.1
thallium	Tl	81	204.38	72.9	82.6	10.3	12.2	14.3
thorium	Th	90	232.04			13.0	16.2	19.0
thulium	Tm	69	168.93	50.7	57.6	7.2	8.1	9.4
Tin	Sn	50	118.71	25.3	28.5	3.4	3.7	4.1

Appendix B:

Table 4-2. X-ray Emission Energies Arranged Alphabetically by Element, by name

Element	Symbol	Atomic Number	Atomic Weight	Ka1	Kb1	La1	Lb1	Lg1
titanium	Ti	22	47.87	4.5	4.9			
tungsten	W	74	183.84	59.3	67.2	8.4	9.7	11.3
uranium	U	92	238.03			13.6	17.2	20.2
vanadium	V	23	50.94	4.9	5.4			
xenon	Xe	54	131.29	29.8	33.6	4.1	4.4	5.0
ytterbium	Yb	70	173.04	52.4	59.4	7.4	8.4	9.8
yttrium	Y	39	88.91	15.0	16.7			
zinc	Zn	30	65.41	8.6	9.6			
zirconium	Zr	40	91.22	15.8	17.7			

Appendix C: SpectraView

SpectraView enables you to qualitatively analyze the fluorescent x-rays of most of the elements in the periodic table. For a complete list of elements and their fluorescent x-rays see Appendix A. In SpectraView Mode, the spectrum is displayed in a linear scale, autoscaled logarithmically so that the highest peak on the screen reaches the top of the scale.

How to Use SpectraView

You can access the SpectraView screen after taking a measurement in any mode, or while viewing a previous measurement, by selecting Spectra from the NAV Menu. Once you are in SpectraView, you can use the up and down positions of the 4-way touch pad to scroll through the spectrum, or you can tap on the spectrum display with the stylus to place the cursor at the point you tapped. The vertical cursor line indicates the current position along the spectrum.

Viewing the Information in SpectraView Mode

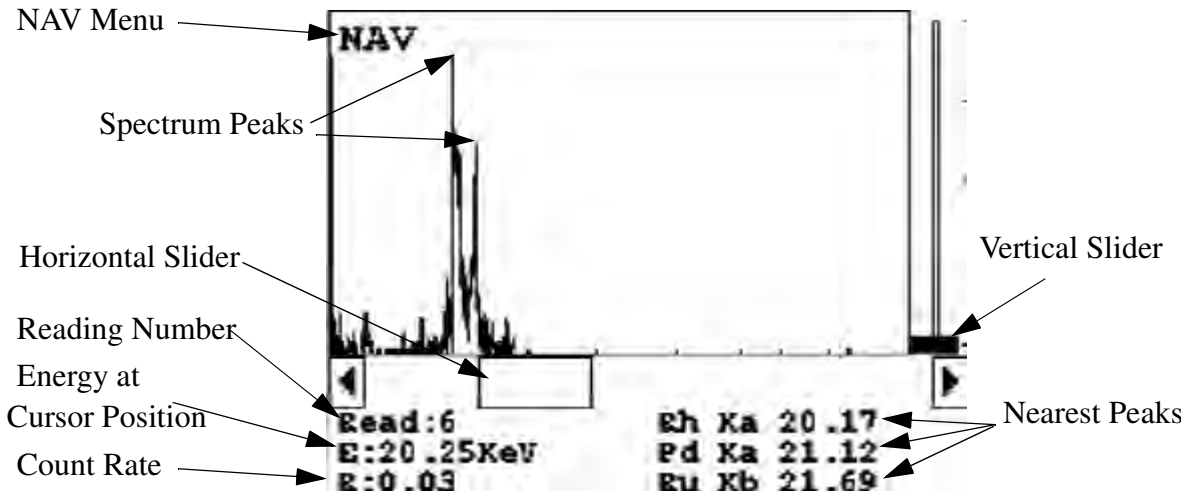


Figure 4-1. The SpectraView Screen

By default, the following information is shown along with the spectrum:

The Reading number (Bottom Left) in the form "Read:x", where x is the Reading number.

The position of the cursor on the energy scale (Bottom Left, under the Reading number), in the form "E: x.xx KeV", where KeV is thousands of electron volts.

The **count rate** (Bottom Left, under the energy position), in the form "R:x.xx".

Ka, Kb, La, Lb, and/or **Lg** peaks of the three elements closest to where your cursor is positioned on the energy scale (Bottom Right). This information is written with the element symbol first, followed by either Ka (K shell alpha peak), Kb (K shell beta peak), La (L shell alpha peak), Lb (L shell beta peak), or Lg (L shell gamma peak). An example would be "Al Ka 1.5." To determine if a given element is present, look at the count rate at that cursor position.

SpectraView cannot be used to determine exact element percentages in a sample.

Multiple Spectra

SpectraView can display the reading spectra from multiple filters if your analyzer has more than one X-ray filter. Use the NAV Menu to select which spectrum to view.

The "Spectra1" choice will display the spectrum produced by excitation from the first filter setting.

The "Spectra2" choice will display the spectrum produced by excitation from the second filter setting.

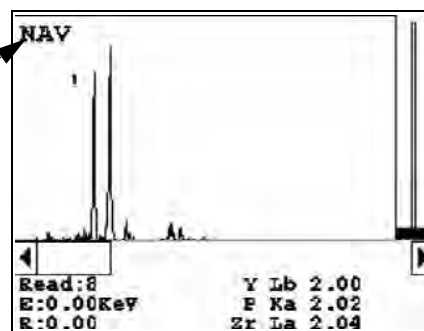
The "Spectra3" choice will display the spectrum produced by excitation from the third filter setting.

SpectraView Navigation

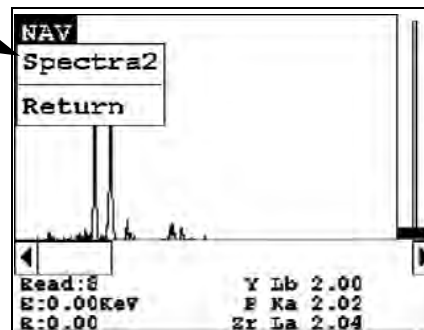
Use the left button on the 4-way touch pad to expand the spectrum, centered on the position of the cursor.

Use the right button on the 4-way touch pad to contract the spectrum, centered on the position of the cursor.

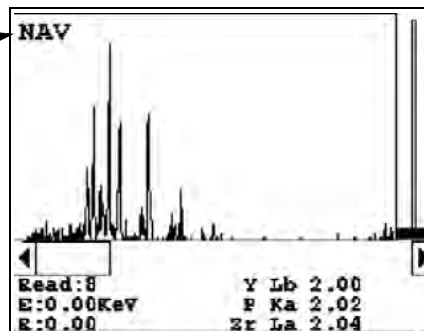
Select NAV to access the NAV Menu while viewing the first source spectrum.



Select Spectra2 to view the second filter spectrum



Select NAV to access the NAV Menu.



Select Spectra1 to return to the first filter spectrum.

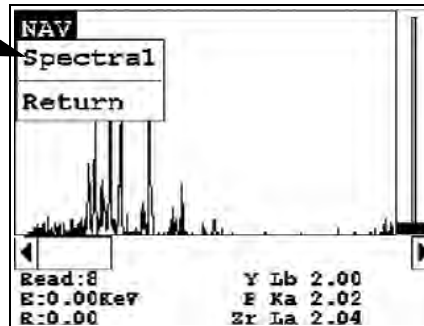


Figure 4-2. Viewing Multiple Spectra

Appendix D: Summary of Warnings



WARNING! Do not attempt to use this instrument without first reading and understanding the entire User's Guide! ♦



WARNING! Always treat radiation with respect. Do not hold your instrument near the Kapton window during testing. Never point your instrument at yourself or anyone else when the shutter is open. ♦



WARNING! Do not attempt to take measurements while downloading readings! This will generate an error requiring a system reset, and may corrupt your stored readings, requiring all stored readings to be erased. ♦



WARNING! All Service, except exterior cleaning and Kapton window replacement, must be performed by Thermo Scientific. Do not attempt to make repairs yourself. Opening the case of your NITON will void the instrument Warranty in its entirety. ♦



WARNING! The preconditions for operation must be continued for the duration of the reading. If the preconditions are violated, the x-ray tube will turn off, the calibration shutter will close, and the measurement will end. The three LED lights will stop blinking when the measurement is ended. The flashing of the LED lights is not synchronized to minimize power consumption. ♦



WARNING! In the highly unlikely event that the x-ray tube remains on when the trigger is not depressed, disconnect the battery pack immediately to turn off the x-ray tube, and call Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States at +1-978-670-7460, or your local Authorized NITON Analyzers Service Center. ♦



WARNING! When the four LED lights are blinking, the x-ray tube is on. This should only occur during a measurement, while the preconditions for operation are met. If the LED lights blink at any other time, disconnect the battery pack and call Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460, or your local Authorized NITON Analyzers Service Center. ♦



WARNING! Tampering with the 5,500 ppm (lead high) lead-in-soil standard may cause exposure to lead dust. Keep all standards out of the reach of children.



WARNING! When taking samples from a site where toxic chemicals may be present, always use gloves and respiration equipment for your own protection.



WARNING! Do not hold bagged samples while testing.



WARNING! Grinding and sifting dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth. ♦

Appendix E: Summary of Cautions



CAUTION Never turn off the analyzer while data is being erased! ♦



CAUTION Whenever you turn on your NITON Analyzer after it has been off for more than 30 minutes, you should measure your check sample to assure proper operation. If the instrument is not reading properly, you should re-calibrate your NITON Analyzer's sample analysis electronics before you start to take readings. When the instrument is turned on after being off for more than 30 minutes, your NITON analyzer will require a 10 minute warm-up period before the instrument can be calibrated, unless this 10 minute warm-up period is manually overridden.



CAUTION Do not leave the battery pack connected to the charger for excessive periods of time. Overnight recharging is recommended. ♦



CAUTION Store the instrument and the spare battery packs in a cool place, away from direct sunlight. ♦



CAUTION Always transport the unit in its padded carrying case, and store the NITON Analyzer in its case whenever it is not being used. ♦



CAUTION Do not let the battery pack recharge for excessive periods of time. ♦



CAUTION In most cases, no notification is required if transporting within state boundaries. This may not be the case when entering federal properties. ♦



CAUTION Do not store battery packs or charger in direct sunlight. ♦



CAUTION Always follow all pertinent local and national regulations and guidelines, wherever your analyzer is transported or used. ♦



CAUTION Always obtain a Return Authorization (RA) number from Thermo Scientific's Service Department in the United States, toll free, at (800) 875-1578, or outside the United States, at +1-978-670-7460 before returning your instrument to the Service Department or to your local Authorized NITON Analyzers Service Center. ♦



CAUTION If you return your NITON instrument without the carrying case, you will void your analyzer's warranty in its entirety. You will be billed for a replacement case plus any repairs resulting from improper shipping. ♦



CAUTION Always remove the battery pack when transporting or storing your instrument. ♦



CAUTION Avoid any vibration, loud noise, strong electronic fields, or other possible interference when your analyzer is calibrating its detector. ♦



CAUTION NITON Analyzers are not intrinsically safe analyzers in regard to sparking. All pertinent Hot Work procedures should be followed in areas of concern. ♦



CAUTION Within the United States, always keep a copy of the US DOT compliance statement in your NITON analyzer case at all times. A copy is included with your analyzer. ♦



CAUTION Never tamper with Test Standards. They should not be used unless they are completely intact.



CAUTION All test equipment must be kept clean to prevent contamination of samples.

Appendix F: Warranty

Seller warrants that the Products will operate or perform substantially in conformance with Seller's published specifications and be free from defects in material and workmanship, when subjected to normal, proper and intended usage by properly trained personnel, for the period of time set forth in the product documentation, published specifications or package inserts. If a period of time is not specified in Seller's product documentation, published specifications or package inserts, the warranty period shall be **Two (2) years** from the date of shipment to Buyer in the country of purchase. Seller agrees during the Warranty Period, to repair or replace, at Seller's option, defective Products so as to cause the same to operate in substantial conformance with said published specifications; provided that Buyer shall (a) promptly notify Seller in writing upon the discovery of any defect, which notice shall include the product model and serial number (if applicable) and details of the warranty claim; and (b) after Seller's review, Seller will provide Buyer with service data and/or a Return Material Authorization ("RMA"), which may include biohazard or other Radiation safety decontamination procedures and other product-specific handling instructions, then, if applicable, Buyer may return and receive the defective Products to Seller with all costs of freight and insurance prepaid by Buyer. Replacement parts may be new or refurbished, at the election of Seller, the warranty of these parts expire with the instrument warranty. All replaced parts shall become the property of Seller. Shipment to Buyer of repaired or replacement Products shall be made in accordance with the Delivery provisions of the Seller's Terms and Conditions of Sale. Accessories and Consumables are expressly excluded from this warranty (see list A for details).

Notwithstanding the foregoing, Products supplied by Seller that are obtained by Seller from an original manufacturer or third party supplier are not warranted by Seller, but Seller agrees to assign to Buyer any warranty rights in such Product that Seller may have from the original manufacturer or third party supplier, to the extent such assignment is allowed by such original manufacturer or third party supplier. In no event shall Seller have any obligation to make repairs, replacements or corrections required, in whole or in part, as the result of:

- i. normal wear and tear,
- ii. accident, disaster or event of force majeure,
- iii. misuse, fault or negligence of or by Buyer,
- iv. use of the Products in a manner for which they were not designed,

- v. causes external to the Products such as, but not limited to, power failure or electrical power surges,
- vi. improper storage and handling of the Products,
- vii. use of the Products in combination with equipment or software not supplied by Seller,
- viii. moderately heavy or excessive impact against any object, including but not limited to floors, walls, furniture, sample or other objects. A shock sensor is fitted inside of the instrumentation; warranty is void if this shock sensor is activated,
- ix. excessive water, moisture or condensing humidity that breaches the instrument seals,
- x. excessive or extreme ambient or direct temperature or
- xi. Heavy vibrations directly to the instrument for extended periods of time.

If Seller determines that Products for which Buyer has requested warranty services are not covered by the warranty hereunder, Buyer shall pay or reimburse Seller for all costs of investigating and responding to such request at Seller's then prevailing time and materials rates. If Seller provides repair services or replacement parts that are not covered by this warranty, Buyer shall pay Seller therefore at Seller's then prevailing time and materials rates.

ANY INSTALLATION, MAINTENANCE, REPAIR, SERVICE, RELOCATION OR ALTERATION TO OR OF, OR OTHER TAMPERING WITH, THE PRODUCTS PERFORMED BY ANY PERSON OR ENTITY OTHER THAN SELLER WITHOUT SELLER'S PRIOR WRITTEN APPROVAL, OR ANY USE OF REPLACEMENT PARTS NOT SUPPLIED BY SELLER, SHALL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED PRODUCTS.

THE OBLIGATIONS CREATED BY THIS WARRANTY STATEMENT TO REPAIR OR REPLACE A DEFECTIVE PRODUCT SHALL BE THE SOLE REMEDY OF BUYER IN THE EVENT OF A DEFECTIVE PRODUCT. EXCEPT AS EXPRESSLY PROVIDED IN THIS WARRANTY STATEMENT, SELLER DISCLAIMS ALL OTHER WARRANTIES, WHETHER EXPRESS OR

IMPLIED, ORAL OR WRITTEN, WITH RESPECT TO THE PRODUCTS AND INCLUDING WITHOUT LIMITATION ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS

FOR ANY PARTICULAR PURPOSE. SELLER DOES NOT WARRANT THAT THE PRODUCTS ARE ERROR-FREE OR WILL ACCOMPLISH ANY PARTICULAR RESULT.

Accessories, Spares and Consumables - exclusions

(List A)

Specific warranties of some common accessories:

- Battery Charger and batteries - 12 months
- Instrument accessories - 12 months
- Consumable - no warranty
- Soil Grinder - no warranty
- Single-stage or two stage helium tank regulator - 12 months
- Test stands, extend-a-poles and docking stations – 12 months
- Parts or spares sold, installed or supplied outside of the product warranty period and not listed above – 12 months

Thermo Fisher Scientific shall not be liable for delays, deprivation of use, or any other damages, direct or indirect, which may result to the purchaser because of defects in the product or because of the purchaser's inability to operate it or use it to his satisfaction. Thermo Fisher will not be liable to anyone for special or consequential damages of any kind. Thermo Fisher neither assumes nor authorizes any person to assume for it, any other obligation or liability with respect to Thermo Fisher products..

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Appendix D

Region 2 RAC2 Contract

Generic Quality Assurance Project Plan for Superfund Sites

December 16, 2013

CDM SMITH

REGION 2 RAC2 CONTRACT

GENERIC QUALITY ASSURANCE PROJECT PLAN

FOR SUPERFUND SITES

This QAPP addresses the following studies:

Remedial Investigation/Feasibility Study
Remedial Design
Remedial Action
Remedial Investigation/Feasibility Study Oversight
Remedial Design Oversight
Remedial Action Oversight

RAC2 Contract No. EP-W-09-002

December 16, 2013

Prepared for:
U.S. Environmental Protection Agency
290 Broadway, New York, NY 10007-1866

Prepared by:
CDM Federal Programs (CDM Smith)
14 Wall Street, New York, NY 10005

The material contained herein is not to be disclosed to, discussed with, or made available to any person or persons for any reason without the prior expressed approval of a responsible official of the U.S. EPA.



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New York, New York 10005
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December 16, 2013

Mr. Bill Sy
EPA QA Officer
U.S. Environmental Protection Agency
2890 Woodbridge Avenue
Edison, New Jersey 08837

PROJECT: EPA RAC2 Contract No.: EP-W-09-002
Work Assignment No.: A11-MOBT-9002
DOC. CONTROL NO.: 3321-001-01866
SUBJECT: Region 2 RAC2 Contract
Generic Contract Quality Assurance Project Plan

Dear Mr. Sy:

CDM Smith is pleased to submit this Generic Contract Quality Assurance Project Plan (QAPP) for field investigations. The worksheets herein address general field and analytical procedures and quality assurance/quality control requirements. This generic QAPP is intended to be used in conjunction with our project-specific QAPPs that are prepared for individual projects. Applicable worksheets in the generic QAPP approved by EPA will be incorporated by reference into each project-specific QAPP that CDM Smith prepares in the future. The project-specific QAPPs will be focused to the work to be conducted at each site. The ability to incorporate worksheets from the generic QAPP into the project-specific QAPP by reference only will streamline preparation of project-specific QAPPs. We anticipate that the streamlining will also result in the need for fewer hours and dollars to prepare most of our project-specific QAPPs.

If you have any questions regarding this plan, please contact me at your earliest convenience at (212) 785-9123.

Very truly yours,

CDM Smith

A handwritten signature in black ink, appearing to read 'Jennifer Oxford'.

Jennifer Oxford, CHMM
RAC2 QA Specialist

Enclosure

cc: D. Butler and H. Eng, NY EPA Region 2 (letter only)
Phil Cocuzza and S. Lopez, Edison EPA Region 2 (electronic copy)
J. Litwin and B. MacDonald, CDM Smith (letter only)
S. Kirchner and V. Macwan, CDM Smith (electronic copy)
RAC2 Document Control (hard copy)

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- 1.2 Site Background and Path Forward

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The following items are not included in this Generic QAPP. The Region 2 EPA QA staff have a copy of the TSOPs on CD, therefore, the TSOPs do not need to be included in the QAPP submitted for review but will be included with field copies of the QAPP. All other items listed below are to be included in Project-specific QAPPs.

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Appendix A *Tables, Site Maps, and Figures and applicable excerpts from Work Plan*

<i>Figures</i>	<i>Site Location</i>
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Appendix B *Sample Shipping Notifications*

Appendix C *CDM Smith Technical Standard Operating Procedures (TSOP)*

- 1-1 Surface Water Sampling*
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- 4-4 Design and Installation of Monitoring Wells in Aquifers**
- 4-8 Environmental Data Management*
- 4-10 Borehole and Well Decommissioning*
- 5-1 Control of Measurement and Test Equipment**

** RAC 2 Contract-Specific Clarifications apply to these TSOPs and are described on Worksheet #21*

Appendix C HACH Kit Test Procedures for Field Sampling
Appendix D CDM DV SOP 029A, Revision 0
Appendix F Field Forms (Examples):
Daily Quality Control Report
Analytical Services Tracking System (ANSETS) Form
Cooler Return Form

References (Literature Cited)

TBD

Acronyms – Generic List

AA	atomic absorption
ABS	absolute difference
AES	atomic emission spectrophotometry
Ag	silver
ANSETS	Analytical Services Tracking System
ASC	analytical services coordinator
AVS	acid volatile sulfide
bgs	below ground surface
BOA	basic ordering agreement
BOD	biological oxygen demand
CCV	continuing calibration verification
CD	compact disk
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHMM	Certified Hazardous Materials Manager
CIH	certified industrial hygienist
CLP	contract laboratory program
COC	chain of custody
COD	chemical oxygen demand
CRQL	contract required quantitation limits
CSM	conceptual site model
CVAFS	cold vapor atomic fluorescence spectrometry
DESA	Division of Environmental Science and Assessment
DO	dissolved oxygen
DQI	data quality indicator
DQO	data quality objective
DV	data validation
DMC	deuterated monitoring compound
DRO	diesel range organics
EDD	electronic data deliverable
EOD	explosives and ordnance disposal
EPA	United States Environmental Protection Agency
eV	electron volt
FAR	Federal Acquisition Regulations
FASTAC	Field and Analytical Services Teaming Advisory Committee
FCN	field change notification
FID	flame ionization detector
FTL	field team leader
GC/MD	gas chromatograph/multi detector
GC/ECD	gas chromatograph/electron capture detector detection
GC/MD	gas chromatograph/multi-detector
GC/MS	gas chromatograph/mass spectroscopy
GRO	gasoline range organics
GW	groundwater
H&S	health and safety
HASP	Health and Safety Plan

HDPE	high density polyethylene
Hg	mercury
ICP	inductively coupled plasma
ID	identification
IR	infra-red
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOQ	limit of quantitation
MCAWW	Method for Chemical Analysis of Water and Wastes
MDL	minimum detection limit
MEE	methane, ethane, ethene
mg/L	milligram per liter
mL	milliliter
MPC	measurement performance criteria
MW	monitoring well
MS	mass spectrophotometer
MS/ MSD	matrix spike /matrix spike duplicate
NA	not applicable
NIST	National Institute of Standards and Technology
NJDEP	New Jersey Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
OPR	ongoing precision recovery
OU	operable unit
%	percent
%D	percent difference
%R	percent recovery
P	total phosphorus
PAH	polycyclic aromatic hydrocarbon
PAL	project action limit
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
PCDD/PCDF	polychlorodibenzodioxin /polychlorodibenzofurans
PE	professional engineer
PID	photo-ionization detector
PM	project manager
POC	particulate organic carbon
POC	point of contact
ppbv	parts per billion by volume
ppm	parts per million
PQL	project quantitation limit
PQLG	project quantitation limit goal
PQO	project quality objective
PREQB	Puerto Rico Environmental Quality Board
PRP	potentially responsible party
PSG	passive soil gas
PTFE	polytetrafluoroethylene
QA	quality assurance

QAPP	quality assurance project plan
QAS	quality assurance specialist
QC	quality control
QL	quantitation limit
QMP	quality management plan
RA	remedial action
RAC	Remedial Action Contract
RAS	routine analytical services
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RPD	relative percent difference
RPM	remedial project manager
RRF	relative response factor
RSCC	Regional Sample Control Coordinator
RSD	relative standard deviation
Sb	antimony
SEM	simultaneously extracted metals
SIM	simultaneous ion monitoring
SLERA	screening level ecological risk assessment
SM	site manager
SOP	standard operating procedure
SOW	scope of work
SPP	systematic planning process
SSHO	site health and safety officer
SVOC	semivolatile organic compound
TAL	target analyte list
TAT	turnaround time
TBD	to be determined
TCL	target compound list
TCLP	toxicity characterization leaching procedure
TDS	total dissolved solids
TSS	total suspended solids
TICs	tentatively identified compounds
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TSOP	Technical Standard Operating Procedure
UFP	Uniform Federal Policy
µg	microgram
µg/kg	microgram per kilogram
µg/L	microgram per liter
µS	micro Siemen
USGS	United States Geologic Survey
VOA	volatile organic analysis
VOC	volatile organic compound
VTSR	verified time of sample receipt
°C	degrees Celsius

INSTRUCTIONS FOR AND INTENDED USE OF THIS RAC2 CONTRACT GENERIC UFP-QAPP:

The purpose of the QAPP is to document the scientific basis of the investigation including why the work is being done, what is planned, the objectives, the intended use of the data collected, and the tools for QA oversight and reconciliation of planned objectives and the investigation results. The QAPP should provide sufficient information and detail so the investigation can proceed without the planning team.

The Generic QAPP worksheets included herein provide typical project and analytical procedures and requirements for field investigations, sampling, and quality assurance/quality control (QA/QC). The instructions in the Optimized UFP-QAPP Worksheets from the UFP-QAPP Manual, March 2012 have been kept in (green text) to facilitate the writer in the use of this Generic QAPP. The information in this green text must be incorporated into project-specific QAPPs. It should be noted that analytical project action limits for any media have not been included in this document. Project-specific QAPPs will include this information. The official approved Generic QAPP will be maintained in the RAC 2 Document Files and an electronic copy will be kept on the CDM Smith electronic document systems (Project Wise and the New York office server).

Prior to commencing field investigation activities a project-specific QAPP will be prepared and applicable worksheets from the Generic QAPP should be incorporated into the project-specific QAPP by reference in the Introduction Section. Therefore, the project-specific QAPPs will not include all worksheets, but rather only the worksheets that are required to conduct the project work. Referenced worksheets from the Generic QAPP should not be included in the project-specific QAPP.

Project-specific QAPP worksheets will provide information on project stakeholders, contacts, background and history, problem summary, objectives, sampling design and rationale, sampling methods and locations (including maps and figures), analytical methods and other site-specific information unique to each work assignment.

The user is instructed to review the project-specific QAPP in its entirety to ensure that the information therein is applicable to the objectives of the work assignment. Each project-specific QAPP will not be identical. If a project has unique or unusual objectives or if oversight is being performed, then the Generic QAPP information may or may not be applicable. For example, Worksheets #12 and #28 should be included in the project-specific QAPP only for methods not included in this Generic QAPP or for method modifications, if required.

The project-specific QAPP preparer, in consultation with the project team, will be responsible for determining the information to be included in the QAPP and ensuring that the document is accurate and complete.

INSTRUCTIONS FOR USE OF THIS RAC2 CONTRACT GENERIC UFP-QAPP:

Some worksheets require information that is unique to each project. The planning and organizational information and project objectives and approach will be addressed for each project. Typical worksheets to be included in the project-specific QAPP include:

Worksheets 1 through 11

Worksheet 13, 14/16, 15, 17, 18

Worksheet 19 & 30 - Sample Containers, Preservation, and Hold Times

Worksheet 20 - Field Quality Control Summary

Worksheet 23 - Analytical SOPs (if a subcontract laboratory will be used)

Note: DESA QAPP worksheets are considered appended to this Generic QAPP.

Include the worksheets below only if:

1. The project will use methods/instruments/equipment not included in the Generic Uniform Federal Policy (UFP)-QAPP
2. The information in the Generic UFP-QAPP does not apply to the project
3. Modifications or clarifications are required.

Worksheet 21	Include a list of required field SOPs in lieu of this worksheet. Include this worksheet if you have project modifications such as special equipment types that need to be specified or additional SOPs not included herein.
Worksheet 22	Field Equipment Calibration, Maintenance, Testing, and Inspection - only if you have field equipment not included in the Generic QAPP
Worksheets 24	Analytical Instrument Calibration - only if you have analytical instruments not included in the Generic QAPP
Worksheets 25	Analytical Instrument Maintenance, Testing, and Inspection- only if you have analytical instruments not included in the Generic QAPP
Worksheet 26 & 27	Sample Handling, Custody, and Disposal - for any deviations/clarifications – include new information only
Worksheet 12	Measurement Performance Criteria
Worksheet 28	Quality Control (QC) Samples
Worksheet 29	Project Documents and Records (if unique records are required)
Worksheet 31, 32, & 33	Clarifications only (e.g., office audit is not required or PE sample will be required at project start for dioxin in pore water)
Worksheet 34	If changes to the information herein are required
Worksheet 35	If changes to the information herein are required
Worksheet 36	Only state which apply or if the percent of data to be validated is less than 10%
Worksheet 37	If changes to the data usability procedures are required

To facilitate review of the QAPP, the project-specific QAPPs will include an introduction before the worksheets as a reader friendly foundation for the worksheets. A document control number will be included on worksheets #1 and 2 and on the QAPP Crosswalk table.

1.0 Guidance on QAPP Introductions

Information on receipt of the work assignment and contract for the work being performed will be included in a project-specific QAPP introduction. It will describe the task/and nature of the assignment, i.e., Remedial Investigation/Feasibility Study (RI/FS), Remedial Design or Remedial action (RD/RA) and whether this is an oversight assignment. It will also describe the operable unit (OU) and a brief summary of the site from the scope of work (SOW).

This project-specific QAPP is prepared in accordance with the UFP-QAPP manual (EPA 2005) and is compliant with EPA's QAPP guidance document EPA QA/R-5 (EPA 2002). The project will be implemented in accordance with the quality procedures in CDM Smith's Quality Assurance (QA) Manual (CDM Smith 2012) and this governing QAPP. This project-specific QAPP and attachments document the work to be executed.

Recommended content of the introduction:

1.1 Site Overview

1.1.1 Site Description and History

- *Brief description of the site and site history*
- *Contaminants of concern and environmental indicators*
- *Previous actions at the site and historic results*
- *Description of physical features and why the investigation is being performed*

1.1.2 Site Background and Path Forward

- *Description of relevant information, such as the nature of contamination at the site, if known*
- *Media in question*
- *Potential stakeholders*
- *Actions that led to the investigation*

INSTRUCTIONS FOR ADDRESSING FIELD CHANGES OR CHANGES IN SCOPE:

1. Use a Field Change Request/Notification Form when adding additional samples of same matrix, or minor change to sampling protocol or adding sample locations.
2. Prepare a Revised QAPP when the QAPP is outdated (5 years or older); major changes require submittal of all worksheets – such as new phase of a project with new objectives and requirements; and field changes or changes in scope which result in a change in the overall objectives of the project.
3. Prepare an Addendum when adding new work like sampling a new media – in this case not all worksheets are resubmitted.

QAPP notes from 2012 QA meeting with EPA:

- **EPA approves electronic submittal of final and draft QAPPs with EPA RPM agreement** (compact disc (CD) or uploaded to a web portal [secure file transfer site]). E-mail EPA when a document is uploaded and provide CD version to Helen Eng.
- If new field work is required on a project and new information is required to explain the new work, a QAPP Addendum will be submitted instead of a Field Change Notification. A QAPP Addendum is required to describe the significant changes to the field program and for QA review by EPA.
- **Include only worksheets requiring project-specific information (e.g., WSs #9, 11, 17 & 19)** to streamline future project QAPPs. The Generic QAPP can be referenced for worksheets that require no project-specific changes.

**REGION 2
REMEDIAL ACTION CONTRACT (RAC) 2**

GENERIC QUALITY ASSURANCE PROJECT PLAN (QAPP)

Prepared for: US Environmental Protection Agency (EPA) Region 2

Prepared by: *CDM Smith*

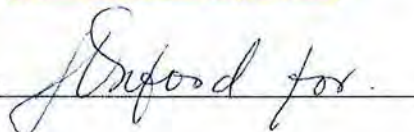
Date: *December 16, 2013*

QAPP Worksheets #1 and 2: Title and Approval Page
(UFP-QAPP Manual Section 2.1)
(EPA 2106-G-05 Section 2.2.1)

This worksheet identifies the principal points of contact for all organizations having decision authority in the project and documents their commitment to implement the QAPP. Signatories usually include the lead organization's Project Manager and QA Manager, and individuals with approval or oversight authority from each regulatory agency. Signatures indicate that officials have reviewed the QAPP and concur with its implementation as written. If separate concurrence letters are issued, the original correspondence should be maintained with the final, approved QAPP in the project file. It is the lead organization's responsibility to make sure all signatures are in place before work begins.

Contract: Remedial Action Contract (RAC) 2, EPA Region 2 EP-W-09-002
Work Assignment Number/Operable Unit: *Provide in Project Specific QAPP*
Document Control No.: 3321-001-01866 *(Update in project-specific QAPPs)*

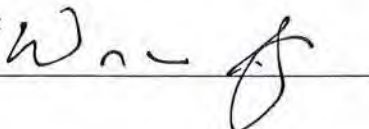
CDM Smith QA Manager:
Jo Nell Mullins

Signature 

RAC 2 Program Manager:
Jeanne Litwin

Signature 

EPA Region 2 Hazardous Waste Support Section Chief or QA Officer:
Phil Cocuzza/Sergio Lopez/Bill Sy

Signature 

EPA Project Officer:
Helen Eng

Signature _____

EPA Remedial Project Manager:

Provide in Project-Specific QAPP

Signature _____

State Regulatory Agency /Stakeholders (name/title/signature/date) (as applicable):

[New Jersey Department of Environmental Protection/ New York State Department of Environmental Conservation/ US Virgin Island Department of Planning and Natural Resources/ Puerto Rico Environmental Quality Board], EPA

Dates and Titles of Plan and Reports Written for Previous Site Work, if Applicable:

[Insert titles of existing project QAPPs and dates]

Required QAPP elements and required information that are not applicable to the project, and an explanation for their exclusions: N/A

QAPP CROSSWALK
Identifying Information
Document Control No.: 3321-001-01866

The following table provides a “cross-walk” between the QAPP elements outlined in the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP Manual), the necessary information, and the location of the information within the text document and corresponding QAPP Worksheet. *Any QAPP elements and required information that are applicable/not applicable to the project will be noted in the project-specific QAPPs.*

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4 , 7 & 8	Personnel Qualifications and Sign-off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certification
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP Elements for Evaluating Existing Data
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection / Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure , Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field QC	2.3.5	Quality Control Requirements
21	Field SOPs	2.3.2	Sampling Procedures and Requirements
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables

QAPP CROSSWALK
Identifying Information (continued)

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements
29	Project Documents and Records	2.2.8	Documentation and Records Requirements
31, 32 & 33	Assessments and Corrective Action	2.4	Assessments and Data Review
		2.5.5	Reports to Management
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

This worksheet is used to identify key project personnel for each organization performing tasks defined in this QAPP. In this example, organizations include the prime contractor and laboratory. Add spaces for addition organizations and personnel as needed. This worksheet lists individuals' project titles or roles; qualifications; and any specialized/non-routine training, certifications, or clearances required by the project, e.g., explosives and ordnance disposal (EOD) technician, Professional Engineer (PE), Certified Professional Geologist, etc.

THIS WORKSHEET WILL BE COMPLETED IN PROJECT-SPECIFIC QAPP:

ORGANIZATION: Prime Contractor

Name	Project Title/Role	Education /Experience	Specialized Training/Certifications	Signature/Date
Project-Specific	SM - Oversee project and responds to EPA Remedial Project Manager (RPM). Manages subcontractors.	TBD	Internal PM training modules	
Project-Specific	Task Manager - Oversees Remedial Investigation tasks. Provide guidance on the sampling and field program; analysis of the geologic data, responsible for implementing the field activities and other tasks as applicable to project	TBD		
Project-Specific	FS Task Manager - Oversees FS Tasks	TBD		
Project-Specific	Project Hydrogeologist - Oversee and provide guidance on the drilling program and analyze the geologic data	TBD		
Project-Specific	Field Team Leader (FTL) - Oversee all field investigation activities	TBD	Trained in EPA CERCLA sampling methods, and field testing procedures	
Project-Specific	Project Ecologist - Performs ecological risk assessment	TBD		
Project-Specific	Project Human Health Risk Assessor -	TBD		
Project-Specific	Field Geologist -	TBD		
Project-Specific	Field Sampler -	TBD		
Project-Specific	Staff Scientist/Engineer -	TBD		
Project-Specific	Staff Engineer -	TBD		

QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

Name	Project Title/Role	Education /Experience	Specialized Training/Certifications	Signature/Date
Shawn Oliveira	Health and Safety Manager - Oversees adherence to Health and Safety requirements	M.S. Environmental Engineering B.S. Chemistry/ Certified Safety Professional, CIH	Certified Industrial Hygienist (CIH)	
Scott Kirchner	Project Chemist - Overall responsibility for laboratory services and data management and evaluating analytical data	B.S. – Chemistry B.S. - Environmental Science	CHMM	
Vanessa Macwan	ASC - Liaise with EPA Regional Sample Control Coordinator (RSCC), Division of Environmental Science and Assessment (DESA) laboratory and subcontract laboratories	B.S. Environmental Science B.S.EngineeringTechnologies	CDM Smith/EPA	
Jeniffer Oxford	QA Specialist - Oversee adherence to QA requirements	B.S.Natural Sciences	CHMM	
Christine Julias	Database Manager - Oversee data management; coordinate with data coordinators and validation staff.	BS Chemical Engineering M.B.A. Marketing Management	P.E.	

ORGANIZATION: Laboratory

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date
EPA CLP Laboratory (TBD)			NELAP/ CLP	
DESA - Sumy Cherukara	QA Officer		NELAP/Trained in EPA and standard analytical methods	
CDM Smith subcontract Laboratory - TBD	QA Officer	TBD	NELAP/ELAP	

Notes:

- Other tasks requiring specialized skills and training will be performed by appropriate subcontractors such as drilling, surveying, and well installing. Training, Certification, and permit requirements will be outlined in separate scopes of work for each task and project.
- CPR/First Aid- Red Cross or CINTAS- periodically as required (1-3 years). Fill in for appropriate non-routine training that is necessary for field activities.
- Signatures in project-specific QAPPs indicate personnel have read and agree to implement this QAPP as written.

QAPP Worksheet #6: Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

This worksheet is used to document specific issues (communication drivers) that will trigger the need to communicate with other project personnel or stakeholders. Its purpose is to ensure there are procedures in place for providing the appropriate notifications and generating the appropriate documentation when handling important communications, including those involving regulatory interfaces, unexpected events, emergencies, non-conformances, and stop-work orders.

THIS WORKSHEET WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPS:

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathways, Documentation, etc.)
Regulatory agency interface	Site Manager (SM)	TBD	[Phone number]	The CDM Smith SM will send all information about the project to the EPA RPM. Field changes will be discussed with the EPA Project Manager prior to implementation.
Manage Field Tasks	Task Manager	TBD	[Phone number]	Act as liaison to SM concerning investigation activities. Daily communication with project team and SM. Communicate implementation issues to FTL.
QAPP Changes: In the Field Prior to field work During project execution	FTL	TBD	[Phone number]	Notify Task Manager immediately and promptly complete a Field Change Notifications (FCN) form and/or corrected worksheets. Send FCN forms to QAS.
	SM or Task Manager	TBD	[Phone number]	Notify EPA RPM, SM and ASC of delays or changes to field work. Prepare QAPP Addendums or revisions in consultation with the client.
Field corrective actions	FTL	TBD	[Phone number]	FTL will oversee implementation of corrective action and notify auditor, SM and Task Manager by email. Task leader will complete the corrective action report form.
Field progress reports	FTL	TBD	[Phone number]	Complete on a daily basis and submit to SM and FTM. SM will forward to EPA RPM upon request.
Booking of Analytical Services	FTL	TBD	[Phone number]	Submit request to ASC before the timeframe below.
	ASC	Vanessa Macwan	732-225-7000	DESA and Contract Laboratory Program (CLP) analytical services through Regional Sample Control Center (RSCC) 3 weeks prior to sampling.
Facilitate Database Setup and Data Management Planning	FTL	TBD	[Phone number]	Provide sample and analytical information prior to sample collection. Provide information on sample and analytical reporting groups, and types of report tables required for project.
Facilitate Data Management	CDM Smith FTL	TBD	[Phone number]	Provide electronic survey data, sample ID, locations and analyses. Transmit completed sample tracking information to data manager by the completion of each sampling case.

QAPP Worksheet #6: Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4) (continued)

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathways, Documentation, etc.)
Incomplete Electronic Data Deliverables (EDDs) or other EDD issues	CDM Smith Data Manager, Task Leader, and Data Coordinator	TBD	[Phone number]	Personnel will request resubmittal of corrected EDD by email.
Data verification issues, e.g., incomplete records	CDM Smith FTL or Sample Manager, and Data Coordinator	[Name]	[Phone number]	Data Coordinator will send an email to the FTL when an issue is found. FTL will address questions or any discrepancies.
Field Corrective Action	CDM Smith Quality Assurance Specialist (QAS), auditor, Task Manager, FTL, and Field Team	[Name]	[Phone number]	SM, Task Manager, FTL, per QA manual requirement corrective actions may also be identified by the field team. FTL initiates corrective action on identified field issues immediately or within QAM recommended timeframe.
Procurement of analytical services	FTL/ASC	[Name]	[Phone number]	FTL or Task leader will prepare laboratory request; ASC will review and send email to RSCC. If needed they will prepare an analytical SOW and submit for project chemist review. FTL initiates laboratory kick-off call with subcontract laboratory (ies) and email agenda.
Analytical Services Support	CDM Smith ASC	Vanessa Macwan	(732) 225-7000	Act as liaison with RSCC for CLP laboratories, with John Birri for DESA, and with subcontract laboratory (ies).
Laboratory Quality Control Variances and Analytical Corrective Actions	Laboratory Project Manager or QC Officer	[Name]	[Phone number]	Daily communication with the Laboratory staff and regular communication with the CDM Smith ASC, QAS or designee. Provide oversight and direction on technical issues as needed.
Notification of Analytical Issues Sample receipt variances	CDM Smith ASC	Vanessa Macwan	(732) 225-7000	Notify FTL of any sample collection/shipment issues. Notify RSCC, DESA laboratory or subcontract laboratories to initiate corrective action.
Data validation issues, e.g., Non-compliance with procedures; Data review corrective actions	CDM Smith data validator or data assessor	[Name]	[Phone number]	Submit a list of questions or issues to EPA or the subcontract laboratory as appropriate for correction or other appropriate response.
Reporting of Issues Relating to Analytical Data Quality (including ability to meet reporting limits, and usability of data)	CDM Smith ASC	Vanessa Macwan	(732) 225-7000	Communicate to SM as appropriate.
	CDM Smith Data Assessor	[Name]	[Phone number]	Communicate to SM as appropriate. Document situation and effect in a data quality report prepared prior to evaluation of remedial design report.
Release of Analytical Data	CDM Smith ASC	Vanessa Macwan	(732) 225-7000	Receive and review data packages before data is used. Initiate data validation of subcontract laboratory data.
Site Health and Safety Issues Stop work due to safety issues	CDM Smith Site Health and Safety Officer	[Name]	[Phone number]	Conduct Daily Health and Safety Meetings, make decisions regarding health and safety issues and upgrading PPE. Communicate to SM, Task Manager, Health and Safety Manager, and field staff as appropriate.

QAPP Worksheet #9: Project Planning Session Summary
(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

A copy of this worksheet should be completed for each project planning session, whether sessions are internal (project teams only) or external (includes regulators and/or stakeholders). It is used to provide a concise record of participants, key decisions or agreements reached, and action items. Depending on the stage of planning, project-planning sessions should involve key technical personnel as needed. Scoping sessions can be by phone, web-conferencing, and/or face-to-face meeting depending upon logistical considerations. Previous meeting minutes can be included as attachments if necessary and referenced. Users may find it helpful to have copies of worksheets on hand for all planning sessions, in whatever state of completion they may be. However, worksheets 10, 11, 15, and 17 should be prioritized in the early stages of project planning. The following template may be modified to suit both the project and the specific planning session.

THIS WORKSHEET WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPS:

Date of Planning Session: <i>[Insert Date]</i>				
Location: <i>[insert location]</i>				
Scoping Session Purpose: <i>[Insert Purpose]</i>				
Participants:				
Name	Organization	Title/ Role	E-mail	Phone

Notes/Comments:

Consensus Decisions Made:

Action Items:

Consensus Decisions:

Action	Responsible Party	Due Date

**italicized text means site-specific information to be added*

**QAPP Worksheet #10: Conceptual Site Model
(UFP-QAPP Manual Section 2.5.2)
(EPA 2106-G-05 Section 2.2.5)**

This worksheet is used to present the project's conceptual site model (CSM). The CSM is a tool to assist in the development of data quality objectives (DQOs). The CSM uses primarily text and/or figures but may also include tables to convey succinctly what is currently known about the site, and is updated as new data is collected. As with the QAPP in general, the level of detail in the CSM is based on the graded approach. If an investigation includes multiple sites with unique characteristics or problems to be addressed, then a separate CSM is prepared for each site.

The CSM should include the following information:

- Background information, i.e., site history (unless this information is presented in an Executive Summary)
- Sources of known or suspected hazardous waste
- Known or suspected contaminants or classes of contaminants
- Primary release mechanism
- Secondary contaminant migration
- Fate and transport considerations
- Potential receptors and exposure pathways
- Land use considerations
- Key physical aspects of the site (e.g., site geology, hydrology, topography, climate)
- Current interpretation of nature and extent of contamination to the extent that it will influence project-specific decision-making

Data gaps and uncertainties associated with the CSM need to be clearly identified.

THIS WORKSHEET WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPs. Attach the existing CSM figure.

For oversight projects, the PRP's QAPP will address the CSM and DQOs.

QAPP Worksheet #11: Project Data Quality Objectives
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

This worksheet is used to develop and document project quality objectives (PQOs) or data quality objectives (DQOs) using a systematic planning process (SPP). Examples of SPP include: 1) the DQO Process¹, and 2) the U.S. Army Corps of Engineers' Technical Planning Process (TPP)². The type of SPP used will vary based on the graded approach. This worksheet is mainly populated as text although some diagrams that capture decision processes are recommended. Regardless of the SPP applied, the QAPP must document the environmental decisions that need to be made and the level of data quality needed to ensure that those decisions are based on sound scientific data. The following guidelines are based on EPA's 7-step DQO process.

Site specific information to include:

1. **State the Problem.** The problem statement should be consistent with information contained in the CSM (Worksheet #10).
2. **Identify the Goals of the Study.** Identify specific study questions and define alternative outcomes. The goals for either decision or estimation problems should explain how the data will be used to answer questions and choose among the stated alternatives. Characterizing the "nature and extent of contamination" is a commonly stated but inappropriate study goal because it is vague and not focused on potential outcomes.
3. **Identify Information Inputs.** Specify the types of data³ that are required to fill gaps in the CSM. Explain in specific terms how all data will be used. In addition to analytical data, this could include published information on geology, climate, population distributions, endangered species, etc. Information inputs should be consistent with decisions made during project scoping, as documented on Worksheet #9.
4. **Define the Boundaries of the Study.** Specify the target population and characteristics of interest, define spatial /temporal limits and the scale of inference (i.e., which populations will be represented by which data.) Developing the list of target analytes presents one of the greatest opportunities for streamlining a project, as it can help avoid unnecessary costs associated with not only sampling, but also analysis, data review, reporting and management. Target analytes should be focused on specific constituents reasonably known or suspected to be present. The list of target analytes should be based on data gaps in the CSM. Focusing the list of analytes also provides better opportunities for optimizing method performance to best suit those analytes.

¹Guidance on Systematic Planning Using the Data Quality Objectives Process, U.S. EPA, EPA QA/G-4, February 2006.

² Technical Project Planning Process, U.S. Army Corps of Engineers, EM 200-1-2, August 1998

³ See full example in Generic QAPP folder

QAPP Worksheet #11: Project Data Quality Objectives
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6) (continued)

5. **Develop the Analytic Approach.** Define the parameter(s) of interest, specify the type of inference (e.g., “samples from groundwater monitoring wells x, y, and z will represent potable water at the site) and develop the logic for drawing conclusions from findings (i.e., which sample results will be used to support which decisions.) For decision problems, these are expressed as “if---then” statements, or decision rules, that link potential results with conclusions or future actions. For estimation problems, specify the estimator and the estimation procedure.
6. **Specify Performance or Acceptance Criteria.** For projects that involve hypothesis testing (e.g. presence or absence of contamination exceeding some threshold value) for decision-making, this will involve specifying probability limits for decision errors. For estimations and other analytic approaches (e.g. estimating the volume of groundwater or soil potentially requiring remediation), this will involve the development of performance criteria (for new data being collected) or acceptance criteria (for existing data being considered for use).
7. **Develop the Detailed Plan for Obtaining Data.** Worksheet #11 generally will briefly explain the basis for the sampling design, and then refer to Worksheet #17 – Sample Design and Rationale, for further details. Worksheets #19, 20, 24-28, and 30 will specify analysis design requirements.

THIS WORKSHEET WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPS – AN EXAMPLE IS INCLUDED IN A SEPARATE FILE – INFORMATION BELOW IS FOR OVERSIGHT PROJECTS:

QAPP Worksheet #11: Project Data Quality Objectives (Oversight)
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

The principal responsible party(ies) (PRP)'s QAPP will address the Project DQOs. Split samples will be used to support the goals of the oversight program. The problem and framework for oversight are:

1. State the Problem – *The overall purpose and project objectives of a PRP study [RI/FS, pre-design, monitoring or other]; problem to be addressed; and environmental questions being asked if different from the information below, will be presented in project-specific QAPPs.*

The investigation is being led by the PRP; EPA needs to determine the accuracy of the PRP generated data and that work is executed in compliance with approved documents. Oversight will include field observation and acceptance of split samples to verify site characterization. CDM Smith will assist EPA in PRP oversight of the field activities and will provide field oversight and analysis of split samples accept from the PRP's contractor to verify compliance with their approved project plans and the accuracy of their data. To evaluate the PRP's data accuracy, CDM Smith will accept 10 percent split samples for analysis at locations determined by field observations, pre-set criteria or as directed by EPA. Generally split samples locations will be determined in consultation with the EPA RPM – *state basis in project-specific QAPPs.*

CDM Smith oversight of the PRP's field investigation will include the following activities:

- Technical Review and evaluation of the PRP's project plans
- Documentation of field activities observations and deficiencies
- Acceptance of split samples
- Sample handling, packaging and shipping to off-site laboratories
- Review of PRP-selected sampling locations
- Comparison of data sets to determine any analytical bias

2. Identify Study Goals – The data will be used to verify, through independent oversight and split sampling analysis, that the PRP activities are in accordance with their Contractor's Work Plan, QAPP, and HASP and that the PRP's data are representative of site contaminant concentrations. Oversight and split sample data will be used to answer the environmental questions below:

- Is the PRP contractor complying with the approved plans or approved deviations?
- Does the PRP data adequately describe the site conditions and is it representative for project decisions?
- Are the PRP and CDM Smith data complete and accurate?
- Are data sets comparable as defined on Worksheet #37?
- Does the data show any analytical bias?
- Are the PRP versus CDM Smith data relative percent difference (RPD)'s within the measurement performance criteria?

QAPP Worksheet #11: Project Data Quality Objectives (Oversight)
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

3. Identify Information inputs – *Project-specific QAPPs will include the types of data needed for a particular oversight study.*

CDM Smith and EPA will determine all necessary analyses, media types, and sample locations to be split based on the PRP's project-specific QAPP and based on the needs and scope of each oversight project. CDM Smith will accept samples during the PRP field program to assess data accuracy and compliance to governing documents and overall project scope. The analyses selected to be split are determined to be more critical for oversight evaluation; the analyses that will not be split are ancillary parameters and not major risk drivers. Typically chemical analyses will be obtained for the contaminants of concern; physical data will not be obtained unless determined critical to the investigation or as directed by EPA. The oversight data will be used to answer the study questions listed in Step 2, Identify Study Goals.

4. Boundaries of the Study – *Define characteristics of interest including analytes, media types, sample locations, and project schedule*

Split samples to be collected for chemical analyses will be listed in project-specific QAPPs:

- a. Analyte groups of interest and analyte groups that will not be split. Selection of analytes for comparison will be biased towards those of greater risk or concern, known or suspected chemicals and data gaps.*
- b. Split samples will be accepted from a wide range of expected concentrations (non-detect to high) and sample types.*
- c. Media types, sample locations, and depths.*
- d. Schedule of events covering important aspects of the field program.*
- e. Project specific data analysis and reporting should also be outlined based on the needs and scope of the PRP's project.*

5. Analytic approach – *The parameters of interest, and sets of data used for the decision making process will be defined in the project-specific QAPPs.*

Field observations and split sample data will enable CDM Smith to perform technical review and evaluation on the PRP field program, analytical data and reports and to qualitatively assess any potential bias in the PRP dataset. Sample results will be evaluated against the PRP's project action limits on Worksheet #15 and against the PRP's data using the split samples data quality indicators on worksheets #12 and 28. Field implementation will be measured against procedures in the PRP's field plans. The project decision criteria below will apply:

QAPP Worksheet #11: Project Data Quality Objectives (Oversight)
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

Project Decision Conditions (“If..., then...” statements):

- If field work is inconsistent with the PRP QAPPs, then the field oversight staff will verify tasks with respect to the PRP’s QAPPs, and HASP and note deviations with the PRP’s field project leader and document such discussions in the Daily Field Summary Reports submitted to EPA. The CDM Smith Project Manager and EPA RPM will be informed if there are deviations.
- If the PRP team needs to relocate survey locations, or there are any changes to the planned field program, CDM Smith will communicate this change to the EPA and document it on the Daily Field Summary Reports.

CDM Smith will present data findings in a Report and submit it to the EPA, who will then determine if any additional actions are required.

6. Performance and Acceptance Criteria – *Document performance criteria for new data or acceptance criteria for existing data*

- CDM Smith’s QC data will be used to determine split samples data quality and whether sample results are acceptable based on the established project data quality objectives (DQOs). Samples results will be compared to the measurement performance criteria (MPC) of the data quality indicators (DQIs).
- EPA’s Field and Analytical Services Teaming Advisory Committee (FASTAC) policy for obtaining laboratory resources will be utilized for sampling events. Laboratory analysis will be performed through the DESA and CLP laboratories.
- Definitive level data is required for full validation of the data.
- The project-specific action limits and quantitation limits are specified on Worksheet #15 for all contaminants of concern. Analytical data generated will be compared to these limits. Data must meet the data quality objectives (DQOs) that have been specified for the site. Refer to Worksheets #12, 18 and 28.
- Laboratory reporting limits (contract required quantitation limits (CRQLs)) need to be below or equal to the CPG’s project quantitation limits goals or the project action limits.
- In addition, to ensure that measurement performance criteria for usability (criteria for measures of precision, accuracy, representativeness, comparability, completeness, and sensitivity) are met, all data will be subject to validation and the outputs used to perform a data usability assessment.

QAPP Worksheet #11: Project Data Quality Objectives (Oversight)
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

7. Detailed Plan for Obtaining Data – *Document basis for sampling design and rationale*

Field sampling and field procedures are described in the PRP's Work Plan and QAPP. Sampling oversight will be performed according to the PRP's schedule, unless unanticipated delays occur. *Refer to figure XX for split sample locations.*

The PRP Contractor's representative will collect and fill the sample containers and CDM Smith's field personnel will prepare the split samples for shipment. CDM Smith will perform sample management, prepare, package, and ship the split samples to the assigned laboratory. DESA, CLP or a subcontract laboratory will generate the data. EPA's RSCC will communicate laboratory assignments to CDM Smith.

CDM Smith field personnel will observe the implementation of field and sampling activities and note any deviations from their Work Plan and QAPP. Deviations will be brought to the attention of the PRP's contractor, and reported to the CDM Smith SM who will communicate this information to the EPA RPM. These will be documented in the daily communications and in the CDM Smith data report. This will include a discussion of the impact of the deviation(s) on the data quality. The PRP contractor's activities will be documented in the field logbook.

Data Reporting

- CDM Smith will prepare a field oversight report for each split sampling event on a monthly basis. Sampling method, number of split samples collected, and document compliance with sampling activities of the PRP will be recorded along with the approved plans and EPA requirements.
- Sampling data results will be emailed to CDM Smith from DESA or the EPA for evaluation and preparation of a data comparability report. Final validated data will be submitted to CDM Smith in electronic format and/or hard copies.
- Following completion of laboratory analyses and receipt of all electronic and hardcopy data, CDM Smith will prepare a split sample summary report and submit to EPA and USACE. The report will include tabulated results and a discussion of the data quality and its comparability with the PRP's data. This review will be used to evaluate the accuracy of the PRP data.

Data archiving

- Data will be downloaded from the EPA website or emailed to CDM Smith.
- Final CLP validated data will be submitted to CDM Smith in electronic format consistent with CLP deliverables
- Electronic data will be input into the project's EQUIS database.
- EPA will archive CLP laboratory raw data in its document control system.
- Hard copies of field data including field logs will be archived in the project files.
- Hard copies of analytical data received by CDM Smith will be archived in the project files for 10 years after contract expiration.

LIST OF WORKSHEET #12s INCLUDED IN THIS QAPPGas/Air

WS #12a - Volatile organic compounds (VOCs) by TO-15
WS #12b - VOCs by CLP SAV01.X
WS #12c - Polychlorinated biphenyls (PCBs) by TO-10A
WS #12d/e - Soil Gas (VOCs and SVOCs) by 8260C modified

Aqueous

WS #12f - Methane, ethane, ethene (MEE) by RSK175
WS #12g - VOCs Low by 8260B
WS #12h - TCL VOCs by SOM01.2
WS #12i - TCL Semi volatile Organic Compounds (SVOCs) by SOM01.2
WS #12j - Polycyclic Aromatic Hydrocarbons (PAHs) and alkyl PAHs by 8270C/D
WS #12k - Polychlorinated dibenzodioxins (PCDD)/
Polychlorinated dibenzofurans (PCDF) by 1613B/8290
WS #12l TCL Pesticides by SOM01.2
WS #12m - Chlorinated Pesticides by 1699
WS #12n - Organochlorine Pesticides by EPA 8081A
WS # 12o - Chlorinated Pesticides by EPA 1699
WS #12p - Herbicides and Organophosphate Pesticides by 8141A/B
WS #12q - Chlorinated Herbicides by 8151A
WS #12r - TCL PCBs by SOM01.2
WS #12s - PCB Congeners by 1668A
WS #12t - Target Analyte List (TAL) Metals, Hardness – ISM01.3 AES
WS #12u - TAL Inorganic Metals – ISM01.3 MS
WS #12v – TAL Inorganic Metals – AES, SW-846, EPA 6010
WS #12w – TAL Inorganic Metals – SW-846, EPA 6020
WS #12x - TAL Total Mercury by ISM01.3
WS #12y - Trace Mercury by EPA Method 1631
WS #12z - Methyl Mercury By 1630
WS #12aa - TAL Total Cyanide by ISM01.3
WS #12ab - Total petroleum hydrocarbon (TPH) [Includes diesel range

organic (DRO) and gasoline range organic (GRO)] by 8015B/C

WS #12ac - Wet Chemistry-Field Test Kits
WS #12ad - Wet Chemistry-Ion Chromatography by EPA 300, 314,
SM4110B
WS #12ae - Wet Chemistry-Colorimetry; Spectrophotometry
WS #12af - Wet Chemistry-Titration or Potentiometer
WS #12ag - Wet Chemistry-Hexavalent Chromium by SM3500 and
HACH 8023
WS #12ah - Hexavalent Chromium by SW-846, 7196A
WS #12ai - Wet Chemistry-Total Suspended Solids (TSS) by SM2540D
WS #12aj - Wet Chemistry-Total Dissolved Solids (TDS) by SM2540C
WS #12ak - Wet Chemistry-Gravimetry by MCAWW
WS #12al - Wet Chemistry-Biological Oxygen Demand (BOD) by
SM5210B
WS #12am - Wet Chemistry-Total Organic Carbon (TOC) by 415.2,
9060, SM5310B
WS #12an - Wet Chemistry-Dissolved Organic Carbon (DOC) by
SM5310B
WS #12ao - Wet Chemistry-Particulate Organic Carbon (POC) by
415.1 DESA Modified
WS #12ap - In-Field Measurements

LIST OF WORKSHEET #12s INCLUDED IN THIS QAPP

Soil/Sediment

WS #12aq – VOCs by AVS-SEM by EPA 376

WS #12ar - TCL VOCs by EPA 8260B

WS #12as - TCL VOCs by SOM01.2

WS #12at - TCL SVOCs by SOM01.2

WS #12au - PAHs by 8270C/D

WS #12av - PCDD/PCDF by 1613B/8290

WS #12aw - TCL Pesticides by SOM01.2

WS #12ax - Chlorinated Pesticides by 1699

WS #12ay - Organochlorine Pesticides by 8081B

WS #12az – Herbicides/Organophosphate pesticides by EPA 8321A/B, 8141A/B, EPA 633/632

WS #12ba - Chlorinated Herbicides by 8151A

WS #12bb - TCL PCBs by SOM01.2

WS #12bc - PCB Congeners by 1668A

WS #12bd - TAL Metals AES by ISM01.3

WS #12be – TAL Metals MS by ISM01.3

WS #12bf - TAL Metals by Method 6010B and 6020

WS #12bg - TAL Total Mercury by ISM01.3

WS #12bh - Total Mercury by EPA Method 1631

WS #12bi - Methyl Mercury by 1630

WS #12bj - TAL Total Cyanide by ISM01.3

WS #12bk - TPH (DRO and GRO) by 8015B/C

WS #12bl - TOC by 9060, 415.2, SM5310BCD

WS #12bm - TOC Lloyd Kahn Method

WS #12bn - Grain Size by ASTM D421-85 and D422-63

WS #12bo - Moisture by SM2540G and ASTM D2216

WS #12bp - Hexavalent Chromium by SW846, 7196A

WS #12bq - Sulfide by SM4500 –s-2-d-f

WS #12br Perchlorate by 314

WS #12bs - Cation Exchange Capacity by SW846, 9080/9081 or 6010B

WS #12bt - Rigid Wall Permeability by ASTM D2434

WS #12bu - pH by ASTM 9045D

WS #12bv - Specific Gravity, Bulk Density, Atterberg Limit by ASTM D854, D2937, D4318

QAPP Worksheet #12: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

General Information:

This worksheet is used to guide the selection of appropriate measurement techniques and analytical methods.

It documents the quantitative measurement performance criteria in terms of precision, accuracy/ bias, and sensitivity for both field and laboratory measurements. MPCs are developed to ensure collected data will satisfy the PQOs or DQOs documented on Worksheet #11. For analytical methods, MPC should be determined for each matrix, analyte, and concentration level.

Each type of field or laboratory measurement requires a separate worksheet. The QC sample and/or activity used to assess the measurement performance for both the sampling and analytical measurement systems are noted. Qualitative MPC (representativeness and comparability) are addressed in the sample design, which is documented on Worksheet #17.

Some engineering parameters [Atterberg limit, bulk density, porosity and other geotechnical parameters] used for input in design calculations do not require field and laboratory QA/QC samples.

Worksheet #28 provides additional QC information.

THIS WORKSHEET WILL BE NOT BE REQUIRED IN PROJECT-SPECIFIC QAPPS, however:

1. If a project requires analytical groups not included in this CDM Smith Generic QAPP then the worksheet #12 must be included to document the measurement performance criteria.
2. The RPD for the sample splits and field duplicates will be as noted herein unless otherwise noted in project-specific QAPPS. *If knowledge of the site matrix indicates that a less conservative field duplicate criterion can be used, the project-specific QAPP will document the alternate criterion.*
5. The project-specific QAPP should list the applicable worksheets from this Generic QAPP.
6. Wet chemistry, soil tests such as grain size may not require a field duplicate based on project needs. The project-specific QAPP should note any deviations from the attached worksheet 12s.

QAPP Worksheet #12a: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Gas/Air
Analytical Group or Method VOCs/TO-15
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Split Samples and Field Duplicates	<25% relative percent difference (RPD)
Overall Accuracy/Bias (contamination)	Field Blank	No analyte > contract required quantitation limit (CRQL)
Analytical Precision	Laboratory Replicate Sample	± 25 percent difference (%D)*
Analytical Accuracy	Laboratory Audit Standard (LCS)	70-130 percent recovery (%R)*
Analytical Accuracy	Laboratory Method Blank	No analyte > CRQL
Analytical Sensitivity	LOQ verification sample (spiked at LOQ)	Recovery within $\pm 25\%$ of limit of quantitation (LOQ) or <QL

*Reference Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by GC/MS, 2nd Edition, January 1999; Table 3 "Summary of Internal Quality Control Procedures for VOCs by EPA method TO-15", Revision 01/21/2000.
Reporting units are parts per billion by volume (ppbv)

QAPP Worksheet #12b: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Gas/Air
Analytical Group or Method VOCs/CLP SAV01.X
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	<25% RPD
Accuracy	Field Blank	No analyte > CRQL
Precision	Laboratory Replicate	± 25% RPD*
Accuracy	Method Blank	No analyte > ½ CRQL
Accuracy	Laboratory Control Sample (LCS) /CCV	±30%R*

*Reference EPA CLP Statement of Work for Volatile Organic Analysis in Air, SAV01.X, Draft, June 2008
 Reporting units are ppbv)

QAPP Worksheet #12c: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Gas/Air
Analytical Group or Method PCBs/TO-10A
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Bias/ Sensitivity- Contamination	Method Blank	No target compounds >QL
Accuracy/Bias/ Sensitivity- Contamination	Field Blank	No target compounds >QL
Accuracy/Bias	LCS	60-140% R
Precision	Split Samples and Field Duplicates	RPD $\leq$ 25% if both samples are >5x QL. Difference $\leq$ 2x QL if results are $\leq$ 5x QL.

Reporting units are ppbv

QAPP Worksheet #12d &e: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Passive Soil Gas*
Analytical Group SVOCs and TPH C5-C9, and TPH C10-C15/SW-846 8260C Modified
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤25% RPD
Accuracy/Bias	Trip Blank; Preparation and Method Blanks	No analyte > 25 ng or LOQ
Precision	Laboratory Duplicate	+ 25 % RPD
Accuracy	LCS	80-120% Recovery

*Samples are collected and desorbed following ASTM International D6196, *Standard Practice for Selection of Sorbents, Sampling, and Thermal Desorption Analysis Procedures for Volatile Organic Compounds in Air*. **Modifications and laboratory SOPs will be included in project-specific QAPPs.**

Matrix Passive Soil Gas
Analytical Group VOCs /SW-846 8260C Modified
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤25% RPD
Accuracy/Bias	Trip Blank; Preparation and Method Blanks	No analyte > 25 ng or LOQ
Precision	Laboratory Duplicate	≤ 25 % RPD
Accuracy	Laboratory Audit Standard (LCS)	80-120% Recovery

QAPP Worksheet #12f: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group MEE/RSK 175
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Split Samples and Field Duplicates	50% RPD when MEE in both samples $\geq$ QL Absolute difference (ABS) $\leq$ 5xQL when one or both results < QL
Overall Accuracy/bias (contamination)	Field and Trip Blank	No analyte > QL No target analyte concentrations $\geq$ $\frac{1}{2}$ QL
Precision	Laboratory Duplicate or Analytical Replicate	RPD $\leq$ 40%
Accuracy	LCS	80-120% Recovery
Sensitivity	LOQ verification sample (spiked at LOQ) or Method Blank	Recovery within $\pm$ 25% of LOQ or Blank $\leq$ QL
Completeness	Data Assessment Also See Worksheet #34	$\geq$ 90% Valid Data versus Total Data Collected and $\geq$ 90% Planned Data versus Data Collected Also See Worksheet #34

Reporting units are $\mu\text{g/L}$

QAPP Worksheet #12g: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix
Analytical Group
Concentration Level

Aqueous
TCL VOCs/EPA 8260B
Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Bias-Contamination	Method/Instrument Blanks	No target compound>QL, no common laboratory contaminants>5xQL
Accuracy/Bias-Contamination	Trip/Equipment Rinsate Blanks	No target compound>QL, no common laboratory contaminants>5xQL
Accuracy/Bias	LCS	60-140%recovery or laboratory internal limits
Accuracy/Bias	MS	±20% VOCs or see laboratory internal limits
Accuracy/Bias	Surrogates	Compound specific, see laboratory internal limits
Precision	MSD	RPD < 20% when detects for both results > QL
Precision	Split Samples and Field Duplicates	RPD ≤ 30% if both samples are ≥QL
Completeness	Data Completeness Check	≥90%
Sensitivity	Laboratory Fortified Blank at the QL	±40% at the QL

QAPP Worksheet #12h: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TCL VOCs/SOM01.2
Concentration Level Trace or Low/Medium (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Split Samples and Field Duplicates	≤50% RPD when VOCs in both samples ≥ CRQL ABS ≤ 5xQL when one or both results < CRQL
Overall Accuracy/bias (contamination)	Field and Trip Blank*	No analyte > CRQL No target analyte concentrations ≥ 1/2 CRQL
Precision	Matrix spike(MS)/Matrix spike duplicate (MSD)**	See Worksheet #28 for compound specific values
Accuracy	***Deuterated Monitoring Compounds (DMC); MS/MSD**	See Worksheet #28 for list of compound specific values and range of acceptable %Rs
Sensitivity	LOQ verification sample (spiked at LOQ) or Method Blank	Recovery within ±25% of CRQL
Completeness	Data Assessment Also See Worksheet #34	≥90% Valid Data versus Total Data Collected and ≥90% Planned Data versus Data Collected Also See Worksheet #34

*Reference EPA Region 2 SOP No. 34 for Trace VOA - Blank Type Criteria Table

**Optional MS/MSD – Reference CLP SOM01.2, Exhibit D, Table 6 for Criteria – Not typically required for CLP in Region 2

***DMCs – Reference CLP SOM01.2, Exhibit D, Table 5 for Criteria

QAPP Worksheet #12i: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TCL SVOCs/SOM01.2
Concentration Level Low/Medium (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Split Samples and Field Duplicates	≤50% RPD when SVOCs in both samples ≥ CRQL otherwise ABS ≤ 5xCRQL
Overall Accuracy/bias (contamination)	Field Blank*	No analyte > CRQL No target analyte concentrations ≥ 1/2 CRQL
Precision	MS/MSD**	See Worksheet #28 for compound specific values
Accuracy	***DMCs; MS/MSD**	See Worksheet #28 for list of compound specific values and range of acceptable %Rs
Sensitivity	LOQ verification or Method Blank	Recovery within ±25% of CRQL
	Data Assessment	CRQLs meet project quantitation limit goals (PQLGs)
Completeness	Data Assessment Also See Worksheet #34	≥90% Valid Data versus Total Data Collected and ≥90% Planned Data versus Data Collected Also See Worksheet #34

*Reference EPA Region 2 /Low/Medium Semivolatile SOP shown on Worksheet # 36 or most recent revision <http://www.epa.gov/region2/qa/documents.htm>

**Optional MS/MSD – Reference CLP SOM01.2, Exhibit D, Table 6 for Criteria – Not typically required for Region 2

***(DMCs) – Reference CLP SOM01.2, Exhibit D, Table 5 for Criteria

QAPP Worksheet #12j: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group PAH and Alkyl PAHs/EPA 8270 C/D modified
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Bias-Contamination	Method Blank /Instrument Blank	No target compound > quantitation limit (QL)
Accuracy/Bias-Contamination	Equipment Rinsate Blank	No target compound >QL
Accuracy/Bias	Ongoing Precision and Recovery (OPR) / Certified Reference Material	Per laboratory SOP
Accuracy/Bias	MS/MSD	50-200 percent (%)
Accuracy/Representativeness	Temperature Blank checks DV	0 to 6 degrees Celsius (°C) 10 °C (DV)
Accuracy/Bias	Laboratory Duplicate	RPD ≤ 40% for concentrations > 10x detection limit (DL)
Accuracy/Bias	Surrogate	15-130% recovery (R)
Accuracy/Bias	PE Sample Data Review or Sample Analysis	Supplier Certified Limits
Comparability	Evaluated during DQA	Comparable units, and methods
Precision	Split Samples and Field Duplicates	RPD ≤40% if both samples are >5x QL or ABS <2x QL if either result is ≤5x QL
Completeness	Data Completeness Check data quality assessment (DQA)	≥90%

Modifications and laboratory SOPs will be included in project-specific QAPPs.

QAPP Worksheet #12k: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group PCDD/PCDF/ EPA 1613B or 8290
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 QL
Precision	Laboratory duplicate	$\pm$ 20% of mean if concentration >10DL
Accuracy/Bias Precision	MS/MSD	70-130 %recovery (or per laboratory SOP) RPD $\leq$ 40%
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6 °C 10 °C (DV)
Precision	Initial precision and recovery standard	Per laboratory SOP
Accuracy/Bias		Various % recovery per laboratory SOP
Accuracy/Bias	Ongoing precision and recovery standard (OPR)	70-130 %recovery
Accuracy/Bias	Surrogate standards	17-130% recovery
Comparability	Evaluated during DQA	Comparable units, and methods
Completeness	Evaluated during DQA	$\geq$ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq$ QLs (WS#15 and laboratory SOP)

QAPP Worksheet #12I: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TCL Pesticides/ SOM01.2
Concentration Level Low/Medium (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Split Samples and Field Duplicates	50% RPD when pesticides in both samples $\geq$ CRQL ABS $\leq$ 5xQL when one or both results < CRQL
Overall Accuracy/bias (contamination)	Field Blank*	No analyte > QL No target analyte concentrations $\geq$ 1/2 CRQL
Precision	MS/MSD**	See Worksheet #28 for compound specific values
Accuracy	***LCS; MS/MSD**	See Worksheet #28 for list of compound specific values
Sensitivity	LOQ verification or Method Blank	Recovery within $\pm 25\%$ of CRQL
	Data Assessment	CRQLs meet PQLGs
Completeness	Data Assessment Also See Worksheet #34	$\geq 90\%$ Valid Data versus Total Data Collected and $\geq 90\%$ Planned Data versus Data Collected Also See Worksheet #34

*Reference EPA Region 2 Low/Medium Pesticide Data Validation SOP shown on Worksheet # 36 or most recent revision <http://www.epa.gov/region2/qa/documents.htm>

**MS/MSD – Reference CLP SOM01.2, Exhibit D, Table 3 for Criteria

***LCS – Reference CLP SOM01.2, Exhibit D, Table 2 for Criteria

QAPP Worksheet #12m: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Chlorinated Pesticides/EPA 1699
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 QL
Precision	Laboratory duplicate	$\pm$ 40% if concentration $>$ 10DL
Accuracy/Bias	LCS	50-150%
Accuracy/Bias	Certified Reference Material (CRM) Calibration Verification	Supplier Certified Limits Per laboratory or method SOP 25% RSD for native analytes that have an exact labeled standard. 35%RSD for others
Accuracy/Bias	OPR /Matrix Spike	50-150% recoveries or per laboratory SOP
Accuracy/ Representativeness	Temperature Blank checks Data validation (DV)	0 to 6 °C 10 °C
Accuracy/Bias	Surrogate	10-250% recovery (See SOP for individual limits)
Comparability	Evaluated during DQA	Comparable units, and methods
Completeness	Evaluated during DQA	$\geq$ 90% Collection and $\geq$ 90% Valid data
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq$ QLs (WS#15 and laboratory SOP)

QAPP Worksheet #12n: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Organochlorine pesticides/EPA 8081A
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Bias-Contamination	Method Blank/Instrument Blank	No target compound above >QL
Accuracy/Bias-Contamination	Equipment Rinsate Blank	No target compound above >QL
Accuracy/Bias	LCS	60%-140%R
Accuracy/Bias	MS	60%-140%R
Accuracy/Bias	PE Sample	Supplier Certified Limits
Accuracy/Bias	Surrogates	Laboratory Specified
Precision	MSD	60%-140%R; RPD ≤30%
Precision	Split Samples and Field Duplicates	RPD ≤40% if both results are >5x QL
Completeness	Data Completeness Check	≥90%

QAPP Worksheet #12o: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Organochlorine pesticides/EPA 1699
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Bias-Contamination	Method Blank/Instrument Blank	No target compound above >QL
Accuracy/Bias-Contamination	Equipment Rinsate Blank	No target compound above >QL
Accuracy/Bias	LCS	60%-140%R
Accuracy/Bias	Labeled isotope dilution standards	Laboratory specified
Accuracy/Bias	PE Sample	Supplier Certified Limits
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if both results are $>5\times$ QL
Completeness	Data Completeness Check	$\geq$ 90%

QAPP Worksheet #12p: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Herbicides and Organophosphate pesticides/EPA 8141A/B
Concentration Level Colorimeter or Spectrophotometer

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	$\leq 40\%$ RPD
Precision	MS/MSD	See Worksheet #28
Accuracy	LCS; MS/MSD	See Worksheet #28

QAPP Worksheet #12q: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Chlorinated Herbicides/EPA 8151A
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Bias (Contamination)	MB/Instrument Blank	No target compound >QL
Accuracy/Bias (Contamination)	Equipment Rinsate Blanks	No target compound >QL
Accuracy/Bias	LCS	60%-140%R
Accuracy/Bias	MS	60%-140%R
Accuracy/Bias	PE Sample or Standard Reference Material	Supplier Certified Limits
Precision	MSD	60%-140%R; RPD ≤30%
Precision	Split Samples and Field Duplicates	RPD ≤40% if both results are >5x QL
Completeness	Data Completeness Check	≥90%

QAPP Worksheet #12r: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TCL PCBs/SOM01.2
Concentration Level Low/Medium (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Split Samples and Field Duplicates	≤50% RPD when PCBs in both samples ≥ CRQL ABS ≤ 5xQL when one or both results < CRQL
Overall Accuracy/bias (contamination)	Field Blank*	No analyte > CRQL No target analyte concentrations ≥ ½ CRQL
Analytical accuracy/bias (contamination)	Method Blank	
Precision	MS/MSD**	See Worksheet #28 for compound specific values
Accuracy	***LCS; MS/MSD** Surrogates	See Worksheet #28 for the list of compound specific values
Sensitivity	LOQ verification or Method Blank	Recovery within ±25% of CRQL
	Data Assessment	CRQLs meet PQLGs
Completeness	Data Assessment Also See Worksheet #34	≥90% Valid Data versus Total Data Collected and ≥90% Planned Data versus Data Collected Also See Worksheet #34

*Reference EPA Region Low/Medium Aroclor Data Validation SOP on Worksheet # 36 or most recent revision <http://www.epa.gov/region2/qa/documents.htm>

**MS/MSD – Reference CLP SOM01.2, Exhibit D, Table 1 for Criteria – Not typically required for Region 2

***LCS – Reference CLP SOM01.2, Exhibit D, Table 2 for Criteria

QAPP Worksheet #12s: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group PCB Congeners/EPA 1668A
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 CRQL
Precision	Laboratory duplicate	$\pm$ 20% of mean if concentration $>$ 10*QL
Accuracy/Bias	Certified Reference Material Calibration Verification Sample	Supplier Certified Limits Per laboratory or method SOP (70-130% of native analytes and 50-150% for surrogates)
Accuracy/Bias Precision	Initial Precision and Recovery	60-140 %recovery RSD $\leq$ 40%
Accuracy/Bias	LCS or OPR	Per laboratory SOP Warning 70-130%R; Accept 50-150 %recovery
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6 °C 10 °C (DV)
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq$ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq$ QLs (WS#15 and laboratory SOP)

QAPP Worksheet #12t: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TAL Metals, Hardness/ISM01.3
Concentration Level ICP-AES (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates *	$\leq 50\%$ RPD ¹ when both results $\geq 5 \times \text{CRQL}$ ABS $\leq \text{CRQL}$ when either result $\leq 5 \times \text{CRQL}$ (¹ Important Note. The validation SOP requires qualification of results $\leq 20\%$ RPD. For the purpose of data use the 50% RPD criterion is satisfactory for most projects)
Accuracy	Field Blank*	No analyte > CRQL
Precision	Laboratory Duplicate Sample **	$\leq 20\%$ RPD**
Accuracy	Matrix Spike ***; LCSW ****	75–125% R; 70–130% R (except Ag and Sb)
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq \text{QLs}$ (WS#15 and laboratory SOP)

*Reference EPA Region 2 ICP-AES Data Validation SOP or most recent revision <http://www.epa.gov/region2/qa/documents.htm> (includes absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of inductively coupled plasma (ICP) atomic emission spectrophotometry (AES) for Duplicate Sample Criteria (page D-22) (include absolute difference criteria)

***Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Spike Sample Criteria (page D-21)

****Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for aqueous LCS (LCSW) Criteria (page D-23) w/exception of silver (Ag) and antimony (Sb)

QAPP Worksheet #12u: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TAL Metals, Hardness/ISM01.3
Concentration Level ICP-MS (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates *	$\leq 50\%$ RPD ¹ when both results $\geq 5 \times \text{CRQL}$ $\text{ABS} \leq \text{CRQL}$ when either result $\leq 5 \times \text{CRQL}$ (¹ Important Note. The validation SOP requires qualification of results $\leq 20\%$ RPD. For the purpose of data use the 50% RPD criterion is satisfactory for most projects)
Accuracy	Field Blank	No analyte > CRQL
Precision	Laboratory Duplicate Sample **	$\leq 20\%$ RPD**
Accuracy	Matrix Spike ***; LCSW ****	75–125% R; 80–120% R (except Ag and Sb)
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq \text{QLs}$ (WS#15 and laboratory SOP)

*Reference EPA Region 2 ICP-MS Data Validation SOP or most recent revision <http://www.epa.gov/region2/qa/documents.htm> (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of (ICP) atomic emission spectrophotometry (AES) for Duplicate Sample Analysis (page D-25) (includes absolute difference criteria)

***Reference EPA CLP ISM01.3, Exhibit D of ICP-MS for Spike Sample Analysis (page D-24)

****Reference EPA CLP ISM01.3, Exhibit D of ICP-MS for aqueous LCS (LCSW) Analysis (page D-26)

QAPP Worksheet #12v: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous (Total and dissolved)

Analytical Group TAL Inorganic Metals/SW-846, EPA 6010

Concentration Level ICP-AES; Low/Medium (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤50% RPD when both results ≥ 5*CRQL ABS ≤ CRQL when either result ≤ 5*CRQL
Accuracy/ representativeness	Temperature Blank	≤ 10 °C
Accuracy / Contamination	Field Equipment Blank	≤ QL
Accuracy	Preparation Blank	No constituent > QL
Accuracy	Matrix Spike	75-125%R
Precision	Laboratory Duplicate or MS/MSD	± 20% RPD
Accuracy	Post-Digestion Spike	75-125%R
Accuracy	LCS	80-120%R
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	≤ QLs (WS#15 and laboratory SOP)

QAPP Worksheet #12w: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous (Total and dissolved)
Analytical Group TAL Inorganic Metals/SW-846, EPA 6020
Concentration Level ICP-MS; Trace/Low (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤50% RPD when both results ≥ 5*CRQL ABS ≤ CRQL when either result ≤ 5*CRQL
Accuracy/ representativeness	Temperature Blank	≤ 10 °C
Accuracy / Contamination	Field Equipment Blank	≤ QL
Accuracy	Preparation Blank	No constituent > QL
Accuracy	Matrix Spike	75-125%R
Precision	Laboratory Duplicate or MS	± 20% RPD
Accuracy	Post-Digestion Spike	75-125%R
Accuracy	Serial dilution test (1:5)	Dilution result ±10% of original result
Sensitivity	Interference Check Sample	± 2 times QL of true value or ± 20% of true value, whichever is greater
Accuracy	LCS	80-120%R
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	≤ QLs (WS#15 and laboratory SOP)

QAPP Worksheet #12x: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TAL –Total Mercury/ISM01.3 - Cold Vapor Atomic Absorption (CVAA)
Concentration Level Low (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates *	$\leq 50\%$ RPD $ABS \leq 5 \times CRQL$ when either result $\leq CRQL$ (¹ Important Note. The validation SOP requires qualification of results $\leq 20\%$ RPD. For the purpose of data use the 50% RPD criterion is satisfactory for most projects)
Accuracy	Field Blank*	No analyte > CRQL
Precision	Laboratory Duplicate Sample **	$\leq 20\%$ RPD*
Accuracy	Matrix Spike***	75–125 %R
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq$ QLs (WS#15 and laboratory SOP)

* Reference EPA Region Hg & CN Data Validation SOP or most recent revision <http://www.epa.gov/region2/qa/documents.htm> (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of Mercury for Duplicate Sample Analysis, (page D-19) (includes absolute difference criteria)

***Reference EPA CLP ISM01.3, Exhibit D of Mercury for Spike Sample Analysis, (page D-18)

QAPP Worksheet #12y: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Mercury (trace)/EPA 1631
Concentration Level Trace (nanogram per liter (ng/L))

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 CRQL
Accuracy	Laboratory duplicate	RPD $\leq$ 25% for values $\geq$ 10 MDL. No more than 35% of RSDs $>$ 25%
Accuracy/Bias	MS/MSD	70-130 %R
Precision	MS/MSD; Initial Precision and Recovery	Laboratory SOP or RPD $\leq$ 30-35%; RSDs $<$ 20%
Accuracy	OPR; Standard Reference Material	Laboratory SOP or 70-130%R; 75-125%R
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6 °C 10 °C (DV)
Comparability	Evaluated during Data Quality Assessment (DQA)	Comparable units, and methods
Completeness	Assessed during DQA	$\geq$ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq$ QLs (WS#15 and laboratory SOP)

QAPP Worksheet #12z: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Methyl mercury (trace)/EPA 1630
Concentration Level Trace

Data Quality Indicators	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 CRQL
Accuracy	Laboratory duplicate	RPD $\leq$ 35% for values $\geq$ 5 MDL. No more than 35% of RSDs $>$ 35%
Accuracy/Bias	MS/MSD	65-135 %R
Precision	MS/MSD	RPD $\leq$ 35%
Accuracy	Ongoing Precision and Recovery (Standard Reference Material)	67-133%R of certified value
Accuracy/ Representativeness	Temperature Blank checks Data validation (DV)	0 to 6 °C 10 °C (DV)
Comparability	Evaluated during DQA	Comparable units, and methods
Completeness	Evaluated during DQA	$\geq$ 90% Collection and $\geq$ 90% Valid data
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq$ QLs (WS #15) $\leq$ 5 MDLs

QAPP Worksheet #12aa: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TAL –Total Cyanide/ISM01.3 - Colorimeter or Spectrophotometer
Concentration Level Low (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates *	$\leq 50\%$ RPD $ABS \leq 5 \times CRQL$ when either result $\leq CRQL$ (¹ Important Note. The validation SOP requires qualification of results $\leq 20\%$ RPD. For the purpose of data use the 50% RPD criterion is satisfactory for most projects)
Accuracy	Field Blank*	No analyte > CRQL
Precision	Laboratory Duplicate Sample **	$\leq 20\%$ RPD*
Accuracy	Matrix Spike ***	75–125 %R
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq$ QLs (WS#15 and laboratory SOP)

* Reference EPA Region Hg & CN Data Validation SOP or most recent revision <http://www.epa.gov/region2/ga/documents.htm> (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of Cyanide for Duplicate Sample Analysis, (page D-20) (includes absolute difference criteria)

***Reference EPA CLP ISM01.3, Exhibit D of Cyanide for Spike Sample Analysis, (page D-19)

QAPP Worksheet #12ab: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group TPH (DRO and GRO)/EPA 8015 B/C
Concentration Level Low/Medium

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 50 % ABS < 2xQL
Precision	MS/MSD	0-40 RPD
Accuracy/Bias	LCS MS Surrogate	60-135%R 75-125%R 65-125%R
Accuracy/ Representativeness	Temperature Blank checks Data validation (DV)	0 to 6 °C 10 °C (DV)
Accuracy/ Representativeness	Laboratory report/ DV	Holding times
Comparability	Data assessment	Comparable units, QLs and methods
Completeness	Data assessment	$\geq$ 90%
Sensitivity/ accuracy	Equipment rinsate blanks Laboratory blanks	$\leq$ QLs

QAPP Worksheet #12ac: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Field Test Kits (Ferrous iron, hexavalent chromium, sulfate)/HACH 8146, 8023, and 8051
Concentration Level Low/Medium (mg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria*
Precision	Split Samples and Field Duplicates	≤50% RPD
Precision	Confirmatory versus Field Screening Sample	≤ 50% RPD for samples
Accuracy	LCS (QC Sample Check)	80-120%R
Sensitivity	Method/ Preparation Blank	≤ QL Detection limits meet project goals
Completeness	Data Assessment	≥ 90%
Comparability	Data Review	Similar Units (mg/L)

QAPP Worksheet #12ad: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-Ion Chromatography/ Methods EPA 300, 314, or SM4110B
Concentration Level Low (mg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Accuracy	Field Blank	No analyte > QL
Accuracy	Temperature Blank	≤ 10 °C
Precision	Laboratory Duplicate	≤ 40% RPD
Sensitivity	Method /Preparation Blank	No analyte > QL; Detection limits meet project goals
Accuracy	Laboratory Fortified Blank; Matrix Spike; Calibration Standard Verification	80–120%R; 75–125%R; 90-110%R
Completeness	Data Assessment	≥ 90%
Comparability	Data Review	Similar Units (mg/L) and methods

Note:

1. Ion chromatography under EPA 300 can be applied to nitrate, chloride, fluoride, nitrite/nitrate, and orthophosphate and all other anions listed for the methods above on Worksheet #23.

QAPP Worksheet #12ae: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-Anions by Colorimetry; Spectrophotometry
Concentration Level Low (mg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Accuracy	Field Blank	No analyte > QL
Accuracy	Temperature Blank	≤ 10 °C
Precision	Duplicate Sample	≤ 40% RPD
Sensitivity	Method / Preparation Blank	No analyte > QL; Detection limits meet project goals
Accuracy	Matrix Spike; LCS	75–125%R; 80-120%R
Completeness	Data Assessment	≥ 90%
Comparability	Data Review	Similar Units (mg/L)

Note:

1. Spectrophotometry can be applied to hexavalent chromium, sulfate, sulfide, nitrite, ferrous iron, cyanide, metals, and mercury (method 1631).
2. Colorimetry can be applied to hardness, hexavalent chromium, cyanide, ferrous iron, nitrate, nitrate/nitrite, sulfide, COD, sulfate, orthophosphorus, phosphorus, phosphate, alkalinity, and ammonia.

QAPP Worksheet #12af: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-Titration or Potentiometer
Concentration Level Low/Medium (mg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Accuracy	Field Blank	No analyte > QL
Accuracy	Temperature Blank	≤ 10 °C
Precision	Duplicate Sample	≤ 40% RPD
Sensitivity	Method Blank	No analyte > QL; Detection limits meet project goals
Accuracy	LCS	80-120 %R
Completeness	Data Assessment	≥ 90%
Comparability	Data Review	Similar Units (mg/L)

Notes:

1. Titrimetric analysis can be applied to AVS SEM, alkalinity (SM 2320B), ammonia (SM4500-NH₃ C, D, E), bromide (320.1), chloride (SM 4500-Cl-B/c/D), fluoride (not included here since not part of MSA subcontract), hardness (SM2340C), sulfide (SM 4500-S-2-F or G or 9031), sulfate (), COD (410.3, 410.4 or SM 5220C), TKN (SM 4500-NH₃ B,C), and nitrate (SM 4500-NO₃-D).
2. Potentiometric analysis can be applied to ammonia.

QAPP Worksheet #12ag: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-Hexavalent Chromium (Dissolved)/ SM3500 Cr-B and HACH 8023
Concentration Level Low

Data Quality Indicators	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 QL
Accuracy	Field Equipment Blank	No analyte > QL
Accuracy/ Representativeness	Temperature Blank	$\leq 10^{\circ}\text{C}$
Precision	Laboratory Duplicate	$\leq 20\%$ RPD ABS $\leq$ QL
Accuracy	Quality Control Sample (QCS); Laboratory Fortified Blank /DV	85-115%R or as updated by laboratory
Sensitivity	Method Blank and sample non-detect results	No analyte > QL* Detection limits meet project goals
Accuracy	Matrix Spike	80-120%R
Completeness	Data Assessment	$\geq 90\%$
Comparability	Data Review	Similar Units ($\mu\text{g/L}$) and methods

QAPP Worksheet #12ah: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous

Analytical Group Hexavalent Chromium/SW-846, 7196A [Colorimeter]

Analytical Method/SOP Reference Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy	Preparation Blank	No analyte > QL
Precision	Split Samples and Field Duplicates	≤50% RPD
Precision	Laboratory Duplicate	≤ 25% RPD
Accuracy	Spike Samples	85 – 115%R
Accuracy	LCS	80-120%R
Accuracy	Temperature Blank	≤ 10 °C for data validation
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	≤ QLs (WS#15 and laboratory SOP)

QAPP Worksheet #12ai: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-TSS/SM2540D¹
Concentration Level Low

Data Quality Indicators	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if values $>5 \times \text{QL}$; otherwise $\text{ABS} \leq \text{QL}$
Accuracy/Bias	Quality Control Sample (QCS) or Laboratory Fortified Blank	80-120%R or as stipulated by manufacturer or laboratory
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6 °C 10 °C for DV
Precision	Laboratory matrix duplicate/ DV	$\leq 20\%$ RPD if values $>5 \times \text{QL}$; otherwise $\text{ABS} \leq \text{QL}$
Comparability	Data Quality assessment	Comparable units, QLs and methods
Completeness	Data Quality Assessment	$\geq 90\%$
Sensitivity/ accuracy	Method blanks	$\leq \text{QLs}$
Sensitivity	Data Review	Detection limits meet project goals

Notes:

1. QAPP Worksheet # 23 provides more information on the sampling and analytical SOPs. Method SM 2540D is equivalent to American Society of Testing and Materials (ASTM) 3977-97 Test Option B.

QAPP Worksheet #12aj: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry –TDS/SM2540C
Concentration Level Low/Medium (mg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Sensitivity	Preparation/ Method Blank	No analyte > QL
Precision	Laboratory Duplicate	≤ 20 RPD; ABS $\leq$ QL for samples $< 5 \times$ QL
Precision	Split Samples and Field Duplicates	$\leq 40\%$ RPD if $> 5 \times$ QL otherwise ABS $\leq$ QL
Accuracy	Laboratory Control Sample or Quality Control Sample	80-120%R or as stipulated by manufacturer or laboratory
Precision	Laboratory Control Sample or Quality Control Sample Duplicate	$\leq 20\%$ RPD
Accuracy/ representativeness	Temperature Blank	≤ 10 degrees Celsius for data validation

QAPP Worksheet #12ak: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-Gravimetry/Method for Chemical Analysis of Water and Wastes (MCAWW) Methods
Concentration Level Low (mg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Accuracy	Field Blank	No analyte > QL
Accuracy	Temperature Blank	≤ 10 °C
Precision	Laboratory Duplicate Sample	≤ 40% RPD
Sensitivity	Method Blank	No analyte > QL
	Data Assessment review of sample results	Detection limits meet project goals
Accuracy	LCS	80-120%R
Completeness	Data Assessment review of data collected and analyzed	≥ 90%
Comparability	Data Review	Similar Units (mg/L)

Notes:

1. Gravimetry can be applied to sulfate and TDS.

QAPP Worksheet #12a: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-BOD/SM5210B
Concentration Level Low/Medium (mg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Accuracy	Temperature Blank	≤ 10 °C
Precision	Laboratory Duplicate Sample	≤ 40% RPD
Accuracy	Seeded Water Blank	DO uptake 0.6-1 mg/L
Accuracy	Water Control Blank	BOD < 0.2 mg/l
Accuracy	Glucose glutamic acid check	Within laboratory control limits (mean ± 3 standard deviations)
Completeness	Data Assessment	≥ 90%
Sensitivity	Data Assessment review of sample results	Detection limits meet project goals
Comparability	Data Review	Similar Units (mg/L)

Note:

- Control limits must be documented and provided.

QAPP Worksheet #12am: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-TOC-Carbon analyzer + infra-red (IR) or flame ionization detector (FID)/EPA Method 415.2, 9060 or SM5310B
Concentration Level Low (mg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	$\leq 50\%$ RPD ABS $\leq 5 \times$ QL when either result $\leq$ QL
Accuracy	Temperature Blank	$\leq 10^{\circ}\text{C}$
Precision	Laboratory Duplicate Sample	$\leq 20\%$ RPD for samples $>5 \times$ QL; $\pm$ QL for samples $<5 \times$ QL
Accuracy	Matrix Spike; LCS	75–125%R; 80-120 %R
Sensitivity	Method Blank	$\leq$ QL; Detection limits meet project goals
Completeness	Data Assessment	$\geq 90\%$
Comparability	Data Review	Similar Units (mg/L)

QAPP Worksheet #12an: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-DOC/SM5310B
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	$RPD \leq 40\%$ if values $>5x$ QL; otherwise $ABS < 5xQL$
Accuracy	Matrix Spike	80-120%R
Accuracy/Bias	Quality Control Sample (QCS); Laboratory Fortified Blank /DV	80-120%R or as updated by laboratory or stipulated by manufacturer
Precision	Laboratory replicate	$RPD \leq 20\%$ if values $>5x$ QL; otherwise $ABS < 5xQL$
Accuracy	Initial calibration verification (ICV)/ continue calibration verification (CCV)	85-115%R
Accuracy/ Representativeness	Temperature Blank checks Data validation/DV	0 to 6°C 10 °C for DV
Comparability	Data Quality assessment	Comparable units, QLs and methods
Completeness	Data Quality Assessment	$\geq 90\%$
Sensitivity/ accuracy	Method blanks/Calibration Blank	$\leq QLs$
Sensitivity	Data Quality Assessment	Detection limits meet project goals

QAPP Worksheet #12ao: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry-POC/EPA Method 415.1 DESA modified¹
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if values $>5 \times QL$; otherwise $ABS \leq QL$
Precision	Split samples	See worksheet #11
Accuracy/Bias	Quality Control Sample (QCS) or Laboratory Fortified Blank or Standard Reference Material	80-120%R or as stipulated by manufacturer or laboratory
Precision		≤ 20 %RPD
Precision	Laboratory matrix duplicate/DV	≤ 20 %RPD if values $>5 \times QL$; otherwise $ABS \leq QL$
Accuracy	ICV/CCV	85-115%R
Accuracy/ Representativeness	Temperature Blank checks Data validation /DV	0 to 6 °C 10 °C for DV
Comparability	Data Quality assessment	Comparable units, QLs and methods
Completeness	Data Quality Assessment	$\geq 90\%$
Sensitivity/ Accuracy	Method blanks/Calibration Blank	$\leq QLs$
	Data Quality Assessment	Detection limits meet project goals

Notes:

1. QAPP Worksheet # 23 provides more information on the sampling and analytical SOPs. Method 415.1 is equivalent to EPA 440.0 and is performed by DESA using SOP C-88 modified.

QAPP Worksheet #12ap: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group In-field Measurements
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy	pH (standard units)	± 0.1
	Conductivity (μ Siemens)	$\pm 3\%$
	Redox potential (Eh) (millivolts)	± 10 mV
	Turbidity	$\pm 10\%$
	Dissolved Oxygen (DO)	$\pm 10\%$
	Photoionization detector	$\pm 10\%$ or $\pm 15\%$ of the calibration gas concentration
	Field monitored – rate as determined in project-specific QAPP	Flow rate

QAPP Worksheet #12aq: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group AVS-SEM VOCs/EPA 376
Concentration Level Colorimeter/titration-ICP AES/MS

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Refer to soil TAL metals worksheet for SEM criteria and to the soil sulfide worksheet for the AVS criteria	Refer to soil TAL metals worksheet for SEM criteria and to the soil sulfide worksheet for the AVS criteria	Refer to soil TAL metals worksheet for SEM criteria and to the soil sulfide worksheet for the AVS criteria

QAPP Worksheet #12ar: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TCL VOCs/EPA 8260B
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤100% RPD ABS ≤ 5xQL when either result <QL
Precision	MSD	70-130% recovery
Accuracy	MS*	<30 % RPD
Accuracy	LCS*	70-130% recovery for targets; difficult analytes 60-140% recovery
Accuracy/Bias	Field/Equipment Blank	≤QL for target analytes; <5xQL for common laboratory contaminants
Sensitivity	Method Blank	≤QL for target analytes; <5xQL for common laboratory contaminants
Data Completeness	Completeness Check	100%

*See laboratory specific internal limits

QAPP Worksheet #12as: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TCL VOCs/SOM01.2
Concentration Level Low/Medium (µg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤100% RPD ABS ≤ 5xQL when either result < QL
Accuracy	Field Blank*	No analyte > CRQL
Precision	Field Duplicate; MS/MSD**	%RPD – see worksheet #28
Accuracy	***DMCs; MS/MSD**	Compound specific %Rs are on worksheet #28
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	≤ QLs (WS#15 and laboratory SOP)

*Reference EPA Region 2 Low/ Medium VOCs Data Validation SOP shown on Worksheet # 36 or most recent revision <http://www.epa.gov/region2/qa/documents.htm>

**Optional MS/MSD – Reference CLP SOM01.2, Exhibit D, Table 6 for Criteria – Not typically required for Region 2

*** (DMCs) – Reference CLP SOM01.2, Exhibit D, Table 5 for Criteria

QAPP Worksheet #12at: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TCL SVOCs/SOM01.2
Concentration Level Low/Medium (µg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤100% RPD ABS ≤ 5xCRQL when either results ≤ 2*CRQL
Accuracy	Field Blank*	No analyte > CRQL
Precision	Laboratory Duplicate; MS/MSD**	Worksheet #28 lists compound specific RPDs
Accuracy	***DMCs; MS/MSD**	Worksheet #28 lists compound specific %Recoveries
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	≤ QLs (WS#15 and laboratory SOP)

*Reference EPA Region 2 Low/Medium SVOCs Data Validation SOP shown on Worksheet # 36 or most recent revision <http://www.epa.gov/region2/qa/documents.htm>

**Optional MS/MSD – Reference CLP SOM01.2, Exhibit D, Table 6 for Criteria – Not typically required for Region 2

***(DMCs) – Reference CLP SOM01.2, Exhibit D, Table 5 for Criteria

QAPP Worksheet #12au: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group PAHs/EPA 8270 C/D
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	$RPD \leq 40\%$ if concentration ≥ 5 CRQL
Precision	Laboratory duplicate or MS/MSD	$\pm 20\%$ of mean if concentration $> 10DL$
Accuracy/Bias	Matrix Spike	50-200 %R (or per laboratory SOP for individual limits)(TBD when laboratory is assigned)
Accuracy/Bias	Perdeuterated Surrogate	15-130 %R
Accuracy/ Representativeness	Temperature Blank checks Data validation (DV)	0 to 6°C 10 °C (DV)
Comparability	Evaluated during Data Quality Assessment	Comparable units, and methods
Completeness	Evaluated during Data Quality Assessment	$\geq 90\%$ Collection and $\geq 90\%$ Valid data
Sensitivity/ accuracy	Field rinsate blanks/ Method blanks/ DV and DQA	$\leq QLs$

QAPP Worksheet #12av: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group PCDD/PCDF/EPA 1613B or 8290
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	$RPD \leq 40\%$ if concentration ≥ 5 CRQL
Precision	Laboratory duplicate	$\pm 20\%$ of mean if concentration > 10 DL
Accuracy/Bias	LCS; MS/MSD	70-130 %recovery or per laboratory SOP
Precision	MS/MSD	$RPD \leq 20\%$ if > 10 QL
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6°C 10 °C (DV)
Precision	Initial precision and recovery	15-50% RSD or per laboratory SOP
Accuracy/Bias		Various % recovery per laboratory SOP
Accuracy/Bias	Ongoing precision and recovery	15-50% RSD or per laboratory SOP
Accuracy/Bias	Surrogate standards	17-130% R
Comparability	Evaluated during Data Quality Assessment	Comparable units, and methods
Completeness	Evaluated during Data Quality Assessment	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate blanks/ Method blanks/DV and DQA	$\leq$ QLs (WS#15)

Laboratory and SOPs TBD. Laboratory is assigned per FASTAC policy.

QAPP Worksheet #12aw: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TCL Pesticides/SOM01.2
Concentration Level Low/Medium (µg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	≤100% RPD ABS ≤ 5xCRQL when either results ≤ CRQL
Accuracy	Field Blank*	No analyte > CRQL
Precision	Laboratory Duplicate; MS/MSD**	See list of compound specific RPDs on Worksheet #28
Accuracy	***LCS; MS/MSD**	See list of compound specific %Rs on Worksheet #28
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	≤ QLs (WS#15 and laboratory SOP)

*Reference EPA Region 2 Low/Medium Pesticide Data Validation SOP shown on Worksheet # 36 or most recent revision <http://www.epa.gov/region2/qa/documents.htm>

**MS/MSD – Reference CLP SOM01.2, Exhibit D, Table 3 for Criteria – Not typically required for Region 2

***LCS – Reference CLP SOM01.2, Exhibit D, Table 2 for Criteria

QAPP Worksheet #12ax: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Chlorinated Pesticides/EPA 1699
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split samples and field duplicates	RPD $\leq$ 100% if concentration $\geq$ 5 QL
Precision	Laboratory duplicate	$\pm$ 20% of mean if concentration $>$ 10DL
Accuracy/Bias	Certified Reference Material Calibration Verification	Per laboratory or method SOP $\pm$ 20%
Accuracy/Bias	On-going Precision and Recovery /Matrix Spike	50-130% recoveries or per Laboratory SOPs
Accuracy/ Representativeness	Temperature Blank checks Data validation (DV)	0 to 6 °C /10 °C (DV)
Accuracy/Bias	Surrogate	30-150%R (See Laboratory SOPs for individual limits)
Comparability	Evaluated during Data Quality Assessment	Comparable units, and methods
Completeness	Evaluated during Data Quality Assessment	$\geq$ 90% Collection and $\geq$ 90% Valid data
Sensitivity/ accuracy	Field rinsate blanks/Method blanks/ DV checked during DQA	$\leq$ QLs (WS#15 and/or per Laboratory SOP)

Laboratory and SOPs TBD. Laboratory is assigned per FASTAC policy.

Provide Laboratory SOPs in Project-specific QAPPs.

QAPP Worksheet #12ay: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Organochlorine Pesticides/EPA 8081B
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Bias/Sensitivity-contamination	MB/Instrument Blank	No target compounds>QL
Accuracy/Bias/Sensitivity-contamination	Equipment Rinsate Blank	No target compounds>QL
Accuracy/Bias	LCS	50%-150%R
Accuracy/Bias	MS	50%-150%R
Accuracy/Bias	PE Sample or SRM	40-140%R
Accuracy/Bias	Surrogates	30-150%R
Accuracy/Precision	MSD	50-150%R; RPD≤35%
Precision	Sample Splits and Field Duplicates	RPD≤100% if both results are >5*QL. Difference ≤2*QL if results are ≤5xQL
Completeness	Data completeness check	≥90%

QAPP Worksheet #12az: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Herbicides and Organophosphate Pesticides/ EPA 8321A/B, 8141A/B, and EPA 633 & 632 Modified
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	RPD $\leq$ 100% if both results are $>5*QL$ otherwise $ABS \leq 2*QL$
Precision	Laboratory Duplicates	$\leq 60\%$
Accuracy/Bias	Matrix Spikes	25-155%
Accuracy/Bias	LCS	25-155%
Accuracy	Temperature Blank	0 to 6 °C
Sensitivity	Method Blanks	$\leq QLs$ Detection Limits meet QLs
Completeness	Data Assessment	$\geq 90\%$
Comparability	Data Review - Compare results from each round	Units mg/kg -

Modifications and laboratory SOPs will be included in project-specific QAPPs.

QAPP Worksheet #12ba: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Chlorinated Herbicides/EPA 8151A
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Accuracy/Bias (Contamination)	MB/Instrument Blank	No target compound >QL
Accuracy/Bias (Contamination)	Equipment Rinsate Blanks	No target compound >QL
Accuracy/Bias	LCS	50%-150%R
Accuracy/Bias	MS	50%-150%R
Accuracy/Bias	PE Sample or SRM	Supplier Certified Limits
Accuracy/Bias	Surrogates	Laboratory Specified
Precision	MSD	50%-150%R; RPD ≤35%
Precision	Sample Splits and Field Duplicate	RPD ≤ 100% if both results are >5*QL otherwise ABS ≤ 2*QL
Completeness	Data Completeness Check	≥90%

QAPP Worksheet #12bb: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TCL PCBs/SOM01.2
Concentration Level Low/Medium (µg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	≤100% RPD ABS ≤ 5xCRQL when either result is ≤ CRQL
Accuracy	Field Blank*	No analyte > CRQL
Precision	MS/MSD**	See list of compound specific RPDs and %Rs on Worksheet #28
Accuracy	LCS***	
	MS/MSD**	
	Surrogates	
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	≤ QLs (WS#15 and laboratory SOP)

*Reference EPA Region 2 Low/Medium Pesticide Data Validation SOP shown on Worksheet # 36 or most recent revision <http://www.epa.gov/region2/qa/documents.htm>

**MS/MSD – Reference CLP SOM01.2, Exhibit D, Table 3 for Criteria – Not typically required for Region 2

***LCS – Reference CLP SOM01.2, Exhibit D, Table 2 for Criteria

QAPP Worksheet #12bc: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group PCB Congeners/EPA 1668A
Concentration Level Low

DQIs	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria
Precision	Sample Split samples and field duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 CRQL
Precision	Laboratory duplicate	$\leq$ 20% RPD; $\pm$ QL for samples $<$ 10x QL
Accuracy/Bias	Certified Reference Material; Calibration Verification Sample	70 -130 %R
Accuracy/Bias	Initial Precision and Recovery	60-140 %R
Precision	Initial Precision and Recovery	RSD $\leq$ 40%
Accuracy/Bias	LCS or Ongoing Precision and Recovery	Per laboratory SOP Warning 70-130%R; Accept 50-150 %R
Accuracy/ Representativeness	Temperature Blank checks Data validation (DV)	0 to 6 °C 10 °C (DV)
Comparability	Data Quality assessment	Comparable units, and methods
Completeness	Data Quality Assessment	$\geq$ 90% collection and analysis
Sensitivity/ accuracy	Field rinsate blanks/ Method blanks/ DV and DQA	$\leq$ QLs (WS#15)

QAPP Worksheet #12bd: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TAL Metals/ISM01.3
Concentration Level ICP-AES (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicate Samples*	$\leq 100\%$ RPD when both results $\geq 5 \times \text{CRQL}$ $\text{ABS} \leq 2 \times \text{CRQL}$ when either result $\leq 5 \times \text{CRQL}$ ⁽¹⁾ Important Note. The validation SOP requires qualification of results $\leq 50\%$ RPD. For the purpose of data use the 100% RPD criterion is satisfactory for most projects)
Accuracy	Field Blank*	No analyte > CRQL
Precision	Laboratory Duplicate Sample **	$\leq 35\%$ RPD* (DV action based on this value)
Accuracy	Matrix Spike***; LCS****	75–125%R 70–130%R
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq \text{QLs}$ (WS#15 and laboratory SOP)

*Reference EPA Region 2 ICP-AES Data Validation SOP or most recent revision <http://www.epa.gov/region2/ga/documents.htm> (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Duplicate Sample Analysis, (page D-22) includes absolute difference criteria

***Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for Spike Sample Analysis (page D-21)

****Reference EPA CLP ISM01.3, Exhibit D of ICP-AES for LCS Sample Criteria (page D-23) with the exception of Ag and Sb

QAPP Worksheet #12be: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TAL Metals/ISM01.3
Concentration Level ICP-MS (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicate Samples*	$\leq 100\%$ RPD when both results $\geq 5 \times \text{CRQL}$ $\text{ABS} \leq 2 \times \text{CRQL}$ when either result $\leq 5 \times \text{CRQL}$ ⁽¹⁾ Important Note. The validation SOP requires qualification of results $\leq 50\%$ RPD. For the purpose of data use the 100% RPD criterion is satisfactory for most projects)
Accuracy	Field Blank*	No analyte > CRQL
Precision	Laboratory Duplicate Sample **	$\leq 35\%$ RPD* (DV action based on this value)
Accuracy	Matrix Spike***; LCS****	75–125%R 70–130%R
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq \text{QLs}$ (WS#15 and laboratory SOP)

*Reference EPA Region 2 ICP-MS Data Validation SOP or most recent revision <http://www.epa.gov/region2/qa/documents.htm> (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of ICP-MS for Duplicate Sample Analysis, (page D-25) includes absolute difference criteria

***Reference EPA CLP ISM01.3, Exhibit D of ICP-MS for Spike Sample Analysis (page D-24)

****Reference EPA CLP ISM01.3, Exhibit D of ICP-MS for LCS Sample Criteria (page D-26)

QAPP Worksheet #12bf: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Metals (no mercury)/Method EPA 6010B/6020
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split samples and field duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 CRQL
Precision	Laboratory duplicate	RPD $\leq$ 35% if concentration $\geq$ 5 CRQL – DESA limit: 25% RPD
Accuracy/Bias	LCS; MS/MSD	90-110 %recovery 75-125%R
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6 °C/ 10 °C (DV)
Comparability	Evaluated during Data Quality assessment	Comparable units, and methods
Completeness	Evaluated during Data Quality Assessment	$\geq$ 90% Collection and $\geq$ 90% Valid data
Sensitivity/ accuracy	Field rinsate blanks/ Method blanks/ DV and DQA	$\leq$ CRQLs (WS#15)

QAPP Worksheet #12bg: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TAL –Total Mercury/ISM01.3 or current method-Cold Vapor Atomic Absorption (CVAA)
Concentration Level Low (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicate Samples *	$\leq 100\%$ RPD when both results $\geq 5 \times \text{CRQL}$ $\text{ABS} \leq 2 \times \text{CRQL}$ when either result $\leq 5 \times \text{CRQL}$ ⁽¹⁾ Important Note. The validation SOP requires qualification of results $\leq 50\%$ RPD. For the purpose of data use the 100% RPD criterion is satisfactory for most projects)
Accuracy	Field Blank*	No analyte > CRQL
Precision	Laboratory Duplicate Sample **	$\leq 35\%$ RPD* (DV action based on this value)
Accuracy	Matrix Spike***	75–125% recovery
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq \text{QLs}$ (WS#15 and laboratory SOP)

*Reference EPA Region 2 Hg &CN Data Validation SOP or most recent revision <http://www.epa.gov/region2/qa/documents.htm> (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of Mercury for Duplicate Sample Analysis (page D-19) (include absolute difference criteria)

***Reference EPA CLP ISM01.3, Exhibit D of Mercury for Spike Sample Analysis (page D-18)

QAPP Worksheet #12bh: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Total Mercury/EPA 1631
Concentration Level Trace (ng/g)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 40% if concentration $\geq$ 5 CRQL
Accuracy	Laboratory duplicate	RPD $\leq$ 25% for values $\geq$ 10 MDL. No more than 35% of RSDs $>$ 25%
Accuracy/Bias	MS/MSD	70-130%R
Precision	MS/MSD; Initial Precision and Recovery	Laboratory SOP or RPD $\leq$ 30-35%; RSDs $<$ 20%
Accuracy	Ongoing Precision and Recovery; Standard Reference Material	Laboratory SOP or 70-130%R; 75-125%R
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6 °C 10 °C (DV)
Comparability	Evaluated during Data Quality Assessment	Comparable units, and methods
Completeness	Evaluated during Data Quality Assessment	$\geq$ 90% Collection and $\geq$ 90% Valid data
Sensitivity/ accuracy	Field rinsate blanks/ Method blanks/DV and DQA	$\leq$ QLs (WS#15) $\leq$ 5MDLs

QAPP Worksheet #12bi: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Methyl Mercury/EPA 1630
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split samples and field duplicates	$RPD \leq 40\%$ if concentration ≥ 5 CRQL
Accuracy	Laboratory duplicate	$RPD \leq 35\%$ for values ≥ 5 MDL. No more than 35% of RSDs $> 35\%$
Accuracy/Bias	MS/MSD	65-135 %R
Precision	MS/MSD	$RPD \leq 35\%$
Accuracy	Ongoing Precision and Recovery (Standard Reference Material)	67-133%R of certified value
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6 °C/ 10 °C (DV)
Comparability	Evaluated during Data Quality Assessment	Comparable units, and methods
Completeness	Evaluated during Data Quality Assessment	$\geq 90\%$ Collection and $\geq 90\%$ Valid data
Sensitivity/ accuracy	Field rinsate blanks/ Method blanks/DV and DQA	$\leq$ QLs (WS#15) $\leq$ 5MDLs

QAPP Worksheet #12bj: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TAL –Total Cyanide/ISM01.3 or current method-Colorimeter or Spectrophotometer
Concentration Level Low (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicate Samples*	$\leq 100\%$ RPD when both results $\geq 5 \times \text{CRQL}$ $\text{ABS} \leq 2 \times \text{CRQL}$ when either result $\leq 5 \times \text{CRQL}$ ⁽¹⁾ Important Note. The validation SOP requires qualification of results $\leq 50\%$ RPD. For the purpose of data use the 100% RPD criterion is satisfactory for most projects)
Accuracy	Field Blank*	No analyte > CRQL
Precision	Duplicate Sample **	$\leq 35\%$ RPD *(DV action based on this value)
Accuracy	Matrix Spike***	75–125%R
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	$\geq 90\%$ collection and analysis
Sensitivity/ accuracy	Field rinsate/ Method blanks assessed during DV and DQA	$\leq \text{QLs}$ (WS#15 and laboratory SOP)

* Reference EPA Region 2 Hg & CN Data Validation SOP or most recent revision <http://www.epa.gov/region2/qa/documents.htm> (include absolute difference criteria)

**Reference EPA CLP ISM01.3, Exhibit D of Mercury for Duplicate Sample Analysis, (page D-19) (includes absolute difference criteria)

***Reference EPA CLP ISM01.3, Exhibit D of Mercury for Spike Sample Analysis, (page D-18)

QAPP Worksheet #12bk: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil
Analytical Group TPH (DRO and GRO)/EPA Method 8015 B/C
Concentration Level Low

Data Quality Indicators	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	RPD $\leq$ 100% ABS $\leq$ 2xCRQL
Accuracy/Bias	Surrogates	Per Method
Accuracy	Equipment Rinsate Blanks	$\leq$ CRQLs
Accuracy	Temperature Blank	0 to 6 °C
Sensitivity	Method Blank	$\leq$ CRQLs
Completeness	Data assessment	$\geq$ 90%
Comparability	Data Review - Compare results from each round	Similar Units ($\mu\text{g/L}$)

QAPP Worksheet #12bl: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TOC using Carbon analyzer + IR or FID detector (Methods 415.2 or SM5310B, C, and D)
Concentration Level Low (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	$\leq 100\%$ RPD ABS $\leq 5 \times \text{QL}$ when either result $\leq 2 \times \text{QL}$
Accuracy	Mid-Range calibration verification standard	80–120%
	Near detection Limit Standard	75–125%
Precision	Duplicate Sample	$\leq 35\%$ RPD
Accuracy	Quadruplicate analysis	$< 3 \times \text{Standard deviation}$
Accuracy	Temperature Blank	0 to 6 °C
Completeness	Data Assessment	$\geq 90\%$

QAPP Worksheet #12bm: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group TOC/Lloyd Kahn Method
Concentration Level Low (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤100% RPD ABS ≤ 5xQL when either result ≤ QL
Accuracy	Mid-Range calibration verification standard	80–120%
	Near detection Limit Standard	75–125%
Precision	Duplicate Sample	≤ 20% RPD
Accuracy/ Representativeness	Temperature Blank checks DV	0 to 6 °C 10 °C (DV)
Comparability	Evaluated during Data Assessment	Comparable units, and methods
Completeness	Evaluated during Data Assessment	≥ 90% Collection and ≥ 90% Valid data
Sensitivity/ accuracy	Method blanks/DV and DQA	≤ QLs

QAPP Worksheet #12bn: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix

Soil/Sediment

Analytical Group

Grain size/ASTM D421-85 and ASTM D422-63 (*The requirements on this sheet may not be applicable to all projects. Update or eliminate the Duplicate MPC accordingly. For example, they are generally not required engineering purposes*)

Concentration Level

NA (percent particle size)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Split Samples and Field Duplicates	≤100% RPD
Precision	Duplicate Sample	≤ 35% RPD

QAPP Worksheet #12bo: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix

Soil/Sediment

Analytical GroupMoisture/SM2540G/ASTM D2216 (*The requirements on this sheet may not be applicable to all projects. Update or eliminate the Duplicate MPC accordingly. For example, they are generally not required engineering purposes*)**Concentration Level**

Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Laboratory duplicate	≤ 100% RPD

QAPP Worksheet #12bp: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Hexavalent Chromium/Colorimeter or spectrophotometer-SW-846, 7196A; extraction by 3060A
Concentration Level Low/Medium (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits, & Field Duplicates	≤100% RPD ABS ≤ 5xQL when either result ≤2* QL
Precision	Laboratory Duplicate Sample	≤50% RPD ABS ≤ 5xQL when either result ≤2* QL
Accuracy	Field Blank	No analyte > QL
Accuracy	Matrix Spike; LCS	75–125% R; 80-120% R
Sensitivity	Method Blank	No analyte > QL Detection limits meet project goals
Accuracy	Temperature Blank	0 to 6 °C
Completeness	Data Assessment	≥ 90%
Comparability	Data Review	Similar Units (mg/L)

QAPP Worksheet #12bq: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Sulfide/Spectrophotometer or titration- SM4500-S-2-D or F
Concentration Level Low/Medium (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	≤100% RPD ABS ≤ 5xQL when either result ≤ QL
Precision	Duplicate Sample	≤40% RPD
Accuracy	Matrix Spike; LCS	50–150% R; 70-130% R
Sensitivity	Method Blank	No analyte > QL; Detection limits meet project goals
Accuracy	Temperature Blank	0 to 6 °C
Completeness	Data Assessment	≥ 90%
Comparability	Data Review	Similar Units (mg/L)

QAPP Worksheet #12br: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Perchlorate/Ion chromatography/EPA 314 with modification for soil extraction
Concentration Level Low/Medium (mg/kg)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	≤100% RPD ABS ≤ 5xQL when either result ≤ 2*QL
Accuracy	Method Blank	No analyte > QL
Precision	Duplicate Sample	≤40% RPD
Accuracy	Laboratory Fortified Blank; Matrix Spike	80–120%R; 75–125%R
Accuracy/Representativeness	Laboratory report/DV	Holding times
Completeness	Data Assessment	≥ 90%
Comparability	Data Review	Similar Units (mg/L) Detection limits meet project goals

QAPP Worksheet #12bs: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix

Soil/Sediment

Analytical Group

Cation Exchange Capacity/SW-846 9080/9081 or 6010B modified (*The requirements on this sheet may not be applicable to all projects. Update or eliminate the Duplicate MPC accordingly. For example, they are generally not required engineering or pilot testing purposes*)

Concentration Level

AES

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	≤100% RPD
Accuracy	Field Blank	No analyte > QL
Precision	Duplicate Sample	≤ 35% RPD
Accuracy	Matrix Spike; LCS	75–125%R 80-120%R

Modifications and laboratory SOPs will be included in project-specific QAPPs.

QAPP Worksheet #12bt: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix
Analytical Group

Soil/Sediment

Rigid Wall Permeability/ASTM D2434 (*The requirements on this sheet may not be applicable to all projects. Update or eliminate the Duplicate MPC accordingly. For example, they are generally not required engineering purposes*)

Concentration Level

NA

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	≤100% RPD
Precision	Duplicate Sample	≤ 35% RPD

QAPP Worksheet #12bu: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment

Analytical Group pH/9045D (*The requirement on this sheet may not be applicable to all projects. Update or eliminate the MPC accordingly*)

Concentration Level 0-12

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	$\leq 100\%$ RPD
Precision	Duplicate Sample	$\leq 35\%$ RPD
Accuracy	Standard buffer solution	± 0.05 pH units
Completeness	Data Assessment	$\geq 90\%$

QAPP Worksheet #12bv: Measurement Performance Criteria
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Soil/Sediment
Analytical Group Specific Gravity ASTM D854/Bulk Density ASTM D2937/Atterberg Limit ASTM D4318
Concentration Level NA

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Precision	Sample Splits and Field Duplicates	$\leq 100\%$ RPD $ABS \leq 5 \times QL$ when either result $\leq QL$
Precision	Duplicate Sample	$\leq 35\%$ RPD
Completeness	Data Assessment	$\geq 90\%$
Comparability	Data Review	Similar Units (mg/L)

QAPP Worksheet # 13: Secondary Data Criteria and Limitations
(UFP-QAPP Manual Section 2.7)
(EPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

This worksheet is used to identify sources of secondary data (i.e., data generated for purposes other than this specific project or data pertinent to this project generated under a separate QAPP) and summarize information relevant to their uses for the current project. This worksheet is supplemented by text describing specifically how all secondary data are used. The project team carefully evaluates the quality of secondary data (in terms of precision, bias, representativeness, comparability, and completeness) to ensure they are of the type and quality necessary to support their intended uses. Secondary data can include the following: sampling and testing data collected during previous investigations, historical data, background information, interviews, modeling data, photographs, aerial photographs, topographic maps, and published literature. When evaluating the reliability of secondary data and determining limitations on their uses, consider the source of the data, the time period during which they were collected, data collection methods, potential sources of uncertainty, the type of supporting documentation available, and the comparability of data collection methods to the currently proposed methods. Examples are provided below.

THIS WORKSHEET WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPS – AN EXAMPLE IS INCLUDED BELOW:

Data Type	Data Source	Data Use Relative to Current Project	Factors affecting the Reliability of Data and Limitations on Data Use
Chemical	RI/FS, Pre-design investigation, record of decision (ROD)	Soil borings, Well and Sample locations	Reason for additional sampling, i.e., changed site conditions/data gaps/ comparability issues, data quality issues
Topographic	United States Geologic Survey (USGS)	Surface water drainage pathways.	Topography in area X has been altered by grading activities between 2008 and 2009.
Background concentrations of Resource Conservation Recovery Act (RCRA) metals in soil	SI Report, AE Engineering 2006	Comparison to metals concentrations in surface and subsurface soils in area X.	Substantial excavation has taken place since 1996 in areas from which background samples were collected. Depth of subsurface samples is unknown. Supplemental background samples will be collected. (See WS 17)
Meteorological	National Weather Service	Estimations of seasonal fluctuations in storm water runoff.	Published data are available for past 20 years. No known limitations.
Past site uses	Plant operating records and personnel interviews	Potential locations of burn pits.	Records for operations prior to 1966 lost in fire. Information prior to 1966 based solely on interviews.

QAPP Worksheet #14 &16: Project Tasks & Schedule
(UFP-QAPP Manual Section 2.8.2)
(EPA 2106-G-05 Section 2.2.4)

The project-specific QAPP will include a project schedule showing specific tasks, the person or group responsible for their execution, and planned start and end dates. Options for presenting this information include the following template or a Gantt Chart can be attached and referenced. Activities to list include key on-site and off-site activities. Any critical steps and dates will be highlighted.

THIS WORKSHEET WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPS – AN EXAMPLE IS INCLUDED BELOW:

Activity	Responsible party	Planned start date	Planned completion date	Deliverable(s)	Deliverable due date
Mobilize/demobilize	CDM Smith			Field notes	
Collect Sample - soils	CDM Smith - FTL			Field notes	
Collect Sample - sediments	CDM Smith - FTL			Field notes	
Analyze Samples	DESA/CLP/or Subcontract Laboratory			Report of Analyses/Data package	
Perform Data Validation	DESA/EPA Contractor/or CDM Smith			Validation Summary report	
Summarize data	CDM Smith - SM			Draft RI Report	
Assess Data Usability	Project Team			Meeting minutes/Usability assessment summary report	

[Project Schedules may be included here as an attachment in lieu of this table]

QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

This worksheet should be completed for each matrix, analyte, analytical method, and concentration level (if applicable). Its purpose is to make sure the selected analytical laboratory and method can provide accurate data (i.e., quantitative results with known precision and bias) at the Project Action Limit (PAL). During the systematic planning process, identify target analytes, PALs, and the reference limits (e.g. regulatory limits or risk-based limits) on which action limits are based. (If more than one set of reference limits are applicable, add additional columns.) Target analytes that are critical to project-specific decision-making should be highlighted. Next, determine the matrix-specific quantitation limit goal. The quantitation limit goal should be lower than the PAL by an amount determined the DQOs/PQOs. This information, along with the MPC documented on Worksheet #12, should be used to select analytical methods and laboratories. Once the methods and laboratories have been selected, the remaining columns should be completed with laboratory-specific information. Project teams need to keep in mind that the laboratory-specific quantitation limit is usually determined in reagent water; therefore, the Project Quantitation Limit Goal (matrix-specific quantitation limit) will be higher. Explanations should be provided in cases where the quantitation limit is greater than either the project quantitation limit goal or the PAL. The laboratory must provide documentation that demonstrates precision and bias at the laboratory-specific quantitation limit. The laboratory-specific quantitation limit cannot be lower than the lowest calibration standard for any given method and analyte.

THIS WORKSHEET WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPS – AN EXAMPLE IS INCLUDED BELOW:

Matrix: Soil

Analytical Method: 8260

Concentration level (if applicable): Low

Analyte	Project Action Limit (PAL)	PAL Reference	Project Quantitation Limit Goal	Laboratory-specific quantitation limit1	Laboratory-specific detection limit2
Benzene	5 mg/kg dry weight	2003 Region 3 BTAG	2 mg/kg dry weight	1.0 mg/kg	0.1 mg/kg

ANALYTICAL METHOD LIMITS ARE PROVIDED IN THE EPA REGION 2 CLP UFP-QAPP [..\EPA UFP-QAPP\UFP-QAPPworksheets-CLP2013\[1\].doc](#)

QAPP Worksheet # 17: Sampling Design and Rationale
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

This worksheet is used to describe the sampling design and the basis for its selection. This worksheet will mainly consist of text. It documents the last step of the systematic planning process. If a site consists of multiple areas to be sampled, a separate worksheet should be used for each.

There are two general types of sampling designs: 1) probability-based designs, which should be used when statistical conclusions are required, and 2) judgmental designs, which are more applicable to help refine conceptual site models when further study is planned, or to confirm previous findings, but which usually do not provide sufficient basis on their own to support statistical conclusions. Advice on selecting appropriate sample designs may be found in Chapter 2 of *Guidance for Choosing a Sampling Design for Environmental Data Collection*, EPA QA/G-5s. *Regardless of the type of design selected, this worksheet should explain the basis for its selection.* It also should describe the following:

1. The physical boundaries for the area under study (include maps or diagrams).
2. The time period being represented by the collected data.
3. The descriptions and basis for dividing the site into sampling areas (e.g., decision units, exposure units, etc.) that support the decision statements documented on Worksheet #11.
4. The basis for the number and placement of samples within sampling areas.
5. If sample locations are specified in the QAPP, descriptions of how actual sample positions will be located once in the field. (Include maps or diagrams).
6. If a sample cannot be collected where planned, the decision process for changing the location.
7. If sample locations will be determined in the field, the decision process for doing so.
8. Contingencies in the event field conditions are different than expected and could have an effect on the sample design.

Instructions from EPA Region 2:

The information in the “green text” above shall be included in the upfront discussion of project-specific QAPPs Worksheet #17 to provide a context for sampling design and rationale. Project-specific QAPPs shall include only additional information or deviations from the TSOPs on Worksheet 17. Attach detailed procedures that are not part of an SOP instead of including all the details on the worksheet.

WORKSHEET #17 WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPS FOR THE ELEMENTS OF THE PROJECT NOT INCLUDED HEREIN. THE DESIGN OF THE SAMPLING SCHEME AND RATIONALE MUST BE INCLUDED TO PROVIDE THE BASIS AND JUSTIFICATION FOR THE INVESTIGATION APPROACH.

**QAPP Worksheet # 17: Sampling Design and Rationale
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)**

[A summary of the sampling program; sampling scheme design and rationale will be included in project-specific QAPPs]

The field program will include:

- Mobilization (**Worksheet 17a**)
 - Site Reconnaissance (**Worksheet 17b**)
- Monitoring Well Abandonment and Well Repair (**Worksheet 17c**)
- Hydrogeological Assessments
 - Continuous Water Level Measurements (**Worksheet 17d**)
 - Synoptic Water Level Measurements (**Worksheet 17e**)
- Soil Screening Sampling with Direct-Push Technology (DPT) (**Worksheet 17f**)
- Soil Screening Sampling with Hollow Stem Augers (**Worksheet 17g**)
- Groundwater Screening with DPT (**Worksheet 17h**)
- Groundwater Sampling (**Worksheet 17i**)
- Air Sampling (**Worksheet 17j**)
- Vapor Intrusion Evaluation (**Worksheet 17k**)
- Monitoring Well Installation (**Worksheet 17l**)
- Decontamination Procedures (**Worksheet 17m**)

QAPP Worksheet # 17a: Sampling Design and Rationale – Mobilization
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Procurement of Technical Services

CDM Smith will procure technical services (drilling, geophysical, analytical laboratory subcontractor, etc.) in accordance with the FAR and CDM Smith procedures.

Site Preparation

All site workers will become familiar with site operations, whether it's a groundwater treatment facility, the locations of the extraction wells, monitoring wells, and supply wells etc. at the Site.

CDM Smith will conduct ground truthing for overhead utilities and surface features around intrusive subsurface sampling locations. The drilling subcontractor will be responsible for contacting an appropriate utility location service to locate and mark out underground utilities.

CDM Smith plans to use existing roadway rights-of-way, open space, and clearings to the maximum extent possible to access sampling locations. However, it may be necessary to clear some areas of vegetation and trees in order to access sampling locations. The drilling subcontractor will be responsible for clearing vegetation. CDM Smith will direct and oversee any necessary clearing activities conducted by the drilling subcontractor. Some field activities are expected to occur on private and public properties. In the event that properties are impacted by field activities, the property will be restored, as near as practicable, to the conditions existing immediately prior to such activities. CDM Smith will maintain photographic documentation of site conditions prior to commencement of and after completion of RI field activities.

EPA will assist with finding a suitable location for the command post area. Prior to the start of drilling activities, the drilling subcontractor will construct a decontamination pad at the command post area to be determined during site reconnaissance. Drilling equipment, supplies, and vehicles will be staged at the command post area. At the completion of the field activities, all decontamination pad materials and drilling equipment, supplies, and vehicles will be removed from the command post area, unless otherwise instructed by EPA. The command post area will be restored, as near as practicable, to its original condition. CDM Smith personnel will perform field oversight and health and safety monitoring during all site restoration field activities.

Access Support

Access to public areas and private property will be needed to execute the field investigation. EPA will be responsible for obtaining site access. CDM Smith will assist EPA with site access. Access support is anticipated for selected tasks to be detailed in project-specific QAPPs. CDM Smith will provide a list of property owners (public and private) to be accessed during the field activities. The list will include the mailing address and telephone number of the property owners. Once EPA has established that access has been granted, field work can begin. CDM Smith will contact and coordinate with property owners and local officials (for work in public areas) to schedule sampling activities. Per EPA direction, CDM Smith will give one week (seven days) advance verbal notice to the facility/property owners before field activities on their properties are initiated.

Field Planning Meetings

Prior to field activities, each field team member will review all project plans (QAPP, HASP, etc.) and participate in a field planning meeting conducted by the CDM Smith SM or designee to become familiar with the history of the Site, health and safety requirements, roles and responsibilities, field procedures, field data collection and management procedures, sample location naming, sample naming, communication procedures, and related QC requirements. CDM Smith field personnel will also attend an onsite tailgate kick-off meeting immediately prior to the commencement of each stage or step of field activities. All new field personnel will receive comparable briefing if they were not at the initial field planning meeting and/or the tailgate kick-off meeting. Supplemental meetings may be conducted as required by any changes in site conditions or to review field operation procedures.

QAPP Worksheet # 17a: Sampling Design and Rationale – Mobilization
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

The PM will identify the required field EDDs and assign the team member to be responsible for its preparation. The FTL will review the analytical method codes to be used in Scribe to ensure that they are consistent with the EQuIS.

Field Equipment and Supplies

Equipment and field supply mobilization, governed by CDM Smith's Quality Procedures (QP) section 2.1, *Procuring Measurement and Test Equipment* and section 5.3, *Inspection of Items*, will entail ordering, renting, and purchasing all equipment and supplies needed for each part of the RI field investigation. This will also include staging and transferring all equipment and supplies to and from the site. Measurement and Test Equipment forms will be completed for rental or purchase of equipment (instruments) that will be utilized to collect field measurements. The field equipment will be inspected for acceptability, and instruments calibrated as required prior to use. This task also involves the construction of a decontamination area for sampling equipment and personnel. A separate decontamination pad will be constructed by the drilling subcontractor for drilling equipment.

Field Trailer, Utilities, and Services

Arrangements will be made for the lease of a field trailer and associated utilities, a secure storage area for investigation derived waste (IDW), trash container, and portable sanitary facilities at the command post area. The command post area will be large enough to accommodate a 40-foot office trailer, two 20-cubic-yard roll-off containers, four 6,500-gallon water tank trucks, portable sanitary facilities, a decontamination area, drilling equipment and supplies, drill rigs and subcontractor support vehicles, and CDM Smith vehicles.

Health and Safety (H&S) work zones including personnel decontamination areas will be established. Local authorities such as the police and fire departments will be notified prior to the start of field activities. Equipment will be demobilized at the completion of each field event, as necessary. Demobilized equipment will include sampling equipment, drilling subcontractor equipment, H&S equipment, and decontamination equipment.

Investigation Derived Waste (IDW)

CDM Smith will procure a subcontractor who will be responsible for the removal and proper disposal of all generated waste soils, liquids, solids, and personal protective equipment. Representative waste samples will be collected and analyzed by a laboratory to characterize the IDW.

Field Procedures for these Activities are detailed in:

- TSOP 2-2 Guide to Handling Investigation Derived Waste
- TSOP 5-1 Control of Measurement and Test Equipment
- TSOP 4-1 Field Logbook Content and Control*
- TSOP 4-2 Photographic Documentation of Field Activities
- TSOP 5-1 Control of Measurement and Test Equipment

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet # 17b: Sampling Design and Rationale - Site Reconnaissance
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Site Reconnaissance

Activities of the site reconnaissance

The following reconnaissance activities are also required to support the field activities:

- Aerial photography and analysis
- Ecological resource reconnaissance
- Topographical survey
- Reconnaissance of the main trunk sanitary and storm sewer lines
- Cultural resources survey
- Photographic documentation

Review of Aerial Photography *[If applicable]*

Ecological Resource Reconnaissance *[If applicable]*

Topographical Mapping, Monitoring Well Survey, and Sampling Point Location *[If applicable]*

Cultural Resources Survey *[If applicable]*

Photographic Documentation *[If applicable]*

Monthly Field Activity Report

CDM Smith will submit a monthly field activity report to the EPA RPM electronically using email and in hard copy.

Field Procedures for these Activities are detailed in:

- TSOP 3-2 Topographic Survey
- TSOP 4-1 Field Logbook Content and Control*
- TSOP 4-2 Photographic Documentation of Field Activities, Sections 5.2.2 General Guidelines for Still Photography and 5.2.4 Photographic Documentation

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet # 17b: Sampling Design and Rationale - Ecological Characterization
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Habitat Characterization

The purpose of the ecological field characterization is to identify ecological conditions on and in areas nearby the site that are potentially affected by the migration of site contaminants. Site conditions and conditions of the adjacent area will be visually inspected concurrent with the Stage II field investigation. Observations on habitat conditions, wildlife utilization, and contaminant exposure pathways will be made, including the following types of ecological information:

- Vegetation cover types on, and in areas immediately adjacent to, the site
- Dominant vegetation species and general visual observations of abundance/diversity
- Topographic features (e.g., drainages)
- Location of surface waters and their general aquatic habitat characteristics (e.g., approximate size, flow and direction, bottom substrate, and plant coverage)
- Observations of wildlife use, including (to the extent practicable) species identification and type of usage
- Indications of environmental stress that could be related to site contaminants

The results of this characterization will be provided in the SLERA and in the ecological characterization section of the RI report.

Identification of Threatened and Endangered Species and Critical Habitats

The presence of any federal- and/or Commonwealth-listed threatened or endangered species or significant habitats at the site or surrounding area will be determined. Information received under this activity will be reviewed and presented in the screening level ecological risk assessment (SLERA) and the ecological characterization section of the RI report.

Field Procedures for these Activities are detailed in:

- TSOP 3-2 Topographic Survey
- TSOP 4-1 Field Logbook Content and Control*
- TSOP 4-2 Photographic Documentation of Field Activities, Sections 5.2.2 General Guidelines for Still Photography and 5.2.4 Photographic Documentation

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet # 17c: Sampling Design and Rationale - Monitoring Well Abandonment and Well Repair
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Monitoring WellsWell Abandonment*[If applicable]*Well Repair*[If applicable]***Field Procedures for Well Abandonment are detailed in:**

- TSOP 2-2 Guide to Handling of Investigation-Derived Waste
- TSOP 4-10 Borehole and Well Decommissioning, except Sections 5.3 (Well Over drilling) and 5.4 (Borehole or Well Plugging)
- Worksheet 17I Decontamination Procedures

QAPP Worksheet # 17d: Sampling Design and Rationale - Continuous Water Level Measurements
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Continuous water level measurements will be collected. Water level and barometric pressure readings will be measured using In-situ TROLL[®] data loggers, and will be operated according to manufacturer's instructions.

[Description of where water levels will be collected]

Field Procedures for these Activities are detailed in:

- TSOP 1-6 Groundwater Level Measurement, Section 5.3.4 Continuous Recording Method
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement, if required by Health and Safety Plan
- TSOP 4-1 Field Logbook Content and Control, with a RAC 2 clarification*
- TSOP 5-1 Control of Measurement and Test Equipment
- Worksheet 17I Decontamination Procedures

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet # 17e: Sampling Design and Rationale - Synoptic Water Level Measurements
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Groundwater levels will be used to monitor site-wide groundwater elevations. Synoptic water level elevation measurements will be collected from *[names of monitoring wells]*.

Water level measurements will be collected from conventional monitoring wells using an electronic water level indicator, at the surveyors mark on the inner casing. *[Other ancillary site specific information for project]*

Field Procedures for these Activities are detailed in:

- TSOP 1-6 Groundwater Level Measurement, Section 5.2 Water Level Measurement Using Electronic Water Level Indicators (and manufacturer's instructions)
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement, if required by Health and Safety Plan
- TSOP 4-1 Field Logbook Content and Control, with a RAC 2 clarification*
- Worksheet 17I Decontamination Procedures

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet # 17f: Sampling Design and Rationale - Soil Screening Sampling with Direct-Push Technology (DPT)
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

[Description of soil screening sampling with DPT with location, number of samples, analysis, procedures]

Field Procedures for these Activities are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 1-4 Subsurface Soil Sampling, Section 5.2. Direct Push Rig Sampling
- TSOP 1-6 Groundwater Level Measurement, Section 5.2 Water Level Measurement Using Electronic Water Level Indicators (In-Situ Level TROLL or equivalent)
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 2-2 Guide to Handling Investigation Derived Waste
- TSOP 4-1 Field Logbook Content and Control, with a RAC 2 clarification*
- Worksheet 17I Decontamination Procedures
- Worksheet 18 Sampling Locations and Methods/ SOP Requirements

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet # 17g: Sampling Design and Rationale - Soil Screening Sampling with Hollow Stem Augers
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

[Description of soil screening sampling with hollow stem augers with location, number of samples, analysis, procedures]

Field procedures for these activities are detailed in:

- Appendix A Site-Specific Low Flow Groundwater Purging and Sampling Procedure
- TSOP 1-2 Sample Custody
- TSOP 1-4 Subsurface Soil Sampling, Section 5.2.3 Split-Barrel (or Split-Spoon) Sampling
- TSOP 1-6 Groundwater Level Measurement, Section 5.2 Water Level Measurement Using Electronic Water Level Indicators
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 2-2 Guide to Handling Investigation Derived Waste
- TSOP 3-5 Lithologic Logging
- TSOP 4-1 Field Logbook Content and Control, with contract clarification*
- Worksheet 17I Decontamination Procedures
- Worksheet 18 Sampling Locations and Methods/ SOP Requirements
- ASTM D 1586-99 Penetration Test and Split-Barrel Sampling of Soils

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

**QAPP Worksheet # 17h: Sampling Design and Rationale
Groundwater Screening with DPT
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)**

Groundwater Screening Sampling

[Description of groundwater screening sampling with DPT with location, number of samples, analysis, procedures]

Field Procedures for these Activities are detailed in:

- TSOP 1-12 Low –Stress (Low-Flow) Groundwater Sampling
- TSOP 1-2 Sample Custody
- TSOP 1-6 Groundwater Level Measurement, Section 5.2.3 Water Level Measurement Using Electronic Water Level Indicators (and manufacturer’s instructions)
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 2-2 Guide to Handling Investigation Derived Waste
- TSOP 3-1 Geoprobe® Sampling
- TSOP 4-1 Field Logbook Content and Control, with a RAC 2 clarification*
- Worksheet 17I Decontamination Procedures
- Worksheet 18 Sampling Locations and Methods/ SOP Requirements

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet # 17i: Sampling Design and Rationale
Groundwater Sampling
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

[Description of groundwater sampling including locations, analyses, frequency and procedures]

Field Procedures for these Activities are detailed in:

- TSOP 1-12 Low –Stress (Low-Flow) Groundwater Sampling
- TSOP 1-2 Sample Custody
- TSOP 1-6 Water Level Measurement, Section 5.2.3 Water Level Measurement Using Electronic Water Level Indicators (and manufacturer’s instructions)
- TSOP 1-9 Tap Water Sampling, with a RAC 2 clarification
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 2-2 Guide to Handling Investigation Derived Waste
- TSOP 4-1 Field Logbook Content and Control, with a RAC 2 clarification*
- Worksheet 17I Decontamination Procedures
- Worksheet 18 Sampling Locations and Methods/ SOP Requirements

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet # 17j: Sampling Design and Rationale
Air Sampling
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

[Description of air sampling, procedures, locations, and quantity]

Field Procedures for these Activities are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement, if required by Health and Safety Plan
- TSOP 1-8 Volatile Organic Compound Air Sampling Using EPA Method TO-15 with SUMMA® Canister
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 2-2 Guide to Handling Investigation Derived Waste
- Worksheet 17I Decontamination Procedures
- Worksheet 18 Sampling Locations and Methods/SOP Requirements

QAPP Worksheet # 17k: Sampling Design and Rationale
Vapor Intrusion Evaluation
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

The sub-slab vapor samples will be collected using laboratory-certified clean SUMMA canisters with flow regulators and a vacuum of 28 inches mercury (Hg) $\pm$ 2 inches. Vacuum readings in the canister should be approximately 28-30 inches Hg. The end of the tubing will be connected directly to the summa canister's regulator intake valve. Flexible silicone tubing will be used at a minimum and as a tubing adapter only. The sample shall be collected with a 6 L laboratory-certified Summa canister with dedicated regulator, set for 24-hour sample collection. When the vacuum gauge reads between one to five inches of Hg, the valve will be closed, and sampling will be complete. Initial and final vacuum pressures will be recorded in the field logbook.

Upon sample retrieval, the temporary sub-slab vapor ports will be removed, and the slab will be patched with concrete.

Helium Tracer Test

Tracer tests will be conducted at all sub-slab vapor locations to verify the integrity of the sub-slab vapor port seal. A bucket will be placed upside down over the borehole, with the tubing coming out through a hole at the top. Helium will then be injected through a hole near the bottom of the bucket to enrich the atmosphere to at least 80 percent helium. The concentration of helium inside the bucket will be monitored with an MGD 2000 helium detector located at a second hole near the bottom of the bucket. Once the atmosphere is enriched to the appropriate concentration, the helium detector will then be used to check the concentration coming out of the tubing from the borehole. If the helium reading is below 10 percent, the probe seal will be considered sufficient, and a sample will be collected as described above. If the helium reading is above 10 percent, the port seal cannot be considered sufficient; in this case the port surface will be resealed with conduit clay, and the tracer test will be repeated until the helium reading is below 10 percent.

Indoor Air and Ambient Air Samples

Indoor air samples will be co-located with each of the sub-slab vapor samples to assist in the evaluation for vapor intrusion. The indoor air samples will be collected approximately 3 to 5 feet above the ground to represent the breathing zone. In addition to the indoor air samples, one ambient air sample will be collected outside of the building, upwind of the sampling area, to represent the outdoor air associated with the facility.

[Project specific QAPP will provide number of samples and rationale]

Both the indoor air and ambient (outdoor) air samples will be collected using laboratory-certified clean Summa canisters with flow regulators and a vacuum of 28 inches Hg $\pm$ 2 inches. Vacuum readings in the canister should be approximately 28-30 inches Hg. The sample shall be collected with a 6 L laboratory-certified Summa canister, with dedicated regulator set for 24-hour sample collection. When the vacuum gauge reads between one to five inches Hg, the valve will be closed, and sampling will be complete. Initial and final vacuum pressures will be recorded in the field logbook.

According to EPA Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) (November 2002), the indoor air sampling building survey and questionnaire provided in the ITRC Vapor Intrusion Guidance should be completed during vapor intrusion evaluation activities. The ITRC Vapor Intrusion Guidance references the New York State Department of Environmental Conservation (NYSDEC) Vapor Intrusion Guidance questionnaire, provided in Appendix B. In compliance with EPA OSWER, the NYSDEC questionnaire will be completed during vapor intrusion evaluation activities.

Field Procedures for these Activities are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement

QAPP Worksheet # 17k: Sampling Design and Rationale
Vapor Intrusion Evaluation
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

- TSOP 1-8 Volatile Organic Compound Air Sampling Using EPA Method TO-15 with SUMMA® Canister
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 2-2 Guide to Handling Investigation Derived Waste
- TSOP 4-1 Field Logbook Content and Control*
- TSOP 4-2 Photographic Documentation of Field Activities, Sections 5.2.2 General Guidelines for Still Photography and 5.2.4 Photographic Documentation
- Worksheet 17I Decontamination Procedures
- Worksheet 18 Sampling Locations and Methods/SOP Requirements

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

Analytical groups/concentrations

See worksheet 18.

Sampling locations

Project Specific

Number of samples/frequency

See worksheet 20; Sample naming is detailed in Worksheet #26.

QAPP Worksheet # 17I: Sampling Design and Rationale
Monitoring Well Installation
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Monitoring Well Installation

CDM Smith will prepare a technical memorandum summarizing the results of the soil and groundwater investigation. If determined monitoring wells are required, CDM Smith will provide rationale in the technical memorandum for the total number of monitoring wells, locations, and depths. The following procedures will be refined with a Field Change Notification after the technical memorandum is submitted.

[Description of the monitoring well installation]

Development

[How monitoring wells will be developed]

Geophysical Logging

[How geophysical logging will be performed, if applicable]

Field Procedures for these Activities are detailed in:

- TSOP 1-12 Low –Stress (Low-Flow) Groundwater Sampling
- TSOP 1-2 Sample Custody
- TSOP 1-6 Water Level Measurement, Section 5.2 Water Level Measurement Using Electronic Water Level Indicators
- TSOP 1-10 Field Measurement of Organic Vapors, Section 5.1 Direct Reading Measurement
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 2-2 Guide to Handling Investigation Derived Waste
- TSOP 3-4 Geophysical Logging, Calibration, and Quality Control
- TSOP 4-1 Field Logbook Content and Control with a RAC 2 clarification*
- TSOP 4-2 Photographic Documentation of Field Activities, Sections 5.2.2 General Guidelines for Still Photography and 5.2.4 Photographic Documentation
- TSOP 4-3 Well Development and Purging, with a RAC 2 clarification**, Section 5.3 Indicator Parameter Method of Well Purging
- TSOP 4-4 Design and Installation of Monitoring Wells in Aquifers (Mud Rotary Drilling)
- Worksheet 17I Decontamination Procedures
- Worksheet 18 Sampling Locations and Methods/ SOP Requirements
- ASTM D 1586-99 Penetration Test and Split-Barrel Sampling of Soils *[If applicable]*

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

**.- Water removed during evacuation should not be reintroduced into the well. Record water level in well, pumping flow rate, and the total volume of water purged.

QAPP Worksheet # 17m - Sampling Design and Rationale
Decontamination Procedures
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Decontamination Procedure:

The required decontamination procedure for all sampling equipment is:

- * a. wash and scrub with low phosphate detergent
 - b. tap water rinse
 - ** c. 10 percent nitric acid rinse (for metals analysis only), laboratory grade (one percent solution will be used when carbon steel equipments, such as split-spoons, are used)
 - d. demonstrated analyte-free water rinse
 - *** e. isopropanol rinse (all solvents must be pesticide-grade or better)
 - **** f. demonstrated analyte-free water rinse (amount of water must be at least five times that of the solvents used)
 - g. air dry
 - h. wrap in aluminum foil, shiny side out, for transport
- * Tap water must be from a municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.
- ** Nitric acid rinse will only be used when samples are collected for inorganics
- *** Solvent rinse required only when sampling for organics.
- **** A sample of the demonstrated analyte-free water will be collected and submitted for chemical analysis. Analytical results will be kept on-site. Determination of analyte-free water will be according to the EPA Region II CERCLA QA Manual (EPA 1989) (see page 59).

While performing decontamination activities, phthalate-free gloves should be used to prevent phthalate contamination of the sampling equipment that could result from the interaction of the gloves with the organic solvents.

Decontamination Equipment

- Steam cleaner
- Distilled/deionized water
- Potable water
- Deep basins
- Brush
- Acetone or isopropanol (pesticide-grade)
- Personnel protective equipment
- 10 percent nitric acid (one percent when needed), ultra pure grade
- Power source (e.g., generator), if required
- Demonstrated analyte-free water
- Polyethylene sheeting
- Utility knife
- Non-phosphate detergent (i.e. Alconox)
- Aluminum foil
- Air monitoring equipment and calibration gas

Field Procedures for these Activities are detailed in:

- TSOP 4-5 Field Equipment Decontamination at Nonradioactive Sites
- TSOP 4-5 Low Flow Sampling Procedures.

QAPP Worksheet # 17n - Sampling Design and Rationale
Oversight Split Sampling
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Describe and provide a rationale for choosing the sampling approach:

As part of the Project, the PRP is implementing an investigation and field sampling program in support of an RI/FS/ or other investigation. On behalf of the EPA, CDM Smith will provide oversight and will accept and analyze split samples. The oversight program is designed to provide technical review and evaluation of associated PPR-implemented QAPPs. Worksheet 10 of project-specific QAPPs will state the oversight activities to occur during the field sampling programs, and Worksheet #11 will provide details on the collection of split samples. Oversight forms are provided in Appendix B; additional forms if required will be included in project-specific QAPPs.

CDM Smith will accept split samples at a rate of approximately 10 percent to ensure that the PRP's data is accurate. Locations for the split samples will be selected prior to the start of each oversight activity and determined by EPA and the CDM Smith SM. For tissue samples, a PRP-assigned laboratory will be responsible for homogenizing the tissue sample, generating a split sample, and shipping the sample to the assigned oversight laboratory. Field activities will be conducted according to the TSOPs below:

Describe the Sampling Action and Rationale in terms of: Matrix to be sampled and Frequency (including seasonal considerations);**Sampling locations (including QC, critical, and background samples); Analytical groups and Concentration; Number of samples to be taken:**

Refer to Worksheets #10, 11, 18 and the text above for sampling and analysis rationale, matrices to be sampled, and analytical groups to be analyzed. Refer to Worksheets # 11 and 18 for number of samples to be taken and sampling frequency. CDM Smith will accept split samples from the PRP at a rate of approximately 10 percent.

Decontamination Procedures

Equipment decontamination procedures will be implemented by the PRP in accordance with their QAPP and HASP to prevent. CDM Smith will follow the PRP's HASP prepared by their contractor.

Field Procedures for these Activities are detailed in:

- TSOP 1-2 Sample Custody
- TSOP 2-1 Packaging and Shipping Environmental Samples
- TSOP 4-1 Field Logbook Content and Control with a RAC 2 clarification*
- TSOP 4-2 Photographic Documentation of Field Activities, Sections 5.2.2 General Guidelines for Still Photography and 5.2.4 Photographic Documentation

*- Logbook notes should include decontamination procedures used, descriptions of photos taken, problems encountered and notes of conversations with Project Engineer/ PM/ Project Geologist. Details of samples collected including CLP numbers and visual observations.

QAPP Worksheet #18: Sampling Locations and Methods
(UFP-QAPP Manual Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.1 and 2.3.2)

The primary value of this worksheet is as a completeness check for field personnel and auditors/assessors. It facilitates checks to make sure all planned samples have been collected and appropriate methods have been used. Ideally, this worksheet should list each individual sample that is planned to be collected, including field QC samples. Samples with common entries may be grouped but field QC samples and samples that are unique must be listed separately. If a sample is being collected in increments, use only one line to identify the sample as it will be analyzed; there is no need to list the increments separately. (If the increments are placed in separate containers to be combined in the laboratory, then each container must be labeled.) If a project involves the collection of a large number of samples, however, it may be acceptable to list groups of similar samples on a single row. Detailed sampling SOPs must be available to field personnel and should be included as an appendix to the QAPP and referenced in this worksheet. The comments field can be used as a reminder to note any special sample handling required in the field and/or GPS coordinates. A map with locations marked should be included. Use additional worksheets as necessary.

THIS WORKSHEET WILL BE REQUIRED IN PROJECT-SPECIFIC QAPPS – AN EXAMPLE IS INCLUDED BELOW:

Sample ID	Matrix ¹	Depth (feet bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments
CHS-S-VOC-001	S	0-2	Hand auger	VOCs	TSOP1-xx	GPS coordinates: 123 x 456
CHS-S-VOC-001D	S	0-2	Field Duplicate	VOCs	TSOP1-xx	
CHS-S-VOC-002	S	6-8	Hand auger	VOCs	TSOP1-xx	
CHS-S-VOC-002MS/MSD	S	6-8	MS/MSD	VOCs	TSOP1-xx	
CHS-S-MET-001	S	2-4	Hand auger	RCRA Metals	TSOP1-xx	
CHS-S-MET-001D	S	2-4	Field Duplicate	RCRA Metals	TSOP1-xx	
CHS-PCB-001 thru 009	S	0-2	Hand auger	PCBs	TSOP1-xx	Use disposable equipment only

¹Key: SS = surface soil, S = soil, SD = sediment, GW = groundwater, SW = surface water, bgs=below ground service

QAPP Worksheet #18: Sampling Locations and Methods – (Oversight)
(UFP-QAPP Manual Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.1 and 2.3.2)

Sample ID	Matrix ¹	Depth (feet bgs)	Type	Analyte/Analytical Group	Sampling SOP	Comments *
PRP sample ID+CDM or other denotation as determined by project teams	TBD	TBD – PRP QAPP	TBD	TBD	Refer to PRP's QAPP for sampling SOPs. CDM Smith will accept samples collected by the PRP's contractor.	
	TBD	TBD – PRP QAPP	TBD	TBD		
	TBD	TBD – PRP QAPP	TBD	TBD		
	TBD	TBD – PRP QAPP	TBD	TBD		
	TBD	TBD – PRP QAPP	TBD	TBD		
	TBD	TBD – PRP QAPP	TBD	TBD		
	TBD	TBD – PRP QAPP	TBD	TBD		

* Comments include coordinates, use of disposable equipment, or other information the sampler should be aware of.

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

The purpose of this worksheet is to serve as a reference guide for field personnel. It is also an aid to completing the Chain of Custody (COC) form and shipping documents. Complete this table for each laboratory used. If laboratory accreditation/certification is required for this project, the project team must verify that the laboratory maintains current accreditation/certification status for each analyte/matrix/method combination, as applicable, throughout its involvement with the project. If the accreditation expiration dates are the same for all entries then a global expiration date can be added at the top of the table as appropriate.

Note: EPA maintains CLP laboratory accreditation information.

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (*Name, sample receipt address, POC, e-mail, and phone numbers*):

List any required accreditations/certifications: *Fill in for project-specific QAPP*

Back-up Laboratory: *Fill in for project-specific QAPP*

Sample Delivery Method: *Fill in for project-specific QAPP*

Sample Delivery Method: Fill in for project-specific QAPPs								
Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
Passive Soil Gas (PSG)	Air	ASTM 4196 SW-846 8260C Modified, equivalent to TO-17	[This will be included in project-specific QAPPs]	PSG Sampler Sorbent Tubes per sample	NA - Protect from temperature extremes	30 days	30 days	Standard turnaround time (TAT) is 21 days for analysis and 21 days for validation.
VOCs (Indoor Air)		TO-15 SIM or EPA SAV01.X		SUMMA canister – 6L		30 days		
VOCs (Soil Gas)		TO-15 scan		SUMMA canister – 6L		30 days		
PCBs		TO-10A		PUF Sorbent Cartridge; wrap in aluminum foil in glass jar	0 to 6 °C; protect from light	7 days to extraction	40 days to analysis	

Notes (use as applicable)

1. Disregard sample tag numbers when they show up on the COC.
2. Technical holding time is referenced unless otherwise noted. (Technical is from time of sample collection).
3. Data package turnaround time includes time for both analysis and data validation. If the project requires a different TAT include the information in the project-specific QAPP consult the CLP Guidance for Field Samplers and include required information in the project-specific QAPPs.
4. *Modifications and laboratory SOPs will be included in project-specific QAPPs.*

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (Name, sample receipt address, POC, e-mail, and phone numbers):

List of required accreditations/certifications: Fill in for project-specific QAPP

Back-up Laboratory: Fill in for project-specific QAPP

Sample Delivery Method: Fill in for project-specific QAPP

Analyte/ Analyte Group	Matrix	Analytical & Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
VOCs	Soil or Sediment	5035A/ SOM01.2	[This will be included in project-specific QAPPs]	CLP Guidance Option 1: (3) 40 mL glass vials with magnetic stir bars & PTFE lined septa/ open top screw caps OR/ CLP Guidance Option 2: (3) EnCore Samplers (pre-notify RSCC)	Cool 0 to 6°C (Additional vials needed for modified analytical requests)	Not applicable	If frozen: 10 days verified time of sample receipt (VTSR); Technical-14 days If iced: Technical-48 hours	Standard turnaround time (TAT) is 21 days for analysis and 21 days for validation.
%Moisture-send with VOC vials		SOM01.2		(1) 4 oz. jar w/Teflon lined cap. No headspace	None - No headspace	Technical-48 hours		
TCL SVOCs		SOM01.2		(1) 8 oz. glass jar w/Teflon lined cap	Cool 0 to 6°C	14 days (10 days –VTSR)	40 days	
TCL Pesticides ⁵		SOM01.2		(1) 8 oz. glass jar w/Teflon lined cap		10 days-VTSR; Technical 14 days	40 days	
TCL PCBs ⁵				(1) 8 oz. glass jar w/Teflon lined cap ⁵	Cool 0 to 6°C			

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (Name, sample receipt address, POC, e-mail, and phone numbers):

List of required accreditations/certifications: Fill in for project-specific QAPP

Back-up Laboratory: Fill in for project-specific QAPP

Sample Delivery Method: Fill in for project-specific QAPP

Analyte/ Analyte Group	Matrix	Analytical & Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time

Notes:

1. Soil VOC vials must be shipped on the day of collection. Record VOC vials sample weights; a log of the vial, vial plus sample and spin bar weights will accompany the cooler.
2. MS/MSD is not required for TCL VOC and SVOC when a CLP laboratory is assigned
3. See worksheet 21 and the CLP Guidance for further VOC sampling procedure information.
4. If PCBs and Pesticides are analyzed by the same laboratory, only one sample needs to be taken for both fractions.
5. Record weight of vial and bar prior to and after adding soil to vials. Submit this information to the laboratory along with the COCs.
6. Soil PCBs and Pesticides-no additional volume is required for MS/MSD analyses. The sampler shall designate a sample for the laboratory to perform the MS/MSD analysis at a frequency of one per twenty samples. MS/MSD samples should be submitted with the first (preferable) or second shipment to facilitate the CLP laboratory meeting its contractual obligation to perform the MS/MSD analyses with each SDG.
7. The field team is encouraged to consolidate the sample volumes in consultation with DESA, RSCC and the subcontract laboratories as appropriate. Additional sample volumes may be required when more than one option of a method is requested, for example, low plus SIM SVOC analysis. Consult the CLP Guidance for Field Samplers and include this information in the project-specific QAPPs. DESA QAPP worksheets are provided in Appendix D for reference.
8. Additional sample volumes may be required when more than one option of a method is requested, for example Low plus SIM SVOC analysis.

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (Name, sample receipt address, POC, e-mail, and phone numbers):

List of required accreditations/certifications: Fill in for project-specific QAPP

Back-up Laboratory: Fill in for project-specific QAPP

Sample Delivery Method: Fill in for project-specific QAPP

Analyte/ Analyte Group	Matrix	Analytical & Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
VOCs	Soil or Sediment	EPA 8260B	[This will be included in project-specific QAPPs]	(3) 60 or 125 ml glass vials w/ polytetrafluoroethylene (PTFE)-faced silicone septa For Aromatic/Halogenated VOCs: (3) 40 ml volatile organic analysis (VOA) vials with PTFE septum caps	Cool 0 to 6°C; freeze <-7°C; [can preserve with NaHSO_4 or methanol but not preferred]	48 hours if cooled only; 14 days if frozen or preserved	14 days	Standard turnaround time (TAT) is 21 days for analysis and 21 days for validation.
% Moisture (include with VOC vials)		SM2540G -to record dry weight results		(1) 4 oz. jar w/Teflon lined cap. No headspace	None - No headspace	Technical-48 hours		
PAHs		EPA 8270C/D	[This will be included in project-specific QAPPs]	(1) 4 oz glass jar	Cool 0 to 6°C; Store in dark	14 days	40 days	
PCDD/PCDF		1613B or 8290		(1) 2 oz wide mouth amber glass jar	<-10 °C, store in dark	1 year	1 year	
PCB Congeners		1668A		(1) 8 oz wide mouth amber glass jar	<-10 °C, store in dark	1 year	1 year	

Notes:

1. Soil VOC vials must be shipped on the day of collection.
2. Soil VOC vials sample weights are recorded; a log of the vial, vial plus sample and spin bar weights will accompany the cooler.
3. Soil PCBs and Pesticides-no additional volume is required for MS/MSD analyses. The sampler shall designate a sample for the laboratory to perform the MS/MSD analysis at a frequency of one per twenty samples. MS/MSD samples should be submitted with the first (preferable) or second shipment to facilitate the CLP laboratory meeting its contractual obligation to perform the MS/MSD analyses with each SDG.
4. See worksheet 21 and the CLP Guidance for further VOC sampling procedure information.
5. If PCBs and Pesticides are analyzed by the same laboratory, only one sample needs to be taken for both fractions.

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (Name, sample receipt address, POC, e-mail, and phone numbers):

List any required accreditations/certifications: Fill in for project-specific QAPP

Back-up Laboratory: Fill in for project-specific QAPP

Sample Delivery Method: Fill in for project-specific QAPP

Analyte Group	Matrix	Analytical & Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
Organochlorine Pesticides	Soil or Sediment	EPA 8081A/B	[This will be included in project-specific QAPPs]	(1) 8 oz wide mouth amber glass jar	Cool 0 to 6°C, store in dark	14 days	40 days	Standard TAT is 21 days for analysis and 21 days for data validation
Organochlorine Pesticides		EPA 1699 or 8081A		(1) 4 oz wide mouth amber glass jar	<-10 °C, store in dark	1 year if frozen or 14 days	1 year if extract is frozen otherwise 40 days	
Pesticides		EPA 632/633			Cool 0 to 6°C	14 days	40 days	
Chlorinated herbicides		8151A		2-8 oz jars	<-10 °C, store in dark	1 year if frozen	1 year if frozen	
Herbicides and Organophosphorous Pesticides		EPA 8141A/B 8321A/B			Cool to 0 to 6 °C	14 days	40 days	
Total Petroleum Hydrocarbons (TPH) Gasoline Range Organics Diesel Range Organics		EPA 8015B/C		(1) 8 oz. glass jar w/Teflon lined cap	Cool 0 to 6°C	14 days	14 days	

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (*Name, sample receipt address, POC, e-mail, and phone numbers*):

List any required accreditations/certifications: *Fill in for project-specific QAPP*

Back-up Laboratory: *Fill in for project-specific QAPP*

Sample Delivery Method: *Fill in for project-specific QAPP*

Sample Delivery Method: Fill in for project specific QAPPs								
Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
TAL Metals	Soil or sediment	ISM01.3	[This will be included in project-specific QAPPs]	(1) 8 oz. glass jar w/Teflon lined cap	Cool 0 to 6°C	TBD	180 days	Standard TAT is 21 days for analysis and 21 days for data validation
TAL Total Mercury				(1) 8 oz. glass jar w/Teflon lined cap			28 days	
Cyanide				(1) 8 oz. glass jar w/Teflon lined cap			14 days	
Metals (no mercury)		EPA 6010B/6020		(1) 8 oz. glass jar	Cool 0 to 6°C	6 months		
Methyl mercury		1630		(1) 2 oz glass jar	≤-15 °C	1 year if aliquoted, weighed and frozen at <-15 CC		
Total Mercury (trace/low)		1631/ SW-846 Method 7471						
Sulfide		SM4500-S2-D/ F		(1) 4 oz glass jar	Cool 0 to 6°C	TBD	7 days	
Perchlorate		EPA 314.0 Mod [soil extraction]		(1) 4 oz glass jar w/Teflon lined cap			28 days	
TOC		Lloyd Kahn		(1) 8-oz glass jar			14 days	
Hexavalent Chromium		SW-846 3060A/7196A		(1) 8 oz glass jar		30 days		
AVS-SEM	SW-9030/9034/ 376/ 3010/ 6010B or ISM01.3	(1) 4 oz glass jar w/Teflon lined cap	TBD	14 days				

Notes:

1. Technical-VTSR - Subtract 2 days – this is an allowance for sample receipt by the laboratory.
2. Separate volumes are required to reduce the potential for problems associated with sample volumes when the pesticides and PCB analysis are performed at two different CLP laboratories.

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (*Name, sample receipt address, POC, e-mail, and phone numbers*):

List any required accreditations/certifications: *Fill in for project-specific QAPP*

Back-up Laboratory: *Fill in for project-specific QAPP*

Sample Delivery Method: FedEx or Courier: *Fill in for project-specific QAPP*

Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
Grain size	Soil or sediment	ASTM D421-85 ASTM D422-63	[This will be included in project-specific QAPPs]	(1) 8-oz glass jar	Cool 0 to 6°C	None		Standard TAT is 21 days for analysis and 21 days for data validation
pH		SW-846, 9045D				48 hours		
Cation exchange Capacity		EPA 9080, 9081, ISM01.3 or 6010B Modified		(1) 4 oz glass jar	None	None		
Rigid Wall permeability		ASTM D2434						
In-situ Porosity [Determined from specific gravity & dry bulk density]		ASTM D854 ASTM D2937		Shelby tube				
Specific Gravity		ASTM D 854 SW-846 9080/9081		(1) 16 oz wide mouth glass	Cool 0 to 6°C			
Atterberg Limit		ASTM D 4318		(1) 16 oz wide mouth glass or HDPE				
Bulk Density		ASTM D 7263-09/2937		(1) 16 oz wide mouth glass or high density polyethylene (HDPE) bottle				
Moisture		SM2540G		(1) 4-oz glass jar	Cool 0 to 6°C	Analyze as soon as possible		

Notes:

1. VTSR holding time is referenced above.
2. MS/MSD is not required for QC samples.
3. The field team is encouraged to consolidate the sample volumes in consultation with DESA, RSCC and the subcontract laboratories as appropriate. Additional sample volumes may be required when more than one option of a method is requested, for example Low level plus SIM SVOC analysis. DESA QAPP Worksheets are provided in Appendix D for reference.
4. Soil VOC vials must be shipped on the day of collection. Soil VOC vials should have recorded sample weights or a log of the vial weights and vial plus sample and spin bar weights to accompany the cooler.
5. Soil PCBs and Pesticides- no additional volume is required for MS/MSD analyses. The sampler shall designate a sample for the laboratory to perform the MS/MSD analysis at a frequency of one per twenty samples. MS/MSD samples should be submitted with the first (preferable) or second shipment to facilitate the CLP laboratory meeting its contractual obligation to perform the MS/MSD analyses with each SDG. If PCBs and Pesticides are analyzed by the same laboratory, only one sample needs to be taken for both fractions.
5. CDM Smith will follow the EPA FASTAC policy for procuring analytical services. As a result laboratory information is not known during QAPP preparation. Laboratory name, location, accreditation status and method SOPs are maintained by the EPA for tier 1 and 2 (DESA and CLP). If a subcontractor laboratory is required for a particular project, this information will be provided to EPA.

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (Name, sample receipt address, POC, e-mail, and phone numbers):

List any required accreditations/certifications: Fill in for project-specific QAPP

Back-up Laboratory: Fill in for project-specific QAPP

Sample Delivery Method: FedEx or Courier: Fill in for project-specific QAPP

Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation n Holding Time	Analytical Holding Time	Data Package Turnaround Time
TCL VOCs Trace plus SIM	Aqueous	SOM01.2	[This will be included in project-specific QAPPs]	(5) 40 ml VOA vials w/Teflon lined septa	1:1 HCl to pH<2; no headspace; no bubbles.	Technical 14 days 10 days VTSR Preserved; Unpreserved 7 days		Standard TAT is 21 days for analysis and 21 days for data validation
TCL VOCs trace or Low		SOM01.2		(3) 40 ml VOA vials w/Teflon lined septa	Do not preserve if effervescence occurs. Cool 0 to 6°C	Analyze within 14 days of collection		
TCL SVOCs		SOM01.2		(2) 1L amber glass bottles w/Teflon lined cap. No additional volume required for SIM	Cool 0 to 6°C	7 days (5 VTSR)		
TCL Pesticides ⁵		SOM01.2		(2) 1L amber glass bottle w/Teflon lined cap		7 days (5 VTSR)		
TCL PCBs ⁵		SOM01.2		(2) 1L amber glass bottle/Teflon lined cap	Cool 0 to 6°C	7 days (5 VTSR)		
MEE		RSK 175		(3) 40 ml glass vials w/ PTFE-lined caps No headspace	1:1 HCl to pH<2; no headspace; no bubbles. Do not preserve if effervesces. Cool 0 to 6°C	Analyze within 14 days of collection		
TCL VOCs		EPA 8260B		(3) 40 ml glass vials w/ PTFE-lined caps No headspace	Cool 0 to 6°C; preserve with 1:1HCL, NAHSO ₄ or H ₂ SO ₄	7 days (no preservative) 14 days (with preservative)		

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (*Name, sample receipt address, POC, e-mail, and phone numbers*):

List any required accreditations/certifications: *Fill in for project-specific QAPP*

Back-up Laboratory: *Fill in for project-specific QAPP*

Sample Delivery Method: *Fill in for project-specific QAPP*

Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
PAH and Alkyl PAHs	Aqueous	EPA 8270C/D modified	[This will be included in project-specific QAPPs]	1L amber glass	0 to 6°C; store in dark	Extract within 7 days	Analyze within 40 days of extraction	Standard TAT is 21 days for analysis and 21 days for data validation
Organochlorine Pesticides		EPA 8081A		(1) 1L amber glass w/PTFE lined cap each		7 days		
Chlorinated Pesticides		EPA 1699						
Chlorinated herbicides		EPA 8151A		(2) 1L amber glass bottle w/Teflon lined cap	Cool 0 to 6°C Store in dark			
Herbicides and Organophosphate Pesticides		EPA 8141A/B or 8321A/B			Cool 0 to 6°C			
PCDD/PCDF		1613B or 8290		1x 1L amber glass bottle	Cool 0 to 6°C; store in the dark	1 year–1613B 30 days–8290		
PCB Congeners		EPA 1668A		(1) 1L amber glass w/Teflon lined cap	Cool 0 to 6°C; store in the dark	1 year for preparation and analysis		
Total Petroleum Hydrocarbons (TPH) – Gasoline Range Organics TPH – Diesel Range Organics		EPA 8015 B/C		(1) 8 oz. glass jar w/Teflon lined cap (1) 2-L Amber	Cool 0 to 6 HCl	14 days		

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (*Name, sample receipt address, POC, e-mail, and phone numbers*):

List any required accreditations/certifications: *Fill in for project-specific QAPP*

Back-up Laboratory: *Fill in for project-specific QAPP*

Sample Delivery Method: *Fill in for project-specific QAPP*

Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
TAL Mercury	Aqueous	ISM01.3	[This will be included in project-specific QAPPs]	1L HDPE + 1-1L [extra bottle is for MS analysis]	HNO ₃ to pH<2; Cool 0 to 6°C	28 days (26 days VTSR)		Standard TAT is 21 days for analysis and 21 days for data validation
TAL Metals		ISM01.3				6 months		
Cyanide		ISM01.3		1L HDPE + 1-1L [extra bottle is for MS analysis]	HNO ₃ to pH<2; Cool 0 to 6°C	28 days (26 days VTSR)		
Metals		SW-846 3050+ 6010/6020				6 months		
Mercury		SW-846 7470A		1L HDPE + 1-1L [extra bottle for MS analysis]	HNO ₃ to pH<2; Cool 0 to 6°C	28 days		
Cyanide		SW-846 9010C followed by 9014 or 9012B		(1) 1 L HDPE	NaOH to pH>12; Cool 0 to 6°C	14 days		
Methyl mercury		EPA 1630		1 × 500 mL fluoropolymer bottle each	0 to 6°C; Preserve with hydrochloric acid (HCL)	Preservation within 48 hours; 6 months for preparation and analysis		
Mercury (trace)		EPA 1631		(1) 500 mL HDPE	Fill with no headspace. Cool 0 to 6°C. Preserve with HNO ₃	Preservation within 28 days and 90 days for analysis from collection.		
Hexavalent Chromium		SW-846 7196A		0.5 L HDPE	Cool 0 to 6°C	24 hours		

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (Name, sample receipt address, POC, e-mail, and phone numbers):

List any required accreditations/certifications: Fill in for project-specific QAPP

Back-up Laboratory: Fill in for project-specific QAPP

Sample Delivery Method: Fill in for project-specific QAPP

Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
Alkalinity	Aqueous	EPA 310.2 and SM2320B	[This will be included in project-specific QAPPs]	(1) 250 mL HDPE	Cool 0 to 6°C	TBD	14 days	Standard TAT is 21 days for analysis and 21 days for data validation
Ammonia		EPA 350.1/ SM4500-NH3-B, C, D, E, F, G and H		(1) 1 L HDPE			28 days	
Bromide		EPA 300, 320.1, 4110B		(1) 250 mL HDPE				
Chloride		SM 4110B B, C, D, E		(1) 125 mL HDPE				
Fluoride		EPA 300, 300.1, SM4110B		(1) 500 mL HDPE; 300 mL for 340.1	Cool 0 to 6°C	TBD	6 months	
Hardness		EPA 130.1, SM2340B/C ISM01.3 + calculation		(1) 250 mL HDPE	HNO ₃ to pH<2; Cool 0 to 6°C			
Nitrate		EPA 300, 352.1, or 4110B, 4500-NO3-D		(1) 250 mL HDPE	Cool 0 to 6°C	NA	48 hours	
Nitrite		EPA 300, 353.2, 4110B, 4500-NO3-E, or F		(1) 250 mL HDPE	Cool 0 to 6°C	NA	48 hours	
Nitrate/Nitrite		EPA 353.2, 300 or SM 4110B, 4500-NO3-E/F		250 mL polyethylene bottle	H ₂ SO ₄ to pH <2; Cool 0 to 6°C	NA	28 days	
TKN	EPA 351.1, 351.2, SM 4500-NH3 B, C, D, E, F/ G	(1) 1 L HDPE	H ₂ SO ₄ to pH <2; Cool 0 to 6°C	NA	28 days			

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory *(Name, sample receipt address, POC, e-mail, and phone numbers)*:

List any required accreditations/certifications:

Back-up Laboratory:

Sample Delivery Method:

Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
Chemical Oxygen Demand (COD)	Aqueous	EPA 410.3, 410.4 SM 5220 (1) C or (2) D	This information will be included in project-specific QAPPs	(1) 125 mL HDPE	H ₂ SO ₄ to pH <2; Cool 0 to 6°C	NA	28 days	Standard TAT is 21 days for analysis and 21 days for data validation
BOD		SM5210B		(1) 2 L HDPE	Cool to ≤6°C		48 hours	
DOC		EPA 9060 or SM5310B		(1) 250 mL amber glass bottle or protect from light	Filter, H ₂ SO ₄ to pH<2; Cool 0 to 6°C		28 days	
TOC		EPA 415.2, 9060 or SM5310B			H ₂ SO ₄ to pH <2; Cool 0 to 6°C			
DOC/POC		EPA 415.1		(1) 250 mL amber glass bottle or protect from light	Filter, H ₂ SO ₄ to pH <2; Cool 0 to ≤6°C		28 days	
Orthophosphorus		EPA 300, 365.1, or 365.3, 4110B		(1) 125 mL HDPE	Cool 0 to 6°C		48 hours	
Phosphorus (all forms)		EPA 300, 365.1, 365.3, or 365.4			H ₂ SO ₄ to pH <2; Cool 0 to 6°C		28 days	
Sulfate		SM4500 SO ²⁻ C or D		(1) 250 mL HDPE	Cool 0 to 6°C		28 days	
		EPA 300, 375.2, 4110B or SM 4500-SO4-C or D						
Sulfide	SM4500-S-2-(2)D, E, (1)F or (1)G	(1) 1 L HDPE (2) 100 mL HDPE	Zinc acetate and NaOH to pH>9; Cool to ≤6°C	7 days; Unpreserved 48 hours				

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory (Name, sample receipt address, POC, e-mail, and phone numbers):

List any required accreditations/certifications: Fill in for project-specific QAPP

Back-up Laboratory: Fill in for project-specific QAPP

Sample Delivery Method: Fill in for project-specific QAPP

Sample Delivery Method: Submit for project-specific QAPP								
Analyte/ Analyte Group	Matrix	Analytical and Preparation Method/ SOP	Accreditation Expiration Date	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround Time
Ferrous Iron (field test)	Aqueous	HACH 8146	Dates will be included in project-specific QAPPs	1 HDPE	Cool 0 to 6°C	TBD	Analyze on day collected	Standard TAT is 21 days for analysis and 21 days for data validation
Hexavalent Chromium (field test)		HACH 8023		Test kit bottle				
Sulfate		HACH 8051		Test kit bottle				
Sulfide		HACH 8131		Test kit bottle	Cool 0 to 6°C; No headspace		28 days to analysis	
TSS		SM2540D		(1) 1 L HDPE or amber glass bottle or protect from light				
TDS		SM2540C			Cool 0 to 6°C		Ship to the laboratory and preserve within 48 hours. 7 days to analysis	

Notes:

1. Technical holding time is referenced unless otherwise noted.
2. MS/MSD is not required for TCL VOC and SVOC when a CLP laboratory is assigned.
3. The field team is encouraged to consolidate the sample volumes in consultation with DESA, RSCC and the subcontract laboratories as appropriate. Additional sample volumes may be required when more than one option of a method is requested, for example, low plus SIM SVOC analysis. Consult the CLP Guidance for Field Samplers and include this information in the project-specific QAPPs. DESA QAPP worksheets are provided in Appendix D for reference.

QAPP Worksheet #20: Field Quality Control Summary
(UFP-QAPP Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.5)

This worksheet provides a summary of the types of samples to be collected and analyzed for the project. Its purpose is to show the relationship between the number of field samples and associated QC samples for each combination of analyte/analytical group and matrix. This worksheet is also useful for informing the laboratory of the number of samples to expect and for preparing analytical cost estimates. The number and types of QC samples should be based on project-specific DQOs, and this worksheet should be adapted as necessary to accommodate project-specific requirements. Not all types of QC samples shown in the example below will be necessary for all projects. However, some projects may require additional QC samples (e.g. proficiency testing samples), which can be listed in the “other” column.

Samples that are collected at different depths at the same location, and analyzed separately, should be counted as separate field samples; even if they are taken from the same container as the parent field sample. **If your analytical contract specifies that matrix spikes and matrix spike duplicates are included in the per sample unit price then they are not included in the total number of samples; otherwise they should be counted separately as analyzed separate analyses.** If composite samples or incremental samples are being collected, include only the sample that will be analyzed; subsamples and increments should not be listed separately; however, all containers making up the sample (as received by the laboratory) must be labeled.

QAPP Worksheet #20: Field Quality Control Summary
(UFP-QAPP Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.5)

THIS WORKSHEET WILL BE POPULATED IN PROJECT-SPECIFIC QAPPs

Matrix	Analyte/ Analyte Group	Field Samples	Field Duplicate	Matrix Spike	Matrix Spike Duplicate	Field Equipment Blanks	Trip. Blanks	Other	Total # analyses
Air	Soil Gas								
	Indoor Air								
Soil/ Sediment	TCL VOC								
	Percent Moisture								
Aqueous	VOCs								
	Methane, ethane, ethene								
	TAL Metals								
	Wet Chemistry								

Notes:

- The exact number of QC samples will be detailed in the project-specific QAPPs. The frequency of QC samples are:
 - 1/20 samples for field duplicates;
 - matrix spike frequency - See the CLP Guidance for Field Samplers - 1 per SDG. This is also defined in more detail on Worksheet #28.
 - Field Blanks - 1 per decontamination event per matrix not to exceed 1 per day.
 - Trip blanks will be collected one per cooler for aqueous VOC samples unless determined otherwise for a project.
- The "Total # analyses" column does not include the matrix spike and matrix spike duplicate.
- Field duplicates are not required for oversight projects except when specified by the client.

**QAPP Worksheet #21: Field SOPs
(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)**

This worksheet is intended for use to document the specific field procedures being implemented, which is important for measurement traceability. The QAPP must contain detailed descriptions of procedures for all field activities, including sample collection; sample preservation; equipment cleaning and decontamination; equipment testing, maintenance and inspection; and sample handling and custody. **If these procedures are included in existing SOPs, then the SOPs should be reviewed to make sure they are either 1) sufficiently prescriptive to be implemented as written, or 2) modified as necessary for this project. If an SOP provides more than one procedure or option (for example, one SOP covers the use of several different types of field equipment for the same procedure) this worksheet must note the specific option or equipment being used.)** Basic information about the SOPs should be provided in this table, and the SOPs themselves should be included in an appendix to the QAPP. Field SOPs must be readily available to all field personnel responsible for their implementation. The QAPP must explain any planned modifications to field SOPs. Modifications should be clearly noted on the SOPs themselves. The specific type(s) of SOP modifications/deviations must be summarized in the comments column or a reference provided.

Do not include the CDM Smith's TSOPs in the copies sent to EPA for review. EPA has a CD with the 2012 TSOPs. Include project-specific TSOPs, TSOPs updated after January 2013, or new written procedures. Include the TSOPs in the field copies of the Final QAPP.

EXAMPLE:

SOP # or reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
DECON-003	Decontamination SOP, Revision 3, October 2005	Ma & Pa Sampling Inc.	Applies to all equip. used for non-volatile organics	Y	Methanol will be used instead of acetone as the final rinse solvent
Soil-Grab-01 A	Surface soil sampling SOP, Revision 0, June 2004	Ma & Pa sampling Inc.	Disposable Trowel	Y	Refer to cover sheet of attached SOP for summary of deviations

**QAPP Worksheet #21: Field SOPs
(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)**

SOP # or reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
1-1	Surface Water Sampling, Rev. 9, January 2012	CDM Smith			
1-2	Sample Custody, Rev. 7, January 2012	CDM Smith	<i>Use Scribe Software</i>	Y	- Sample tags are not required. - Scribe generated COCs will be used. - Use waterproof ink for any handwritten labels.
1-3	Surface Soil Sampling, Rev. 8, January 2012	CDM Smith	<i>Section 4 of TSOP Stainless steel bowls & spoons</i>		Closed system vial is preferred for VOC sampling
1-4	Subsurface Soil Sampling, Rev. 7, January 2012	CDM Smith	<i>Section 4 of TSOP Stainless steel bowls & spoons</i>		Direct Push Rig collection using Macro-Core® sampler, Auger Rig with Split-Spoon Sampler, Air Rig with analysis of cutting returns Closed system vial is preferred for VOC sampling
1-5	Groundwater Sampling Using Bailers, Rev. 8, January 2012	CDM Smith			
1-6	Groundwater Water Level Measurement, Rev. 8, January 2012	CDM Smith	<i>Describe measurement type in project-specific QAPPs - from Section 5 of TSOP</i>		
1-7	Wipe Sampling, Rev. 5, January 2012	CDM Smith			
1-8	Vapor Sampling using SUMMA Canister, Rev. 7, January 2012	CDM Smith			
1-9	Tap Water Sampling, Rev. 6, January 2012	CDM Smith			
1-10	Field Measurement of Total Organic Vapors, Rev. 6, January 2012	CDM Smith	<i>TSOP Section 4/ Mini-RAE/Multi-RAE</i>		
1-11	Sediment or Sludge Sampling, Rev. 9, January 2012	CDM Smith			
1-12	Low-Stress Low-Flow GW Sampling, Rev. 1, January 2012	CDM Smith			
1-13	Drum Sampling, Rev. 1, January 2012	CDM Smith			
1-14	Lagoon Sampling, Rev 1., January 2012	CDM Smith			

**QAPP Worksheet #21: Field SOPs
(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)**

SOP # or reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
1-15	Field Portable XRF, Rev. 1, January 2012	CDM Smith			
2-1	Packaging and Shipping Environmental Samples, Rev. 5, January 2012	CDM Smith	<i>TSOP Section 1.3 lists materials needed</i>		Methanol will not be used. Vermiculite shall not be used. Metal cans may be used to collect medium level soil samples.
2-2	Guide to Handling of Investigation-Derived Waste, Rev. 7, January 2012	CDM Smith	<i>Describe waste types in project-specific QAPPs and list applicable subsections of Section 5 in TSOP</i>		
3-1	Geoprobe® Sampling, Rev. 6, January 2012	CDM Smith	<i>Section 4 of TSOP Geoprobe rig and sampling equipment in drilling SOW</i>		
3-2	Topographic Survey, Rev. 7, January 2012	CDM Smith	<i>NA</i>		
3-4	Geophysical Logging, Calibration, and Quality Control, Rev. 6, January 2012	CDM Smith	<i>Gamma Logs Only – Downhole Gamma Logger (Mount Sopris model HLP2375/1)</i>		
3-5	Lithologic Logging, Rev. 8, 2012	CDM Smith	<i>TSOP Section 4</i>		
3-6	Underground Facility Location, Rev. 1, January 2012	CDM Smith			
4-1	Field Logbook Content and Control, Rev. 7, January 2012	CDM Smith	<i>NA</i>		Logbook notes should include decontamination procedures; descriptions of photographs taken; problems encountered and notes of conversations with SM and TM or project engineer; and details of samples collected including CLP numbers and visual observations ¹ .
4-2	Photographic Documentation of Field Activities, Rev. 8, January 2012	CDM Smith	<i>Camera</i>		
4-3	Well Development and Purging, Rev. 6, January 2012	CDM Smith	<i>TSOP YSI</i>		Water removed during evacuation should not be reintroduced into the well. Record water level in well, pumping flow rate, and the total volume of water purged.

**QAPP Worksheet #21: Field SOPs
(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)**

SOP # or reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
4-4	Design and Installation of Monitoring Wells in Aquifers, Rev. 7, January 2012	CDM Smith			For NJ sites apply NJDEP Monitoring Well Construction Requirements
4-5	Field Equipment Decontamination at Nonradioactive Sites, Rev. 9, January 2012	CDM Smith	TSOP Section 4		Use phthalate-free gloves
4-6	Hydraulic Conductivity Testing, Rev. 4, January 2012	CDM Smith			
4-8	Environmental Data Management, Rev. 2, January 2012	CDM Smith			
4-9	Aquifer Performance Tests, Rev. 1, January 2012	CDM Smith	Describe the applicable tests from Section 5 of TSOP in project-specific QAPPs		
4-10	Borehole and Well Decommissioning, Rev. 1, January 2012	CDM Smith			
5-1	Control of Measurement and Test Equipment, Rev. 9, January 2012	CDM Smith	NA		Leased or rented equipment only to be used.
N/A	Site-Specific Low Flow Groundwater Purging and Sampling Procedure	CDM Smith	Fill In equipment – pump type etc.		
D1586	Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils	ASTM	Fill In equipment –see SOP		
3.0	VOA Soil Sample Filling Procedure	EPA	CLP Sampler's Guide		- Use CLP procedure for VOC soil samples collection - Use EnCore only after approval from EPA and RSCC
D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	ASTM	SOP		Sampling Atterberg Limits

Modify table for each project-specific QAPP. Specify the appropriate sections of each TSOP that apply.

Notes:

1. Homogenization of soil is accomplished by thoroughly mixing the collected soil with a stainless steel spoon or spatula in the following manner: (1) The soil should be scraped from the stainless steel container sides, corners, and bottom, then rolled into the middle and initially mixed. (2) The soil is then quartered and moved to the four quarters of the container. (3) Each quarter of the sample should be mixed individually, then rolled to the center of the stainless steel container sample mixed again.

2. For each sample collected and shipped the following information will be recorded (at a minimum) in the field logbook:

▪ Name of field personnel	▪ Type of analysis to be performed
▪ CDM Smith assigned sample number/location (use at least two permanent landmarks for reference points)	▪ Sample volume and containers
▪ Date sampled	▪ Any unusual discoloration or evidence of contamination
▪ Date shipped	▪ Field parameter measurements
▪ Sample location number	▪ Calculations
▪ Corresponding CLP routine analytical services (RAS) sample number	▪ Preservatives added to sample
▪ Media type	▪ Courier airbill number and means of delivery to the laboratory
	▪ General observations

3. *Project-specific QAPPs should indicate the type of equipment required and any modifications required to achieve project objectives.*

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.1.2.4)
(EPA 2106-G-05 Section 2.3.6)

This worksheet documents procedures for calibrating, maintaining, testing, and/or inspecting all field equipment (e.g., tools, pumps, gauges, magnetometers, pH meters, water-level measurement devices, etc.). The frequency, acceptance criteria, and corrective action information is left blank when these activities are documented in an SOP or manufacturer's instructions, and the relevant SOP or instruction is attached. All information summarized in this worksheet is recorded in field notes/logs.

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.1.2.4)
(EPA 2106-G-05 Section 2.3.6)

Field Equipment	Activity	SOP Reference	Title or Position of Responsible Person	Frequency	Acceptance Criteria	Corrective Action
Mini RAE plus Classic (PGM-76) Toxic Gas Monitor - 11.7 electron volt (eV) lamp	Calibration and Maintenance	Manufacturers specifications	FTL	Calibrate at beginning of day and check at the end of the day on days used	± 10% of the calibrated value	Manually zero meter or service as necessary and recalibrate
Multi-RAE plus photoionization detector (PID) Toxic Gas Monitor - 11.7 eV lamp				Maintain as needed in field; semi- annually by supplier		
YSI-600XL Flow through cell	Calibration and Maintenance - Calibrate with standard solutions		FTL	Calibrate at beginning of day and check at the end of the day on days used - YSI temperature should be calibrated to a NIST traceable thermometer Maintenance performed before shipment and as needed	pH: ± 0.05 Specific Conductivity: ±5 micro Siemens (µS) DO ± 0.02 parts per million (ppm) Temp.: ±0.30C	Clean probe, Replace battery, DO membrane, and/or probe Recalibrate or service as necessary / Return to rental company for replacement
In-Situ Mini TROLL (<i>Specify model in project-specific QAPPs</i>)	Calibration and Maintenance		FTL or Sub- contractor	Calibration performed by manufacturer prior to shipping – field staff zero the probe before use	Pass/Fail	Return to rental company for replacement
Water Level Meter	Maintenance as needed		Sub-contractor	Check meter daily before each use	Probe responds upon contact with water	Return to rental company for replacement
LaMotte Turbidity Meter <i>[insert model #]</i>	Calibrate as per manufacturer's recommended procedures Accuracy/calibration check		FTL	Calibrate before use and when anomaly suspected Accuracy/calibration check at the end of the day	From 0-2.5 NTU, accuracy is ±0.05 NTU From 2.5-100 NTU, accuracy is ±2% From 100 NTU, accuracy is ±3%	Replace battery, standards, or bottle, or return for replacement

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.1.2.4)
(EPA 2106-G-05 Section 2.3.6)

Field Equipment	Activity	SOP Reference	Title or Position of Responsible Person	Frequency	Acceptance Criteria	Corrective Action
Trimble GPS	Calibration and Maintenance	Manufacturers specifications	FTL; environmental sampler	Daily, before each use; at all sampling points for maintenance. Charge batteries daily before use; keep from extreme heat or cold. Keep unit clean. If not able to calibrate see service manual.	Manufacturers specifications	Manufacturers specifications
HACH Meter	Accuracy/calibration check		FTL	Calibrate before use and when anomaly suspected	Pass/Fail	Replace battery or bulb or return for replacement
In-Situ Level TROLL® 700	Maintenance performed before shipment and as needed		Subcontractor	Check meter daily before each use		Return to rental company for replacement
Mount Sopris 2FSA-1000 1 Liter, wireline sampler	Maintenance performed before shipment and as needed		FTL	Check sampler daily before each use		Return to rental company for replacement
Mount Sopris 2PGA-1000 Gamma Logging Probe	Manufacturer calibration only		Drilling Subcontractor	Performed by manufacturer prior to sampling		Return to manufacturer for repair/replacement
Natural Gamma (Downhole Geophysics)	Calibrated by manufacturer		Field Geologist	As needed	0-100 kilo counts per second	Recalibrate or service as necessary
Horiba U-20XD with flow through cell	Calibrate daily		FTL	Daily, before each use at the beginning of the day and check calibration at the end of the day	pH: ± 0.0;5 Specific Conductivity:±5 µS; DO ± 0.02 ppm; Temp.: ±0.3°C	Recalibrate or service as necessary
Lower Explosive Limit Meter	Calibrated by manufacturer	EPA Method TO-15	FTL	Calibrate am, check pm	+/- 0.5 ppm	Manually zero or service as necessary and recalibrate
SUMMA® Canister	Check air pressure and valves		FTL	Once	As per laboratory specifications	Reject and return to lab for cleaning and pressurization

1. New Jersey Department of Environmental Protection (NJDEP) Field Sampling Procedures Manual Section 6.9.2.2.4, Laboratory Certification, has additional requirements for the use of field instruments for pH, temperature, and dissolved oxygen. Staff working on NJ projects will evaluate if the certification requirements apply.

<http://www.nj.gov/dep/srp/guidance/fspm/pdf/chapter06e.pdf>.

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

This worksheet documents information about the specific sample preparation and analytical procedures to be used, which is important for measurement traceability. Screening data are used for interim investigations and will not be used for final risk assessment or site assessment decisions unless they have been confirmed with definitive procedures. SOPs for all sample preparation and analytical procedures must be current and referenced whether these activities are performed in the field or in an off-site laboratory. The project team reviews all SOPs to make sure they are either: 1) sufficiently prescriptive to be implemented as written or 2) modified as necessary for this project. SOPs providing more than one procedure or specific option [e.g., extraction procedures for analytes of different concentration levels (SW5035), sulfur cleanup options (SW3660), or derivatization techniques (SW8151)], are noted. This worksheet summarizes planned modifications to existing SOPs. Modifications are clearly noted on the copies of the SOPs themselves. All personnel responsible for implementing sample preparation and analytical SOPs have access to the specific SOPs they are using.

THIS WORKSHEET WILL BE AMENDED IN PROJECT-SPECIFIC QAPPs IF A SUBCONTRACT LABORATORY WILL BE USED

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/ Analytical Group	SOP Option or Equipment Type	[‡] Modified for Project? Y/N
TO-10A	<i>Determination Of Pesticides And Polychlorinated Biphenyls In Ambient Air Using Low Volume Polyurethane Foam (PUF) Sampling Followed By Gas Chromatographic/Multi-Detector Detection (GC/MD), second edition. January 1999.</i>	Definitive	PCBs - Air	GC/MD	
TO-15	<i>Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS), second edition. January 1999.</i>		VOC Gases	GC/MS	
TO-17	<i>Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tube, second edition. January 1999.</i>				
8260B/C	<i>Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS); December 1996./August 2006.</i>				
SAV01.X	<i>Volatile Organics Analysis in Air (Draft). June 2008.</i>				
RSK 175/ AM20Gax use RSK 175 QC procedures	<i>Analysis of Dissolved Methane, Ethane, and Ethene in Groundwater -Robert S. Kerr Environmental Research Laboratory Standard Operating Procedures. May 1998.</i>		MEE	GC/FID	
SW 9030	<i>Acid Soluble and Acid Insoluble Sulfides: Distillation. Revision 2. December 1996.</i>		AVS SEM	Distillation	
SW 9034	<i>Titrimetric Procedure for Acid Soluble and Acid Insoluble Sulfides. December 1996.</i>			Titrimetric	
SW 3010	<i>Acid Digestions of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy. Revision 1. July 1992.</i>			Spectroscopy	
SOM01.2	<i>EPA CLP Statement of Work (SOW) for Multi-Media, Multi-Concentration Organic Analysis. October 2006 with April 2007 amendment.</i>		TCL VOCs	GC/MS	
SOM01.2	<i>CLP SOW for Multi-Media, Multi-Concentration Organic Analysis. October 2006 with April 2007 amendment.</i>		TCL SVOCs	GC/MS	
EPA 8270C/D	<i>Analytical Method for the Determination of Polycyclic Aromatic Hydrocarbons (PAH), and Alkylated PAHs and Alkanes. Revision</i>		PAH and Alkyl PAHs	GC/LRMS	

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/ Analytical Group	SOP Option or Equipment Type	[‡] Modified for Project? Y/N
	10.02. March 2011.	Definitive			
SW 846 7470/7471	<i>Determination of Mercury by Cold Vapor Atomic Absorption (CVAA)</i>		Total Mercury	CVAA	
EPA 1613B or 8290	<i>Analytical Method for the Determination of Polychlorinated Dibenzo-dioxins and Dibenzofurans.</i> Revision 20. March 2011.		PCDD/PCDF	HRGC/HRMS	
SOM01.2	<i>CLP SOW for Multi-Media, Multi-Concentration Organic Analysis.</i> April 2007 amendment.		TCL Pesticides	GC/electron capture detector (ECD)	
EPA 1699	<i>Analytical Method for the Analysis of the Analysis of Multi-Residue Pesticides by HRGC/HRMS.</i> Revision 6. July 2010.		Chlorinated Pesticides	HRGC/HRMS	
EPA 8081A	<i>Organochlorine Pesticides by Gas Chromatography.</i> Revision 1. December 1996.		Organochlorine Pesticides	GC/MS	
EPA 8141A/B	<i>Organophosphorus Compounds by Gas Chromatography.</i> Revision 2. February 2007.		Organophosphorus Pesticides	GC	
EPA 8151A	<i>Chlorinated Herbicides by GC Using Methylation or Pentafluorobenzoylation Derivatization.</i> Revision 1. December 1996.		Chlorinated Herbicides	GC/MS	
EPA 8321A/B	<i>Solvent Extractable Nonvolatile Compounds by High Performance Liquid Chromatography/Thermospray/Mass Spectrometry or Ultraviolet Detection.</i> /Revision 1. Dec. 1996 / Revision 2. Feb 2007.		Herbicides; Organophosphorus Pesticides	Liquid Chromatography (HPLC)/MS or UV	
EPA 633	<i>The Determination of Organonitrogen Pesticides in Municipal and Industrial Wastewater</i>		Organonitrogen Pesticides	GC	
EPA 632	<i>The Determination of Carbamate and Urea Pesticides in Municipal and Industrial Wastewater</i>		Pesticides	HPLC	
SOM01.2	<i>CLP SOW for Multi-Media, Multi-Concentration Organic Analysis.</i> April 2007 amendment.		TCL PCBs	GC/ECD	
EPA 1668A	<i>Chlorinated Biphenyl Congeners in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS.</i> November 2008.		PCB Congeners	HRGC/HRMS	
ISM01.3	<i>CLP SOW for Multi-Media, Multi-Concentration Inorganic Analysis.</i> December 2006.		Hardness	ICP-AES/ICP-MS	
			TAL Metals		

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/ Analytical Group	SOP Option or Equipment Type	[‡] Modified for Project? Y/N
		Definitive	Mercury	CVAA	
			Cyanide	1-Colorimeter 2-Spectrophotometer	
EPA 6020	<i>Standard Operating Procedure: Inductively Coupled Plasma – Mass Spectrometry Analysis.</i> Revision 2. April 1, 2011.		Metals	ICP-MS	
EPA 6010	<i>Inductively Coupled Plasma-Atomic Emission Spectrometry.</i> Revision 2. December 1996.		Metals (no mercury)	ICP-AES	
EPA 1631	<i>Total Mercury Using Atomic Fluorescence Spectroscopy.</i> Revision 2. August 28, 2009.		Mercury (trace)	cold vapor atomic fluorescence spectrometry (CVAFS)	
EPA 1630	<i>Draft Methylmercury Using Distillation, Aqueous Ethylation, Purge and Trap, and Cold Vapor Atomic Fluorescence.</i> July 27, 2010.		Methyl mercury (trace)	CVAFS	
EPA 8015 B/C	<i>Nonhalogenated Organics by Gas Chromatography.</i> Revision 3. February 2007.		TPH (DRO and GRO)	GC	
HACH 8023	HACH Test kit – 1,5-Diphenylcarbohydrazide Method	Screening	Hexavalent chromium	Spectrophotometer or Colorimeter model DR/ 890, 850 or 820	No – modification of Standard Methods
HACH 8051 (Equivalent to EPA 375.4)	HACH Test Kit – Sulfate as SO ₄		Sulfate		
HACH 8131	HACH Test kit – Sulfide		Sulfide		
HACH 8146	HACH Test Kit - Phenanthroline Method (adapted from PM for Water and Wastewater)		Ferrous Iron		
EPA 130.1	<i>MCAWW.</i> Revised 1983		Hardness	Colorimeter- automated	

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/ Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
EPA 300.0, 300.1	<i>Determination of Inorganic Anions by Ion Chromatography.</i>	Definitive	Bromide, Chloride, Fluoride, Sulfate, Nitrate, Nitrite, Nitrate/Nitrite, Orthophosphate	Ion Chromatography	
EPA 310.2	MCAWW. Revised 1983	Definitive	Alkalinity	Colorimeter	
EPA 320.1			Bromide	Titrimetric	
EPA 325/340 DELETED			Chloride/Fluoride	--	
EPA 350.1			Ammonia	Colorimeter- automated	
EPA 410.3, 410.4			COD	1-Titrimetry 2-Colorimeter	
EPA 351.1, 351.2			TKN	Colorimeter	
EPA 352.1			Nitrate	Colorimeter	
EPA 353.2			Nitrate/Nitrite	Colorimeter	
EPA 353.2			Nitrite	Colorimeter	
EPA 375.2			Sulfate	Colorimeter- Automated	
EPA 365.1 or 365.3			Orthophosphorus	Colorimeter- automated	
EPA 365.1, 365.3, or 365.4			Phosphorus (all forms)		
SM 4110B	<i>Determination of Anions by Ion Chromatography. 2000.</i>	Definitive	Bromide, Chloride, Fluoride, Sulfate, Nitrate, Nitrite, Nitrate/Nitrite, Orthophosphate	Ion Chromatography	

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/ Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
SM 4500-NH3 B (1), SM 4500-NH3 C/E (2), SM 4500-NH3 D/E (3), SM 4500-NH3 F, (4), SM 4500-NH3 G/H (4b)	<i>Standard Methods for the Examination of Water and Wastewater.</i> American Public Health Association, American Water Works Association and Water Environment Federation.	Definitive	Ammonia	1 - Distillation & gas diffusion 2 - Titrimetric 3 - Electrode 4 – Manual phenate, salicylate or other substituted phenol reaction [electrode] 4b - Automated	
SM2340B (1)/C (2)		Definitive	Hardness	1-Calculated from metals results 2-Titrator	
SM 2320B		Definitive	Alkalinity	Titrimetric	
SM 4500-Cl-B (1), SM 4500-Cl-C (2), SM 4500-Cl-D (3), SM 4500-Cl-E (4)		Definitive	Chloride	1 - Titrimetric 2 - Mercuric nitrate titration 3 - Potentiometric Titration 4 - Ferricyanide colorimeter [Auto]	
SM 4500-NO3-D		Definitive	Nitrate	Electrode	
SM 4500-NO3-E, F		Definitive	Nitrate/Nitrite	Automated cadmium reduction	
SM 4500-NO3-E, F		Definitive	Nitrite		
SM 4500-NH3 B,C			TKN	Titrimetric	
SM 4500-S-2-D, E, F or G			Sulfide	Titrimetric	

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/ Analytical Group	SOP Option or Equipment Type	[‡] Modified for Project? Y/N
SM 5220 (1) B/C or (2) D	<i>Standard Methods for the Examination of Water and Wastewater.</i> American Public Health Association, American Water Works Association and Water Environment Federation.		COD	1-Titrimetry 2-Colorimeter	
SM 4500-P-E or F			Phosphorus (all forms)	Colorimeter-automated block digester AA 2-Titrimetric	
SM 4500-S-2-(2)D, E, (1)F or (1)G			Sulfide	1-Titrimetry 2-Spectrophotometer	
SM 4500-SO ₄ ⁴⁻ C/D			Sulfate	Gravimetric (balance/oven)	
EPA 9031	<i>Extractable Sulfides.</i> Revision 0. July 1992.	Definitive	Sulfide	Titrimetric	
SW-846 7196A	<i>Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846, 3rd Edition (SW-846).</i>		Hexavalent Chromium	1-Colorimeter 2-Photometer	
SW-846 3060A/7196A	<i>Alkaline digestion for Hexavalent Chromium; Determination of Dissolved Hexavalent Chromium.</i> Revision 1. July 1992.	Definitive	Hexavalent Chromium – soil	Extraction by alkaline digestion; colorimeter	
SM 3500	<i>Standard Method 3500-Cr Chromium.</i> 2001.		Hexavalent Chromium	Colorimeter	
EPA 314	<i>Determination of Perchlorate in Drinking Water Using Ion Chromatography.</i> Revision 1. November 1999 [modified for soil extraction].		Perchlorate	Ion Chromatography	
SM 2540D	<i>Standard Operating Procedure: Total Suspended Solids Volatile Suspended Solids.</i> Revision 3.1. January 31, 2009.		TSS	Filter, Oven, balance	
SM 2540C	Modified: “Standard Operating Procedure: Total Dissolved Solids.” Revision 2.1. January 2009.		TDS	Gravimetric	
SM 5210B	<i>MCAWW.</i> Revised 1983		BOD	DO meter	
EPA 9060 (1), or EPA 415.2 (2)	<i>MCAWW.</i> Revised 1983		TOC	1- IR/FID Carbon analyzer 2- UV Promoted Persulfate Oxidation	
Lloyd Kahn	<i>Determination of TOC in Sediment.</i> July 1998. (and Attachment B of method, <i>Supplemental Technical Direction and Additional QC Procedures.</i>)		TOC - soil	Carbon analyzer	

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/ Analytical Group	SOP Option or Equipment Type	[‡] Modified for Project? Y/N
SM 5310B	<i>Total Organic Carbon</i> . Revision 2.1, January 31, 2009.		Aqueous/ TOC	Organic Carbon Analyzer	
SM 5310B	<i>MCAWW</i> . Revised 1983		Aqueous/ DOC	Carbon analyzer/IR/FID	
EPA 415.1 (DESA SOP)	Modified: “ <i>Standard Operating Procedure: Total Organic Carbon -Sediment.</i> ” Revision 2.1. January 31, 2009.		Aqueous/ POC	Filter and Carbon Analyzer with IR or FID	
EPA 9080, 9081, 6010B or ISM01.3 Modified	<i>Cation Exchange Capacity of Soils</i> . September 1986.	Definitive	Cation Exchange Capacity	AES or Atomic Absorption	
ASTM D421-85	<i>Standard Practice for Dry Preparation of Soil Samples</i> . 2002.	Definitive	Grain Size	Sieves, hydrometer	
ASTM D422-63	<i>Standard Test Method for Particle-Size Analysis of Soils</i> . 2002.		Dry bulk Density	Thin-walled cylinder	
ASTM D2937	<i>Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method</i> . 2002.		Bulk Density	Thin-walled cylinder	
ASTM D7263	<i>Standard Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens</i> . March 2009.		Bulk Density	Drive cylinder	
ASTM D2937	<i>Density of Soil in Place by the Drive Cylinder Method</i> . March, 2010.		Specific Gravity	Water Pycnometer	
ASTM D854	<i>Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer</i>		Moisture	Oven	
ASTM D2216	<i>Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass</i> . January 1999.		Atterberg Limit	NA	
SM 2540G	<i>Standard Methods Solids</i> . 1997		Rigid Wall Permeability	NA	
ASTM D4318	<i>Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils</i> .		Water Quality Parameters	YSI Water quality Checker, Model 600XL	
ASTM D2434	<i>Standard Method for Permeability of Granular Soils (Constant Head)</i> . 2006.		Turbidity	La Motte Turbidity Meter, Model 2020	
NA	Manufacturer’s Manual	Screening			
NA	Manufacturer’s Manual				

* *If yes, explain the modification - A brief summary of project-specific SOP modifications must be provided on this worksheet or referenced.*

Notes:

1. EPA reviews CLP laboratories SOPs. DESA laboratory SOPs will apply and not these generic SOPs when the DESA laboratory is able to perform the analyses. CDM Smith subcontract laboratory specific SOPs are not available at this stage since the Region 2 FASTAC Policy will be implemented for procuring laboratory services. If the DESA laboratory does not have capacity for these analyses, then a CDM Smith master services agreement (MSA) subcontractor laboratory will be selected.
2. For non-RAS data, the ASC will submit the electronic "Analytical Services Tracking System (ANSETS) Data Requirement" form to the RSCC by the first day of each month for the previous month's sampling.
3. *Modifications and laboratory SOPs will be included in project-specific QAPPs.*

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

This worksheet applies to all analytical instruments, whether used in the field or the laboratory. As appropriate to the instrument, calibration procedures include tuning, initial calibration, calibration blank, initial calibration verification (second source), continuing calibration verification (CCV), linear dynamic range (ICP and ICP/MS only), and verification of detection and quantification limits (however defined.) See also Worksheet 15. Procedural SOPs should be attached and referenced as applicable.

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
Instruments used for TO-15 follow the calibration frequencies outlined in the selected laboratory's method SOP.						
GC/MS TO15 and	Initial calibration	Upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met	Initial calibration/ Continuing calibration: relative response factor (RRF) $\geq$ minimum acceptable response factor listed in procedure; %RSD must be $\leq$ value listed in procedure	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate	EPA National Air Contract Laboratory GC/MS Technician; or Subcontractor Laboratory GC/MS Technician	TBD
	Continuing calibration	Following initial calibration verification, once every 12 hours, end of run		Inspect system, recalibrate the instrument, and reanalyze samples		
	GC/MS Tuning	Tune with 4-Bromofluorobenzene (BFB): Beginning of each 12 hour period during which standards and samples are analyzed	See ion abundance table in TO-15.	Inspect the system, identify problem. MS tune criteria must be met before calibration		
	Retention Time Evaluation	Each analysis	+/- 0.50 minute of the internal standard retention time in the associated calibration check verification	Re-calibrate and verify, re-analyze samples back to the last good calibration check verification		
TO-10A	Per laboratory SOP	Per laboratory SOP	Per laboratory SOP	Per laboratory SOP	Per laboratory SOP	

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
GC/MS SOM01.2	Initial calibration: 5 points standards	Upon award of the contract, whenever the laboratory takes corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met	RRF $\geq$ minimum acceptable RRF listed in procedure All target compounds, initial relative standard deviation (RSD) $\leq$ 10% or 20% and correlation coefficient > 0.995 . %RSD $\leq$ value listed in procedure	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate	EPA CLP Laboratory GC/MS Technician	TBD
	Continuing calibration (CCV)	Once every 12 hours	%D $\leq$ 15% or $<$ 30% as required	Inspect system; correct problem; recalibrate the instrument, reanalyze samples and standards		
	Calibration Standards Verification	Each lot of standards	As per laboratory established control limits	Inspect system; correct problem; re-run standard and affected samples		
	Tuning	Daily: every 12 hours	Response factors and RRF as method specified	Inspect system; correct problem; re-run standard and affected samples		

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
GC/ECD	Initial calibration	Upon award of the contract, whenever major instrument maintenance or modification is performed or if the calibration verification technical acceptance criteria have not been met	Initial calibration/ Calibration verification: resolution between two adjacent peaks $\geq 60.0\%$, single components $\geq 90.0\%$ resolved, RTs within the RT window	Inspect the system (e.g., change the column, bake out the detector, clean the injection port); correct problem, re-calibrate	EPA CLP Laboratory GC/ECD Technician	TBD
See SOM01.2	Calibration verification	Once every 12 hours	%D must be greater than or equal to -25 percent and less than or equal to 25 percent, %RSD must be less than or equal to 20.0 percent	Inspect system, recalibrate the instrument, and reanalyze samples		

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference ¹
GC/FID	Initial and continuing calibration as required in SOP.	ICAL after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Calibration verification every 24 hours	ICAL %RSD≤25% for individual compounds and ≤20% for fuel products; CCV ≤25% for individual compounds and no more than 10% of compounds between 25-30%; <20% for fuel products	Inspect system, correct problem, rerun calibration and affected samples	Analyst	TBD
HRGC/HRMS and HRGC/LRMS	Initial Calibration and calibration verification check: Per laboratory SOP	After set up, after instrument changes or failures of checks and Every 12 hours	% RSD and % recovery per laboratory SOPs.	Check, correct; re-calibrate and rerun all samples analyzed after last valid calibration check	Laboratory analyst / QA officer - TBD	TBD
EPA 1699, 1613	Calibration checks: CCVs per laboratory SOP	Daily: Every 12 hours	% recovery per laboratory SOP	Check, correct; re-calibrate and rerun all samples analyzed after last valid cal check	Laboratory analyst / QA officer - TBD	

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference ¹
GC/MS EPA 8270C	Initial calibration:	On award of contract, or corrective action which may change or affect the initial calibration criteria (e.g., ion source cleaning or repair, column replacement, etc.), or if the continuing calibration acceptance criteria have not been met.	RRF $\geq$ minimum acceptable RRF listed in procedure All target compounds, initial RSD $\leq$ 10% or 20% and correlation coefficient (r) $>$ 0.995. %RSD $\leq$ value in laboratory SOP.	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, re-calibrate.	Laboratory GC/MS Technician	TBD
	Continuing calibration (CCV)	Once every 12 hours or as per laboratory SOPs	%D $\leq$ 15% or $<$ 30% or as per laboratory SOPs	Inspect system; correct problem; recalibrate the instrument, reanalyze affected samples and standards.	Laboratory GC/MS Technician	
	Calibration Standards Verification	Each lot of standards	As per laboratory established control limits	Inspect system; correct problem; re-run standard and affected samples	Laboratory GC/MS Technician	
	Tuning	Daily: every 12 hours	Response factors and RRF as method specified	Inspect system; correct problem; re-run standard and affected samples	Laboratory GC/MS Technician	

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
ICP-MS EPA 6020	As per instrument manufacturer's recommended procedures	Initial calibration: daily and each time the instrument is set up. Verify performance daily or once QC checks are non-compliant	$r \geq 0.998$; minimum of 3 standards and a blank.	Inspect the system, correct problem, re-calibrate, and re-analyze samples.	Laboratory or Subcontractor ICP-MS Technician/analyst / QA officer	TBD
	Instrument performance check	Daily; after tuning and optimizing instrument	RSD < 5% after at least 4 runs of the tuning solution	Repeat analysis; re-prepare calibration standards and reanalyze		
	Initial calibration check - ICV	Before sample analysis	90-110% recovery; source of standard separate from calibration standards	Re-calibrate instrument; prepare fresh ICV standards; do not analyze samples until problem is fixed		
	Low Level ICV Standard	After initial calibration verification standard	70-130% recovery (concentration $\pm 30\%$ of true value); prepared from calibration standards			
	Continuing calibration check (CCV)	Every 10 samples and at end of analytical sequence	90-110% recovery; mid-range of ICV standard	Find problem; re-calibrate and rerun all samples analyzed after last valid CCV		
	CCV- ISM0.1	Beginning and end of run; 10% frequency or every 2 hours during each run	As per instrument manufacturer's recommended procedures, with at least 2 standards. A minimum of three replicate integrations are required for data acquisition.			
	Low Level CCV Standard	Beginning and end of run; 10% frequency or every 2 hours during an analysis run	70-130% recovery; prepared from calibration standards			
CVAFS	Per method and laboratory SOP	Calibration	Per method/ laboratory SOP. ICAL $\leq 15\%$ RSD.	Inspect the system, correct problem, re-calibrate, and re-analyze samples.	Assigned laboratory personnel	TBD

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
		ICV: Check daily when instrument is in use	85-115% R for Total mercury; 80-120%R for methyl mercury	Inspect the system, correct problem, re-calibrate, and re-analyze samples.	Assigned laboratory personnel	
		CCV: Beginning and after every 10 samples	77-123% R for total mercury; 67-133%R for methyl mercury			
CV-GAS	Calibration; 3 point standards	After instrument set up	$R^3 \geq 0.995$	Inspect system; correct problem	Laboratory analyst / QA officer - TBD	TBD
	Initial Calibration Verification (ICV)	Before sample analysis	80-120% R; source of standard separate from calibration standards	Do not analyze samples until problem is corrected		
	CCV	10% or every 2 hours, whichever is more frequent	80-120% R	Inspect system, re-calibrate and rerun associated samples		
ICP-AES / ICP-MS ISM01.3	See ISM01.3/ per instrument manufacturer's procedures	Initial calibration: daily or once every 24 hours and each time the instrument is set up	ICP-AES & MS: As per instrument manufacturer's procedures, at least 2 standards	Inspect the system, correct problem, re-calibrate, and re-analyze samples	Laboratory ICP-AES / ICP-MS Technician or DESA Laboratory analyst / QA officer	TBD
	Initial calibration	Daily; after tuning and optimizing instrument	Correlation coefficient >0.995 with a minimum of 3 standards and a blank. MS-A minimum of three replicate integrations are required for data acquisition.	Repeat analysis; re-prepare calibration standards and reanalyze		
	ICV	Before sample analysis	90-110% R; source of standard separate from calibration standards	Re-calibrate; prepare fresh ICV standards; correct problem pre-analyze samples		
	Reporting Limit Standard	After initial calibration verification standard	80-120% R or concentration $\leq$ 30% difference (from true value)	Re-analyze failed standard		
	CCV	Every 10 samples and beginning and at end of analytical sequence	90-110% R; source of standard separate from calibration standards	Re-check; re-calibrate and rerun all samples analyzed after last valid CCV		

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
Soil TOC Analyzer	Calibration and corrective action as per Manufacturer’s instruction. No samples shall be analyzed if instrument calibration exceeds the acceptance criteria.				Laboratory analyst / QA officer - TBD	TBD
Colorimeter ⁴	Initial Calibration; 4 - 9 point standards	Every 3 months; every 6 months for method 300. or as per Laboratory SOP	90-110 % R	Re-check; re-calibrate	Laboratory analyst / QA officer - TBD	
	Calibration check (Cal Check)	Every 10 samples and at end of analytical run	80-120 % R	Re-check; re-calibrate and rerun all samples analyzed after last valid Calibration Check		
Infra red Spectrophotometer	Initial Calibration; 5 point standards	Every 3 months or when other unresolved QC failure occurs	90-110 % R	Re-check; re-calibrate		
UltraViolet Spectrophotometer	Calibration check	Every 10 samples and at end of analytical run	80-120 % R	Re-check; re-calibrate and rerun all samples analyzed after last valid Cal Check		
Ion Chromatography	Initial Calibration; 5 point standards	Every 12 hours of operation	90-110 % R	Find the problem and re-calibrate	Laboratory analyst / QA officer - TBD	TBD
	Calibration check	Every 10 samples and at end of analytical run	90-110 % R	Re-check; re-calibrate and rerun all samples analyzed after last valid calibration check		
Spectrophotometer model	1 point standard	Daily	All target compounds, initial RSD ≤ 20%	Inspect system; correct problem; re-run standard and affected samples		
Thermometer	Calibration	Quarterly; serviced annually	±1°C of true value of National Institute of Standards and Technology traceable thermometer	Replace defective thermometer		

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
Analytical Balance	Calibration verification	Daily - before use	See instrument manual	Troubleshoot as per equipment manual/call for repair	Laboratory analyst / QA officer - TBD	
	Mass check	Daily - before use	See instrument manual			TBD
	Temperature check	Annually	± 2°C			
Oven	Serviced annually as per Manufacturer’s instruction					
pH meter	Daily buffer checks (2 point bracketing sample pH)	Before use/per batch; other checks as per rental company and manufacturer’s recommendations	± 0.1 pH units or ± 0.05 pH units (see the instrument manual for the applicable criteria)	Recheck; replace buffer solutions and recheck. If still fails perform instrument check or place out of service	Laboratory analyst / QA officer - TBD	TBD
Thermometer	Per Laboratory SOP. Calibrated against NIST thermometers	Prior to use and annually or quarterly per laboratory SOP depending on thermometer type	Apply correction factor as determined by calibration results.	Analyst will follow <i>Manual for the Certification of Laboratories Analyzing Drinking Water</i> - EPA		

Notes:

1. The FASTAC decision process will be used for procuring laboratory services. CLP, DESA and CDM Smith subcontract laboratory's calibration and/or method SOPs will be utilized to meet calibration criteria. Specific instrument information (Manufacturer and model) is not available at this time.
2. To be determined (TBD) - Reference SOP depends on the laboratory assignment. EPA maintains the CLP laboratory SOP information. If a subcontract laboratory is needed, CDM Smith will submit their SOP as a field change request.
3. R represents the correlation coefficient.
4. For field screening use the HACH test kit SOPs 8023 for hexavalent chromium and 8146 for ferrous iron. Field instrument are calibrated by the supplier.
5. The laboratory SOP will include the calibration range information.
6. New Jersey Department of Environmental Protection (NJDEP) Field Sampling Procedures Manual Section 6.9.2.2.4, Laboratory Certification, has additional requirements for the use of instruments for pH, temperature, and dissolved oxygen tests. Staff working on NJ projects should evaluate if the NJDEP certification requirements apply and include them in the laboratory scope of work. <http://www.nj.gov/dep/srp/guidance/fspm/pdf/chapter06e.pdf>.

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.2.3)
(EPA 2106-G-05 Section 2.3.6)

The project team will determine whether it is necessary to complete all fields in this table. For example, if the selected laboratory is operating under a quality system that conforms to ISO 17025:2005, then the activities documented in this table will be documented in the laboratory's quality manual (however named). In this case, it may be acceptable to simply reference the quality manual (including revision number and date.) If the project has specific requirements that are different from those contained in the laboratory's quality manual, however, this table will be completed for those items.

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.2.3)
(EPA 2106-G-05 Section 2.3.6)

Instrument/ Equipment	Maintenance Activity	Testing Activity Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	Reference
Analytical instrument maintenance, testing and inspection information and availability of spare parts are not available since the FASTAC decision process will be utilized for analytical services. Information is provided in CDM Smith MSA subcontract laboratories' QA Manuals. The MSA laboratory to be utilized (if DESA is not available) is not determined at this time. Maintenance, testing and inspection frequencies are documented in the MSA laboratories SOPs.							
GC/MS	See TO-15; as per instrument manufacturer's recommendations	See TO-15; as per instrument manufacturer's recommendations	See TO-15; as per instrument manufacturer's recommendations	Acceptable re-calibration; see TO-15	Inspect the system, correct problem, re-calibrate and/or reanalyze samples	EPA National Air Contract Laboratory GC/MS Technician	TO-15
GC/MS	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	Acceptable re-calibration; see SOM01.2	Inspect the system, correct problem, re-calibrate and/or reanalyze samples	EPA CLP Laboratory GC/MS Technician	SOM01.2
GC/ECD	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	See SOM01.2; as per instrument manufacturer's recommendations	Acceptable re-calibration; see SOM01.2	Inspect the system, correct problem, re-calibrate and/or reanalyze samples	EPA CLP Laboratory GC/ECD Technician	SOM01.2
GC/FID	Change septa, clean injectors, change or trim columns, install new liners	Detector signals and chromatograph review	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	Various
HRGC/ HRMS and HRGC/LRMS	Per laboratory SOP	Calibration checks: CCVs per laboratory SOP	Daily: Every 12 hours	% recovery per laboratory SOP	Check, correct; re-calibrate and rerun all samples analyzed after last valid cal check	Laboratory analyst /QA officer - TBD	Laboratory SOP

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.2.3)
(EPA 2106-G-05 Section 2.3.6)

Instrument/ Equipment	Maintenance Activity	Testing Activity Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	Reference
ICP-AES / ICP-MS	As per instrument manufacturer's recommendations	As per instrument manufacturer's recommendations; check connections	As per instrument manufacturer's recommendations	Acceptable re-calibration; see ISM01.3	Inspect the system, correct problem, re-calibrate and/or reanalyze samples	EPA CLP Laboratory ICP-AES / ICP-MS Technician	ISM01.3
CVAFS	Replace disposables, Flush lines	Sensitivity check Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	EPA 1630, 1631
Analytical Balance	Clean balance after each use; service annually	NIST Traceable Weights	Prior to every use	Measured weight within certified	Clean, verify zero on balance	Analyst or Section Supervisor	ASTM D7263-09
Oven	As per Manufacturer's instruction						
CV-Gas	As per Manufacturer's instruction						
Soil TOC Analyzer	As per Manufacturer's instruction						
Spectrophotometer/ HPLC	Daily Semi-annual	Clean glassware Physical Inspection	As per instrument manufacturer's recommendations	Acceptable re-calibration; see SOW/SOP	Inspect the system, correct problem, recalibrate and/or reanalyze samples.	Laboratory Technician	Various
Ion Chromatograph							EPA 300

**QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal
(UFP-QAPP Manual Section 3.3)
(EPA 2106-G-05 Section 2.3.3)**

This worksheet is used to document responsibilities for maintaining custody of samples from sample collection through disposal. Examples of forms, sample labels, and COC documentation are included as an attachment to the QAPP.

Sampling Organization: CDM Smith

Laboratory: DESA, CLP, or Subcontract TBD

Method of sample delivery (shipper/carrier): FedEx

Number of days from reporting until sample disposal: DESA 30 days or CLP as per contract or Subcontract laboratory 60-90 days as specified in SOW

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	CDM Smith - FTL	TSOP 2-1
Chain-of-custody form completion	CDM Smith – Sample manager	TSOP 1-2
Packaging	CDM Smith – Sample manager	TSOP 1-2 and 2-1; EPA CLP Guidance for Field Samplers
Shipping coordination	CDM Smith - FTL, CDM Smith ASC/ CLP coordinator	TSOP 2-1
Sample receipt, inspection, & log-in	Laboratory custodian (DESA, CLP, or Subcontract)	Analytical Scope of work and Laboratory SOP
Sample custody and storage	CDM Smith and Laboratories (DESA, CLP, or Subcontract)	TSOP 1-2; Analytical SOW or Laboratory TSOP
Sample disposal	Laboratory Custodian (DESA, CLP, or Subcontract)	Laboratory TSOP

Notes:

1. Trip blanks, field blanks, and rinsate blanks will be identified using the abbreviation TB, FB, or RB, respectively, followed by the date. For example, TB-070108 indicates that the trip blank was collected on July 1, 2008. A record will be kept to identify which samples are associated with each trip blank. Duplicates will be indicated by adding 100 to the location number. For example, MW-100- 011012 would indicate a duplicate sample collected from MW-1 on January 10, 2012.
2. Filtered samples will be identified by adding the letter F to the end of the location identifier. For example, MW-1-F-011012 would indicate a filtered sample collected from MW-1 on January 10, 2012.

THE SAMPLING NAMING SCHEMES, SHIPPING COMMUNICATION PROTOCOLS AND FREQUENCY AND METHOD OF COLLECTING FILTERED AND FIELD RINSATE BLANK SAMPLES WILL BE INCLUDED IN OR APPENDED TO PROJECT-SPECIFIC QAPPS.

LIST OF WORKSHEET #28s

Some analytes have multiple methods. The project-specific QAPP must clearly identify the methods to be used.

Gas/Air

WS #28a - VOCs by TO-15

WS #28b - VOCs by CLP SAV01.X

WS #28c - PCBs by TO-10A

WS #28d - Passive Soil Gas 8260 Modified

Aqueous

WS #28e - MEE by RSK175

WS #28f - TCL VOCs Low by 8260B

WS #28g - TCL VOCs Trace or Low/Medium by SOM01.2

WS #28h - TCL SVOCs by SOM01.2

WS #28i - PAH and Alkyl PAHs by 8270C/D

WS #28j - PCDD/PCDF by 1613B

WS #28k - PCDD/PCDF by 8290 or DLM02.2

WS #28l - TCL Pesticides by SOM01.2

WS #28m - Chlorinated Pesticides by 1699

WS #28n - Organochlorine Pesticides by EPA 8081A

WS #28o - Organochlorine Pesticides by EPA 1699

WS #28p - Herbicides/Insecticides/Organophosphate Pesticides by
EPA 8141A/B, 8321A/B, 633/632

WS #28q - Chlorinated Herbicides by 8151A

WS #28r - TCL PCBs by SOM01.2

WS #28s - PCB Congeners by 1668A

WS #28t - TAL Metals, Hardness by ISM01.3

WS #28u - TAL Inorganic Metals by SW-846 6010/6020

WS #28v - TAL Total Mercury by ISM01.3, SW-846 7470

WS #28w - Total and Dissolved Mercury/ Method by 1631

WS #28x - Methyl Mercury by 1630

WS #28y - TAL Total Cyanide by ISM01.3

WS #28z - TPH (DRO and GRO) by 8015B/C

WS #28aa - Field Test Kits

WS #28ab - Wet Chemistry - Ion Chromatography by EPA 300

WS #28ac - Wet Chemistry - Colorimetry MCAWW

WS #28ad - Wet Chemistry - Titration or Potentiometer MCAWW

WS #28ae - Hexavalent Chromium (Dissolved) by SM 3500 Cr B

WS #28af - Wet Chemistry - Hexavalent Chromium by SW-846,
7196A

WS #28ag - Wet Chemistry - TSS by 2540D

WS #28ah - Wet Chemistry - TDS by 2540C

WS #28ai - Wet Chemistry - Gravimetry MCAWW

WS #28aj - BOD by SM 5210B

WS #28ak - Wet Chemistry- TOC by 415.2, 9060, 5310B

WS #28al - Wet Chemistry- DOC by 5310B

WS #28am - Wet Chemistry-POC by 415.1 modified

WS #28an - Acid Volatile Sulfide-Simultaneously Extracted Metals
(AVS-SEM) by EPA 376

LIST OF WORKSHEET #28s INCLUDED IN THIS QAPP

Some analytes have multiple methods. The project-specific QAPP must clearly identify the methods to be used.

Soil/Sediment

WS #28ao - TCL VOCs by EPA 8260B	WS #28bc - Metals by EPA 6010B, 6020
WS #28ap - TCL VOCs by SOM01.2	WS #28bd - TAL Total Mercury by ISM01.3, SW-846 7471
WS #28aq - TCL SVOCs by SOM01.2	WS #28be - Total Mercury by EPA 1631 (trace)
WS #28ar - PAHs by 8270C/D	WS #28bf - Methyl Mercury by 1630
WS #28as - PCDD/PCDF by 1613B	WS #28bg - TAL Total Cyanide by ISM01.3
WS #28at - PCDD/PCDF by 8290 or DLM02.2	WS #28bh - TPH (DRO and GRO) by 8015B/C
WS #28au - TCL Pesticides by SOM01.2	WS #28bi - TOC by Lloyd Kahn Method
WS #28av - Chlorinated Pesticides by 1699	WS #28bj - Hexavalent Chromium by SSW846, 7196A
WS #28aw - Organochlorine Pesticides by 8081B	WS #28bk - Sulfide by 376 e
WS #28ax - Herbicides and Organophosphate Pesticides by EPA 8321A/B, 8141A/B, 633, 632	WS #28bl - Perchlorate by 314
WS #28ay - Chlorinated Herbicides by 8151A	WS #28bm - Soil/Sediment Cation Exchange Capacity by SW846 9080/9081, ISM01.3
WS #28az - TCL PCBs by SOM01.2	WS #28bn - Grain Size by ASTM D421-85, D422-63
WS #28ba - PCB Congeners by 1668A	WS #28bo - Moisture by SM2540G, ASTM D2216
WS #28bb - TAL Metals by ISM01.3	WS #28bp - Rigid Wall Permeability by ASTM D2434
	WS #28bq - pH, bulk density, specific gravity, Atterberg Limit by SW 846, 9045D, ASTM2937, D854, 4318, SW 846, 9080/9081

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

The purpose of this worksheet is to ensure that the selected analytical methods are capable of meeting project-specific MPC, which are based on PQOs/DQOs). Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, and analytical group. If method/SOP QC acceptance criteria do not meet the project-specific MPC, the data obtained may be unusable for making reliable project decisions. In this case the project team should consider selecting an alternate method or modifying the method. The list of QC samples in this example is incomplete. See Section 2.2 of Part 2B of the UFP-QAPP QA/QC Compendium, the QA Matrix in Section 3.4, and Tables 4, 5, and 6 for further information and guidance on QC samples.

THIS WORKSHEET WILL BE NOT BE REQUIRED IN PROJECT-SPECIFIC QAPPS, however:

1. If a project includes analytical groups not included in this CDM Smith Generic QAPP then the worksheet #28 must be included to document the measurement and performance criteria:
2. Unless otherwise noted the RPD for the aqueous field duplicates will be < 50% and for Laboratory duplicates will be <40%.
3. Unless otherwise noted the RPD for the soil/sediment field duplicates will be < 100% and for laboratory duplicates will be <35%.
4. Unless otherwise noted the RPD for the air field duplicates and laboratory duplicates will be < 25%.
5. The project-specific QAPP should list the applicable worksheets from this Generic QAPP.
6. Wet chemistry, soil tests such as grain size may not require a field duplicate based on project needs. The project-specific QAPP should note any deviations from the attached worksheet 12s.
7. Where multiple methods are listed use the method that targets the list of analytes, detection limits and required data quality. {The project chemist will make this determination}

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

PROCEDURE FOR FIELD BLANK COLLECTION/ FIELD RINSATE BLANK COLLECTION

Duplicates: Field duplicate samples are collected and analyzed to assess the overall precision of the field sampling technique. Duplicate samples, of the same matrix, will be collected at a rate of five percent (one per 20 samples) or one per every 14 days or one if less than 20 samples are collected. These duplicates will be submitted "blind" to the laboratories by using sample numbers that differ from their associated environmental samples. For groundwater samples collected during the sampling event, duplicate samples will be collected on a per event basis.

Duplicate samples will be collected by alternately filling bottles for the same analysis.

Trip Blanks A trip blank will be prepared at the start of each day on which aqueous samples will be collected for analysis of VOCs and MEE. Trip blanks associated with PSG samplers will be provided by the subcontract laboratory. Trip blanks are used to determine whether on site atmospheric contaminants are seeping into the sample vials, or if any cross-contamination of samples is occurring during shipment or storage of sample containers. A trip blank consists of demonstrated analyte-free water sealed in 40-ml Teflon septum vials with no headspace (including bubbles) in the vials. Trip blank water will be considered analyte-free when analysis results for VOC analysis are below CRQL. Certification of blank water quality will be kept on site and will be filed in the project files once field work is completed. A sample of the blank water lot used in the field will be submitted for confirmatory analysis.

Trip blanks are to be kept in close proximity to the samples being collected and will be maintained at 4 oC (°C) and handled in the same manner as the other VOC or MEE aqueous samples. Preservation of trip blanks is presented on Worksheet # 19. One trip blank will be included with each cooler that contains aqueous samples collected for VOC and/or MEE.

Field Rinsate Blanks (Field Blanks): One field blank will be collected for each equipment type per decontamination event and will be analyzed for the same constituents as the environmental samples. Field blanks, also known as "rinsate blanks" or "equipment blanks," are used to assess the effectiveness of equipment decontamination. Field blanks will be collected before the use of the decontaminated equipment for sampling. The frequency for field blanks is one per decontamination event, not to exceed one per day, for each equipment type and for each sample matrix. Field blanks are generated by pouring demonstrated analyte-free water over or through the decontaminated sampling tool.

**QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

**PROCEDURE FOR FIELD BLANK COLLECTION/ FIELD RINSATE BLANK COLLECTION
(Continued)**

The definition of demonstrated analyte-free water is discussed in the previous section. Field blanks will be collected in a way that will minimize potential contamination from the ambient air. The use of the same aliquot of water on all equipment associated with a particular matrix for the required analyses is permissible. However, a separate field rinse blank may be collected for each piece of equipment associated with a particular sample matrix that will be analyzed for VOCs or MEE. Preservation of field blanks is specified on Worksheet # 19. Field blanks will accompany the set of samples collected by the decontaminated sampling equipment and will be kept between 0 and 6°C.

Field blanks may be minimized by decreasing the frequency of decontamination and using additional equipment. In this case the samples associated with the field blank will be noted in the field logbooks and sample trip report. Field equipment blank samples should be analyzed prior to environmental samples.

Cooler Temperature Indicators

One cooler temperature indicator or “temperature blank” will be placed in each cooler containing samples (solid and aqueous) being sent to the laboratory for analysis. The temperature blank will consist of a sample container filled with non-preserved water (potable or distilled). The container will be labeled “COOLER TEMPERATURE INDICATOR” and dated.

Matrix Spikes

Matrix spikes (MS) are laboratory QC samples drawn from excess volumes of existing samples to demonstrate the accuracy of laboratory analysis. In accordance with EPA Region 2, matrix spikes will be designated on environmental samples at a rate of one per sample delivery group (SDG). This designation will be noted on the sample container labels and the sample paperwork. An SDG is defined as one of the following:

1. All samples of an analytical case if the sample number is less than 20 (including environmental duplicates and QC blanks) and if sampling is completed within 7 calendar days.
2. Each group of 20 samples within an analytical case (including environmental duplicates, but excluding QC blanks) if the number is greater than 20.
3. Each 7-day calendar day period during which samples within an analytical case are received. This period begins with the receipt of the first sample in the SDG.

Triple volume may be required for aqueous VOC matrix MS/MSD if a subcontract laboratory is being used and are not required for CLP method SOM01.2. EPA's DESA laboratory requires double volume for aqueous VOC samples. The water quality parameters may require extra volume as identified on Worksheet #19 and confirmed with a non-CLP laboratory.

QAPP Worksheet #28a: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Gas/Air
Analytical Group VOCs
Analytical Method/SOP Reference TO-15

QC Sample	Frequency/ Number	Method/SOP Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Notify SM and flag field duplicate results	CDM Smith ASC and FTL	≤25% RPD
Laboratory Method Blank	1 every 24 hours	No analyte >CRQL	Flag outliers	National Air Contract Laboratory Technician	No analyte > CRQL
Laboratory Replicate Sample	1 per 20 samples	± 25%D	Flag outliers	National Air Contract Laboratory Technician	± 25% RPD
LCS	1 every 24 hours	±30% R	Flag outliers	National Air Contract Laboratory Technician	±30% R

QAPP Worksheet #28b: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Gas/Air

Analytical Group

VOCs

Analytical Method/SOP Reference

CLP SAV01.X

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Notify SM and flag field duplicate results	CDM Smith ASC and FTL	25% RPD
Laboratory Method Blank	1 per 24 hours	No analyte > ½ CRQL	Suspend analysis; reanalyze affected samples	Laboratory Technician	No analyte > ½ CRQL
Laboratory Replicate Sample (LCS & CCV)	1 per 24 hours	± 25% RPD	Recalibrate system and reanalyze affected samples	Laboratory Technician	± 25% RPD
LCS	1 per 24 hours	± 30%R	Recalibrate system and reanalyze affected samples	Laboratory Technician	± 30%R

QAPP Worksheet #28c: Analytical Quality Control and Corrective Action

**(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix: Gas/Air

Analytical Group: PCBs

Analytical Method/SOP: TO-10A

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per batch (up to 20 samples)	NA	Evaluate data during data valuation.	Data validation staff	RPD $\leq$ 50% if both results are $>5\times$ QL ABS $\leq 2\times$ QL otherwise
Laboratory Method Blank	1 per batch (up to 20 samples)	No target compounds $>$ QL	Identify source and attempt to eliminate. Reanalyze blank and affected samples (if sufficient sample remains). Qualify data as needed.	Laboratory Analyst/Data Validation Coordinator	No target compounds $>$ QL
Field Blank	1 per 20 samples or 1 per day (whichever is least)	No target compounds $>$ QL	Evaluate impacts on data on a case-by-case basis.	Data validation staff	No target compounds $>$ QL
LCS	1 per batch (up to 20 samples)		Reanalyze associated sample qualify data as needed.	Laboratory Analyst or Section Supervisor	60-40%R

QAPP Worksheet #28d: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Gas/Air from Soil or Sediment

Analytical Group

Passive Soil Gas-VOCs, TPH C5-C9, and TPH C10-C15

Analytical Method/SOP Reference

SW-846 8260C Modified**

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Trip Blank	1 per field deployment	≤ 25 ng*	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ 25 ng*
Preparation Blank	1 per 20 samples	No analyte > 25 ng*	Suspend analysis; redigest and reanalyze	Laboratory Technician	No analyte > 25 ng* or limit of quantitation (LOQ)
Split Samples and Field Duplicates	1 per 20 samples	None	Flag outliers	CDM Smith ASC	%RPD ≤ 25%, ABS ≤ 5xRQL
Internal Standards	All samples	50% to 200% of the area count of the respective internal standard from the midpoint of the initial calibration	Review for co-elution or masking, rerun samples if possible, otherwise discuss in report	Laboratory Analyst	+ 50 % of response area, ± 20 sec retention time shift
LCS	1 per 20 samples or every 12 hours	+/- 20% of true value	Verify results; remake standard, rerun or clean system then recalibrate	Laboratory Analyst	80-120% recovery

* Reported quantitation level for each of the targeted compounds is 25 ng; however, the demonstrated limit of detection is 5 ng for each compound.

This information is derived from the Beacon laboratory SOP. **Modifications and laboratory SOPs will be included in project-specific QAPPs.

QAPP Worksheet #28e: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous

Analytical Group MEE

Analytical Method/SOP Reference RSK 175

QC Sample	Frequency/Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Field rinsate blank	1 per decon event per matrix; or 1 per day	≤ CRQL	Verify results; reanalyze	Laboratory analyst/FTL	<QL
Trip blank	1 per cooler	≤ CRQL	Verify results; reanalyze	Laboratory analyst/FTL	No analyte > QL No target analyte concentrations ≥ ½ QL
Temperature blank	1 per cooler	0 to 6 degrees C	Inform field crew to use adequate coolant	Laboratory analyst/FTL	≤ 10 degrees C for data validation
Method blank	Per method	≤ CRQL	Per method	Laboratory analyst/FTL	≤ CRQL
Split Samples and Field Duplicates	1 per 20 samples per matrix	None	Data assessor to inform SM if RPD OR ABS exceeds MPC	FTL	RPD ≤ 50% ABS ≤ QL
Standard Checks	1 per SDG per matrix	Per method	Per method	Laboratory analyst/FTL	80-120%

Note:

1. The number of QC samples is listed on Worksheet 20
2. ABS applied when sample or duplicate results are detected two times below CRQL or up to 2 times the CRQL.

QAPP Worksheet #28f: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous

Analytical Group TCL VOCs Low

Analytical Method/SOP Reference EPA 8260B

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank, Equipment Rinsate Blank, Trip Blank	Method Blank: 1/batch (20 samples) Equipment Rinsate Blank: 1 per week per sampling team Trip Blank: 1 per cooler of VOC samples	No target compound >QL, no common laboratory contaminants >5xQL	Identify source and attempt to eliminate. Reanalyze blank and affected samples (if sufficient sample remains). Alert project team if repeated or widespread exceedances impact project DQOs. Report results if sample results >20x blank result or sample results are non-detect.	Laboratory Analyst/Section Supervisor	No target compound >QL, no common laboratory contaminants >5xQL
Surrogates	Every sample	Compound specific, see laboratory internal limits	Check calculations and instrument performance; recalculate, reanalyze		Compound specific, see laboratory internal limits
LCS	1/batch (20 samples)		If sufficient sample is available, reanalyze samples. Qualify data as needed.		
MS/MSD	1/batch (20 samples)		Flag data. Discuss in narrative.		
Split Samples and Field Duplicates	1 per 20 samples	RPD ≤30% if both samples are >5xQL	Evaluate during data validation. Qualify data.	Data Validation Staff	RPD ≤30% if both samples are >5xQL

**QAPP Worksheet #28g: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix Aqueous

Analytical Group TCL VOCs Trace or Low/Medium (µg/L)**

Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Split Samples and Field Duplicates	1 per 20 samples	None		Notify SM and flag duplicate results	CDM Smith ASC and FTL	≤50% RPD when both samples ≥ CRQL otherwise ABS ≤ 5xQL	
Temperature Blank	1 per cooler	0 to 6 degrees C		Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation	
Trip Blank	1 per cooler	≤ CRQL		Verify results; re-analyze. Flag outliers	Laboratory analyst	≤ CRQL	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL	
Method Blank	1 every 12 hours	No analyte > CRQL*		Suspend analysis unit source recertified	DESA or EPA CLP Laboratory GC/MS Technician	No analyte > CRQL*	
Deuterated Monitoring Compounds	all samples	Vinyl chloride-d3	65-131 %R	Check calculations and instruments, reanalyze affected samples		Vinyl chloride-d3	65-131 %R
		Chloroethane-d5	71-131 %R			Chloroethane-d5	71-131 %R

*with the exception of methylene chloride, 2-butanone and acetone which can be up to 2 times the CRQL.

Indicate in project-specific QAPP the required VOC level.

QAPP Worksheet #28g
Analytical Quality Control and Corrective Action
(TCL VOCs Aqueous continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
TCL Low VOCs Continued							
Deuterated Monitoring Compounds [cont'd]	all samples	1,1-Dichloroethene-d2	55-104 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet recovery limits	DESA or EPA CLP Laboratory GC/MS Technician	1,1-Dichloroethene-d2	55-104 %R
		2-Butanone-d5	49-155 %R			2-Butanone-d5	49-155 %R
		Chloroform-d	78-121 %R			Chloroform-d	78-121 %R
		1,2-Dichloroethane-d4	78-129 %R			1,2-Dichloroethane-d4	78-129 %R
		Benzene-d6	77-124 %R			Benzene-d6	77-124 %R
		1,2-Dichloropropane-d6	79-124 %R			1,2-Dichloropropane-d6	79-124 %R
		Toluene-d8	77-121 %R			Toluene-d8	77-121 %R
		trans-1,3-Dichloropropene-d4	73-121 %R			trans-1,3-Dichloropropene-d4	73-121 %R
		2-Hexanone-d5	28-135 %R			2-Hexanone-d5	28-135 %R
		1,4-Dioxane-d8	50-150 %R			1,4-Dioxane-d8	50-150 %R
		1,1,2,2-Tetrachloroethane-d2	73-125 %R			1,1,2,2-Tetrachloroethane-d2	73-125 %R
		1,2-Dichlorobenzene-d4	80-131 %R			1,2-Dichlorobenzene-d4	80-131 %R
Internal Standards	all samples	60-140%		Check calculations and instruments, reanalyze affected samples		± 40% of response area, ± 20 sec retention time shift	

QAPP Worksheet #28g
Analytical Quality Control and Corrective Action
(TCL VOCs Aqueous continued)

Matrix Aqueous

Analytical Group TCL VOCs

Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Matrix Spike (Not Required)	1 per 20 samples or less (if requested)	1,1-Dichloroethene	61-145 %R	Flag outliers	DESA/ CLP Laboratory GC/MS Technician	1,1-Dichloroethene	61-145 %R
		Trichloroethene	76-127 %R			Trichloroethene	76-127 %R
		Benzene	71-120 %R			Benzene	71-120 %R
		Toluene	76-125 %R			Toluene	76-125 %R
		Chlorobenzene	75-130 %R			Chlorobenzene	75-130 %R
Matrix Spike Duplicate (Not Required)	1 per 20 samples or less (if requested)	1,1-Dichloroethene	0-14 %RPD	Flag outliers		1,1-Dichloroethene	0-14 %RPD
		Trichloroethene	0-11 %RPD			Trichloroethene	0-11 %RPD
		Benzene	0-14 %RPD			Benzene	0-14 %RPD
		Toluene	0-13 %RPD			Toluene	0-13 %RPD
		Chlorobenzene	0-13 %RPD			Chlorobenzene	0-13 %RPD

QAPP Worksheet #28h: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group TCL SVOCs
Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤50% RPD when both results ≥ CRQL otherwise ABS ≤ 5xQL
Temperature Blank	1 per cooler	0 to 6 degrees C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL
Method Blank	1 per ≤20 samples or batch	No analyte > CRQL*	Stop analysis, re-extract and reanalyze affected samples	DESA or CLP Laboratory GC/MS Technician	≤ CRQL

*with the exception of bis (2-Ethylhexyl) phthalate which can be up to 5 times the CRQL. (EPA CLP National Functional Guidelines, Final, July 2007)

QAPP Worksheet #28h
Analytical Quality Control and Corrective Action
(continued)

Laboratory QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
TCL SVOCs [cont'd]							
Deuterated Monitoring Compounds	all samples	Phenol-d5	39-106 %R	Check calculations and instruments, reanalyze affected samples; up to 4 DMCs may fail to meet recovery limits	DESA or CLP Laboratory GC/MS Technician	Phenol-d5	39-106 %R
		Bis(2-chloroethyl)ether-d8	40-105 %R			Bis(2-chloroethyl)ether-d8	40-105 %R
		2-Chlorophenol-d4	41-106 %R			2-Chlorophenol-d4	41-106 %R
		4-Methylphenol-d8	25-111 %R			4-Methylphenol-d8	25-111 %R
		Nitrobenzene-d5	43-108 %R			Nitrobenzene-d5	43-108 %R
		2-Nitrophenol-d4	40-108 %R			2-Nitrophenol-d4	40-108 %R
		2,4-Dichlorophenol-d3	37-105 %R			2,4-Dichlorophenol-d3	37-105 %R
		4-Chloroaniline-d4	1-145 %R			4-Chloroaniline-d4	1-145 %R
		Dimethylphthalate-d6	47-114 %R			Dimethylphthalate-d6	47-114 %R
		Acenaphthylene-d8	41-107 %R			Acenaphthylene-d8	41-107 %R
		4-Nitrophenol-d4	33-116 %R			4-Nitrophenol-d4	33-116 %R
		Fluorene-d10	42-111 %R			Fluorene-d10	42-111 %R
		4,6-Dinitro-2-methylphenol-d2	22-104 %R			4,6-Dinitro-2-methylphenol-d2	22-104 %R
		Anthracene-d10	44-110 %R			Anthracene-d10	44-110 %R
		Pyrene-d10	52-119 %R			Pyrene-d10	52-119 %R
		Benzo(a)pyrene-d12	32-121 %R			Benzo(a)pyrene-d12	32-121 %R
Internal Standards	all samples	50-100% of area, ± 20 second retention time shift		Check calculations/instrument s reanalyze affected samples	DESA or CLP Laboratory GC/MS Technician	50-100% of area, ± 20 second retention time shift	

QAPP Worksheet #28h
Analytical Quality Control and Corrective Action
(TCL SVOCs Aqueous continued)

Matrix Aqueous

Analytical Group TCL SVOCs

Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Matrix Spike (Not Required)	1 per 20 samples or less (if requested)	Phenol	12-110 %R	Flag outliers	DESA/ CLP Laboratory GC/MS Technician	Phenol	12-110 %R
		2-Chlorophenol	27-123 %R			2-Chlorophenol	27-123 %R
		N-Nitroso-di-n-propylamine	41-116 %R			N-Nitroso-di-n-propylamine	41-116 %R
		4-Chloro-3-methylphenol	23-97 %R			4-Chloro-3-methylphenol	23-97 %R
		Acenaphthene	46-118 %R			Acenaphthene	46-118 %R
Matrix Spike Duplicate (Not Required)	1 per 20 samples or less (if requested)	4-Nitrophenol	29-94 %R	Flag outliers		4-Nitrophenol	29-94 %R
		2,4-Dinitrotoluene	24-96 %R			2,4-Dinitrotoluene	24-96 %R
		Pentachlorophenol	9-103 %R			Pentachlorophenol	9-103 %R
		Pyrene	26-127 %R			Pyrene	26-127 %R
		Phenol	0-42 %RPD			Phenol	0-42 %RPD

QAPP Worksheet #28i: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous

Analytical Group

PAHs and Alkyl PAHs

Analytical Method/SOP Reference

EPA 8270C/D modified

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	per extract batch	Per laboratory SOP	Investigate and correct per laboratory SOP	Laboratory Analyst	No analyte > QL
MS/MSD and laboratory duplicate	1 per 20 samples	Per laboratory SOP	Investigate and correct; reanalyze affected samples. Flag outliers	Laboratory Analyst	± 20% of mean if sample concentration >10x DL
On-going Precision Recovery (ORP)	1 per 20 samples or with each group of field samples	Per laboratory SOP	Investigate and correct. Document in data summary	Laboratory Analyst	50-200% R or per laboratory SOP (TBD when the laboratory is assigned)
Surrogate	Every field and QC sample, standards, blanks	Per laboratory SOP	Identify source of problem, make other adjustments and reanalyze	Laboratory Analyst	15-130% R - See Laboratory SOP
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5*QL) or ABS<QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

Modifications and laboratory SOPs will be included in project-specific QAPPs.

QAPP Worksheet #28j: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group PCDD/PCDF
Analytical Method/SOP Reference EPA 1613B

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per 20 samples	TCDD/F <0.5 pg/sample, PeCDD/F, HxCDD/F, HpCDD/F <1.0 pg/sample, OCDD/F <5 pg/sample unless sample concentrations > 10* blank levels (per SOP)	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise redigest and reanalyze	Laboratory Analyst	No analyte > QL
Laboratory Duplicate	1 per 20 samples	± 20% mean for concentrations >10*QL	Investigate and correct; Flag outliers	Laboratory Analyst	± 20% of mean if sample concentration >10x DL ¹
Initial Precision and Recovery	Prior to sample analysis	Per laboratory SOP	Investigate and correct	Laboratory Analyst	Per method/laboratory SOP
Ongoing Precision and Recovery	1 per batch of 20 samples	Per laboratory SOP or 70-130%R	Identify source of problem, make other adjustments; redigest if needed and reanalyze	Laboratory Analyst	Individual laboratory established limits per SOP
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
Surrogates	1 per 20 samples	25-120%R-warning limit 17-130%R-control limit	Investigate and correct	Laboratory Analyst	25-120%R-warning limit 17-130%R-control limit
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

1. The DLs referenced in laboratory SOP are equivalent to the QLs or sample reporting limits.

QAPP Worksheet #28k: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous

Analytical Group

PCDD/PCDF

Analytical Method/SOP Reference

EPA 8290 or DLM02.2

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per 20 samples	No analyte > CRQL (DLM02.2) No signal >0.2 ppt for water samples [8290]	Assess data/correct problem, redigest and reanalyze blank and associated samples	Laboratory Analyst	No analyte > CRQL (DLM02.2) No signal >0.2 ppt for water samples [8290]
Laboratory Duplicate	1 per 20 samples	± 20% mean for concentrations >10*QL or RPD<50%	Investigate and correct; Flag outliers	Laboratory Analyst	± 20% of mean if sample concentration >10x DL ² or RPD <50%
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
LCS [DLM02.2]	1 per 20 samples	70-130%R; Individual limits per Table 6 in DLM02.2 [up to 3 failures allowed]	Correct problem and reanalyze. if out, re-prepare blank and samples.	Laboratory Analyst	70-130%R; Individual limits per Table 6 in DLM02.2 [up to 3 failures allowed]
MS (method 8290)	1 per 20 samples	Individual laboratory established limits per SOP (No criteria listed in 8290)	Assess data for analytical error or matrix effect. Analyze LCS for failed analytes. Report problem to project chemist.	Laboratory Analyst	50-150%R
Internal Standards	1 sample/standard	40-135%R or per laboratory SOP if internal standard method is used	Investigate and correct	Laboratory Analyst	40-135%R
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

QAPP Worksheet #28I: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix
Analytical Group
Analytical Method/SOP Reference

Aqueous
TCL Pesticides
SOM01.2

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Split Samples and Field Duplicates	1 per 20 samples	None		Notify SM and flag duplicate results	CDM Smith ASC and SM	≤50% RPD when both samples ≥ CRQL otherwise ABS ≤ 5xQL	
Temperature Blank	1 per cooler	0 to 6 degrees C		Laboratory - inform RSCC/CDM Smith and note in data narrative. CDM Smith - check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ QL No target analyte concentrations ≥ 1/2 LOQ	
Method Blank	1 per ≤20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis; re-extract and reanalyze blank and affected samples	DESA or CLP Laboratory GC/ECD Technician	Analyte ≤ CRQL	
Matrix Spike	1 per ≤20 samples; if requested	gamma-BHC (Lindane)	56-123 %R	Flag outliers	DESA or CLP Laboratory GC/ECD Technician	gamma-BHC	56-123 %R
		Heptachlor	40-131 %R			Heptachlor	40-131 %R
		Aldrin	40-120 %R			Aldrin	40-120 %R
		Dieldrin	52-126 %R			Dieldrin	52-126 %R
		Endrin	56-121 %R			Endrin	56-121 %R
		4,4'-DDT	38-127 %R			4,4'-DDT	38-127 %R
Matrix Spike Duplicate	1 per ≤20 samples; if requested	gamma-BHC	0-15 %RPD	Flag outliers		gamma-BHC	0-15 %RPD
		Heptachlor	0-20 %RPD			Heptachlor	0-20 %RPD
		Aldrin	0-22 %RPD			Aldrin	0-22 %RPD
		Dieldrin	0-18 %RPD			Dieldrin	0-18 %RPD
		Endrin	0-21 %RPD			Endrin	0-21 %RPD
		4,4'-DDT	0-27 %RPD			4,4'-DDT	0-27 %RPD

QAPP Worksheet #28I
Analytical Quality Control and Corrective Action
(continued)

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
LCS [cont'd]	1 per 20 samples	Heptachlor epoxide	50-150 %R	Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	Heptachlor epoxide	50-150 %R
		Dieldrin	30-130 %R			Dieldrin	30-130 %R
		gamma-BHC	50-120 %R			gamma-BHC	50-120 %R
		4,4'-DDE	50-150 %R			4,4'-DDE	50-150 %R
		Endrin	50-120 %R			Endrin	50-120 %R
		Endosulfan sulfate	50-120 %R			Endosulfan sulfate	50-120 %R
		gamma-Chlordane	30-130 %R			gamma-Chlordane	30-130 %R
Surrogate	all samples	30-150 %R		Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	30-150 %R	

Matrix	Aqueous
Analytical Group	Chlorinated Pesticides
Analytical Method/SOP Reference	EPA 1699

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	per extract batch	<QL	Investigate and correct per laboratory SOP	Laboratory Analyst	No analyte > QL
Laboratory Duplicate	1 per 20 samples	Per laboratory SOP	Investigate/correct; Flag outliers		± 20% of mean if sample concentration >10x DL
Initial Calibration	Prior to sample analysis	Per laboratory SOP	Investigate and correct		Per laboratory SOP
Calibration Verification/ Certified Reference Material (CRM)	Beginning of each 12-hour shift; Periodically at least quarterly	Per laboratory SOP	Check standards; recalibrate if required		Laboratory SOP/ CRM-TBD
Ongoing Precision and Recovery/ MS	1 per batch of 20 samples prior to sample analysis	50-150% R	Identify source of problem, make other adjustments as per laboratory SOP	Laboratory Analyst	See method limits; for individual compound limits /see laboratory SOP*
Surrogate	Every field and QC sample, standards, blanks	10-250% R	Evaluate data for interferences and apply corrective action as per laboratory SOP		
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

CDM Smith RAC 2 Region 2

QAPP Worksheet #28n: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Organochlorine Pesticides
Analytical Method/SOP Reference EPA 8081A

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method blank	1 per batch (up to 20 samples)	No Target Compounds >QL; no common laboratory contaminants >5xQL; or compounds <5x sample concentration	Identify source and attempt to eliminate. Re-extract and/or reanalyze blank and affected samples (if sufficient sample remains). Alert Project Team if repeated or widespread exceedances impact project DQOs. Report results if sample results >5x blank result or sample results ND.	Laboratory Analyst/Section Supervisor	Not target compound > QL
Equipment Rinstat Blank	1 per week per sampling team	No Target Compounds >QL; no common laboratory contaminants >5xQL; or compounds <5x sample concentration	Evaluate impacts on data on a case-by-case basis	Data validation staff	No target Compounds >QL; no common laboratory contaminants >5xQL; or compounds <5x sample concentration
Surrogates	Every sample	Laboratory specified	Check calculations and instrument performance; recalculate; reanalyze	Laboratory Analyst/Section Supervisor	Laboratory specified
LCS	1 per batch (up to 20 samples)	50%-150%R	Reprepare and/or reanalyze affected samples. Qualify data as needed.	Laboratory analyst/Section Supervisor	50%-150%R
MS/MSD	1 per batch (up to 20 samples)	50%-150%R RPD≤35%	Flag data. Discuss in narrative. Reprepate and reanalyze to verify matrix interference for recoveries <10%.	Laboratory analyst/Section Supervisor	50-150%R; RPD≤35%
Split Samples and Field Duplicates	1 per 20 field samples	RPD ≤50% if both results are >5x QL	Evaluate during data validation.	Data validation staff.	RPD≤40% if both samples are >5x QL
PE Sample	1 per method per year	Supplier Certified Limits	Provide feedback to laboratory/laboratory reviews data	Project Chemist/Laboratory Staff	Supplier Certified Limits

QAPP Worksheet #28o: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Organochlorine, organophosphate Pesticides
Analytical Method/SOP Reference EPA 1699

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method blank	1 per batch (up to 20 samples)	No Target Compounds >QL	Re-extract /or reanalyze blank and affected samples (if sufficient sample remains). Alert Project Team if repeated or widespread exceedances impact project DQOs. Report results if sample results >5x blank result or sample results ND. If contamination is widespread, analysis must stop until contamination is eliminated or reduced.	Laboratory Analyst/Section Supervisor	Not target compound > QL
Equipment Rinstat Blank	1 per week per sampling team	No Target Compounds >QL; no common laboratory contaminants >5xQL; or compounds <5x sample concentration	Evaluate impacts on data on a case-by-case basis	Data validation staff	No Target Compounds >QL; no common laboratory contaminants >5xQL; or compounds <5x sample concentration
LCS	1 per batch (up to 20 samples)	50%-150%R	Reprepare and/or reanalyze affected samples if sufficient sample is available. Qualify data as needed.	Laboratory analyst/Section Supervisor	50%-150%R
Labeled Isotope Dilution Internal Standards	Spiked into every sample and QC sample	Laboratory Specified	Check all calculations for error; ensure that instrument performance is acceptable; recalculate the data and/or reanalyze the extract if either of the above checks reveals a problem.	Laboratory analyst/Section Supervisor	Laboratory Specified
Split Samples and Field Duplicates	1 per 20 field samples	RPD ≤50% if both results are >5x QL	Evaluate during data validation.	Data validation staff.	RPD≤40% if both samples are >5x QL
PE Sample	1 per method per year	Supplier Certified Limits	Provide feedback to laboratory/laboratory reviews data	Project Chemist/Laboratory Staff	Supplier Certified Limits

QAPP Worksheet #28p: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Herbicides, Insecticides, and Organophosphate Pesticides et al
Analytical Method/SOP Reference EPA 8141A/B, 8321A/B, 633/632

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Temperature blank	1 per cooler	0 to 6 degrees C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Method blank	Per Analytical Method	≤ QL	Per Method	Laboratory analyst	≤ QL
Split Samples and Field Duplicates	1 per 20 field samples	NA	Data assessor to inform SM if RPD or ABS exceeds MPC		RPD≤40% if both samples are >5x QL
MS/MSD and LCS	1 per 20 samples	Per Method 8321	Per Method	Laboratory analyst	50-110%; RPD 20
MS/MSD and LCS	1 per 20 samples	Per Method 8141	Per Method	Laboratory analyst	MS 25-155%, LCS 30-155%, RPD 60

Matrix	Aqueous
Analytical Group	Chlorinated Herbicides
Analytical Method/SOP Reference	EPA 8151A

CDM Smith RAC 2 Region 2

QAPP Worksheet #28r: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group TCL PCBs
Analytical Method/SOP Reference SOM01.2

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Split Samples and Field Duplicates	1 per 20 samples	None		Notify SM and flag duplicate results	CDM Smith ASC and SM	50% RPD when PCBs in both samples $\geq$ QL Otherwise ABS $\leq$ 5xQL	
Temperature Blank	1 per cooler	0 to 6 degrees C		Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	$\leq$ 10 degrees C for data validation	
Field Blank	1 per decontamination event not to exceed 1 per day	$\leq$ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	$\leq$ CRQL No target analyte concentrations $\geq$ $\frac{1}{2}$ CRQL	
Method Blank	1 per $\leq$ 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis –reextract and reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	No analyte > CRQL No target analyte concentrations $\geq$ $\frac{1}{2}$ CRQL	
Matrix Spike	1 per $\leq$ 20 samples; if requested	Aroclor-1016	29-135 %R	Flag outliers	DESA or CLP Laboratory GC/ECD Technician	Aroclor-1016	29-135 %R
		Aroclor-1260	29-135 %R			Aroclor-1260	29-135 %R
Matrix Spike Duplicate		Aroclor-1016	0-15 %RPD			Aroclor-1016	0-15 %RPD
		Aroclor-1260	0-20 %RPD			Aroclor-1260	0-20 %RPD
LCS	1 per $\leq$ 20 samples	Aroclor-1016	50-150 %R	Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	Aroclor-1016	50-150 %R
		Aroclor-1260	50-150 %R			Aroclor-1260	50-150 %R
Surrogate	all samples	30-150 %R		Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	30-150 %R	

QAPP Worksheet #28s: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group PCB Congeners
Analytical Method/SOP Reference EPA 1668A

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per 20 samples	Concentration < 2 pg, 10 pg or 50 pg/sample-See SOP. Sum of all congeners < 300 pg /sample unless sample concentrations > 10* blank levels	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise redigest and reanalyze	Laboratory Analyst	No analyte > QL
Analysis (Laboratory) Duplicate	1 per 20 samples	± 20% mean for concentrations >10*QL	Flag outliers	Laboratory Analyst	RPD ≤ 40% for concentrations >10x DL ¹ ; otherwise ABS<QL
Certified Reference Material or Quality Control Sample	Periodically at least quarterly	50-150%R;	Check standards; recalibrate if required	Laboratory Analyst	70-130%R;
Calibration Verification Sample	Beginning of each 12-hour shift	70-130%R;	Adjust and/or recalibrate	Laboratory Analyst	70-130%R
Initial Precision and Recovery	Prior to sample analysis	Per laboratory SOP	Investigate and correct	Laboratory Analyst	60-140%R ≤ 40% RSD
Ongoing Precision and Recovery	1 per batch of 20 samples	Per laboratory SOP	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	Laboratory Analyst	Warning 70-130%R; Accept 50-150%R
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	RPD ≤ 40%; ABS<QL for samples <5x QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

Notes:

1. The DLs referenced in the laboratory SOP are equivalent to the QLs or sample reporting limits.

QAPP Worksheet #28t: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous

Analytical Group TAL Metals, Hardness

Analytical Method/SOP Reference ISM01.3 or current method

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤50%RPD, ABS ≤ 5xCRQL when any result ≤ CRQL
Temperature Blank	1 per cooler	0 to 6 °C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL
Preparation Blank	1 per ≤20 samples	No constituent > CRQL	Suspend analysis rectify source; redigest and reanalyze affected samples	DESA or CLP Laboratory ICP Technician	No constituent > CRQL
Spike	1 per ≤20 samples	75-125%R*	Flag outliers	DESA or CLP Laboratory ICP Technician	75-125%R*
Laboratory Duplicate	1 per ≤20 samples	± 20% RPD**	Flag outliers	DESA or CLP Laboratory ICP Technician	≤20% RPD**
Post-Digestion Spike	after any analyte (except Ag) fails spike %R	75-125%R	Flag outliers	DESA or CLP Laboratory ICP Technician	75-125%R
Interference Check Sample [ICP Analysis Only]	Beginning of each run	± CRQL + true value or ± 20% of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory ICP Technician	± 2 times CRQL of true value or ± 20% of true value, whichever is greater
LCS	1 per ≤20 samples	70-130%R	Suspend analysis until source rectified; redigest and reanalyze affected samples	DESA or CLP Laboratory ICP Technician	70-130%R

*except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken

** except when the sample and/or duplicate concentration is less than 5 times the CRQL, then ± CRQL.

QAPP Worksheet #28u: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous (Total and dissolved)

Analytical Group

TAL Inorganic Metals

Analytical Method/SOP Reference

EPA 6020/6010

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Notify SM and address in data quality assessment	CDM Smith ASC and SM	≤40% RPD for results ≥5QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Note in laboratory narrative. CDM Smith will check packing procedure and increase coolant	CDM Smith field task leader (FTL)	≤ 10 degrees C for data validation
Field Equipment Blank	1 per sampling event	≤ QL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ QL
Preparation Blank	1 per 20 samples	No constituent > QL	Suspend analysis fix source; redigest and reanalyze affected samples (see laboratory SOP)	Laboratory inductively coupled plasma (ICP) analyst	No constituent > QL
Matrix Spike	1 per 20 samples/event	75-125%R*	Flag outliers and run post digestion spike or dilution test	Laboratory ICP analyst	75-125%R*
Laboratory Duplicate or MS	1 per 20 samples	± 20% RPD**	Flag outliers	Laboratory ICP analyst	± 20% RPD**
Post-Digestion Spike	If serial dilution fails criteria	80-120%R	Flag outliers and run dilution test	Laboratory ICP analyst	75-125%R
Serial dilution test (1:5)	1 per batch	Dilution result ±10% of original when original result >10QL	Note chemical or physical interference effect in narrative	Laboratory ICP analyst	Dilution result ±10% of original result
Interference Check Sample	Beginning of run and /or every 12 hours	20% or 50% of true value (see laboratory SOP)	Check calculations and instruments, reanalyze affected samples (see laboratory SOP)	Laboratory ICP analyst	± 2 times QL of true value or ± 20% of true value, whichever is greater
LCS	1 per 20 samples	80-120%R	Re-run once; then redigest and reanalyze affected samples once	Laboratory ICP analyst	80-120%R

Notes:

* and ** except when the sample concentration is greater than 10 times the IDL, then disregard the recoveries; no data validation action taken

** - (include ABS criteria)

**except when the sample and/or duplicate concentration is less than 5 times the CRQL, then ± CRQL.

QAPP Worksheet #28v: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix**Analytical Group****Analytical Method/SOP Reference**

Aqueous

TAL – Total Mercury

ISM01.3, SW-846 7470 or current method– Cold Vapor Atomic

Absorption (CVAA)

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤50% RPD, ABS ≤ 5×CRQL when either result ≤ CRQL
Temperature Blank	1 per cooler	0 to 6 degrees C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL
Preparation Blank (PB)	1 per ≤20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	DESA or CLP Laboratory Technician	No analyte > CRQL
Laboratory Duplicate	1 per ≤20 samples	± 20% RPD*	Flag outliers	DESA or CLP Laboratory Technician	± 20% RPD
Spike Sample	1 per ≤20 samples	75 – 125 %R	Flag outliers	DESA or CLP Laboratory Technician	75 – 125 %R

*Reference EPA Region 2 SOP No. HW-2c, Revision 15 - (include ABS criteria)

QAPP Worksheet #28w: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Mercury (total and dissolved)
Analytical Method/SOP Reference EPA 1631 – Atomic fluorescence spectroscopy

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	20% RPD	Notify SM and address in data quality report	CDM Smith ASC and SM	≤ 40% RPD (for results ≥ 5QL) or ABS≤QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Note in laboratory narrative. CDM Smith will use more coolant; check packing procedure	CDM Smith FTL	≤ 10 degrees C for data validation
Field Rinsate Blank	1 per decontamination event not to exceed 1 per day	≤ QL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ QL
Preparation Blank (PB)	1 per 20 samples	No analyte > QL (greater of 0.4 ng or <0.1xsample)	Suspend analysis; redigest and reanalyze if sample<10*blank result	Laboratory Analyst	No analyte > QL
Laboratory duplicate	1 per 20 samples	Per laboratory SOP	Investigate and correct; Flag outliers; Note in case narrative. Multiple failures require re-distillation and reanalysis.		≤ 35% RPD if result >5QL
Certified Reference Material (Quality Control Sample) or Ongoing Precision and Recovery Samples	1 per 20 samples or 12-hour shift	Per laboratory SOP	Check calculations and instruments, reanalyze affected samples. Report in case narrative.		70-130%R for OPR/CRM <20 RSD for IPR 75-125%R for IPR
MS/MSD	1 per 20 samples or with each group of field samples	Per laboratory SOP	Investigate matrix effects and note in data narrative.		70-130%R RPD ≤35% (30 per method)

QAPP Worksheet #28x: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Methyl Mercury (total and dissolved)
Analytical Method/SOP Reference EPA 1630

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	RPD <35% (method 1630)	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
Temperature Blank	1 per cooler	0 to 6 degrees C	Note in laboratory narrative. CDM Smith will use more coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation
Preparation Blank	1 per 20 samples or batch	< 0.0001 ng/L per method or Per laboratory SOP	Suspend analysis until source rectified; re-distill and reanalyze affected samples if results are <10 times the blank	Laboratory Analyst	No result > QL
LCS	1 per 20 samples batch or per day	Per limits in LIMS	Stop analysis and recalibrate or report data with an appropriate qualifier. Document on CAR form.	Laboratory Analyst	Per limits in LIMS
Quality Control Sample	1 per 20 samples batch or 1 per day mid batch	Per laboratory SOP – or TBD	Investigate and correct; Flag outliers; Note in case narrative. Multiple failures require re-distillation and reanalysis.	Laboratory Analyst	Per laboratory SOP
Initial and Ongoing Precision and Recovery Samples	1 per 20 samples or group of field samples at end of run or 12-hour shift	Per laboratory SOP	Check calculations and instruments, recalibrate for IPR and reanalyze affected samples for OPR	Laboratory Analyst	77-123%R of true value for OPR 79-121%R for IPR per method
MS/MSD	1 per 20 samples or with each group of field samples	Per limits in LIMS	Investigate matrix effects and note in data narrative	Laboratory Analyst	75-125%R
					RPD ≤25%

QAPP Worksheet #28y: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous

Analytical Group

TAL - Total Cyanide

Analytical Method/SOP Reference

ISM01.3 or current method – Colorimeter or Spectrophotometer

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	$\leq 50\%$ RPD, $ABS \leq 5 \times CRQL$ when either result $\leq CRQL$
Temperature Blank	1 per cooler	0 to degrees 6 C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	$\leq CRQL$	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	$\leq CRQL$
Preparation Blank (PB)	1 per ≤ 20 samples	No analyte $> CRQL$	Suspend analysis; redistill and reanalyze	DESA or CLP Laboratory Technician	No analyte $> CRQL$
Laboratory Duplicate	1 per ≤ 20 samples	$\pm 20\%$ RPD*	Flag outliers	DESA or CLP Laboratory Technician	$\leq 20\%$ RPD
Spike Sample	1 per ≤ 20 samples	75 – 125 %R	Flag outliers	DESA or CLP Laboratory Technician	75 – 125 %R

*Reference EPA Region 2 SOP No. HW-2c, Revision 15 - (include ABS criteria)

QAPP Worksheet #28z: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix: Aqueous

Analytical Group: TPH (DRO and GRO)

Analytical Method / SOP Reference: EPA 8015 B/C

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	$\leq 50\%$ RPD, $ABS \leq 2 \times CRQL$ when either result $\leq CRQL$
Temperature blank	1 per cooler	0 to 6 degrees C	Inform field crew to use adequate coolant	Laboratory analyst/FTL	≤ 10 degrees C for data validation
Method Blank	1 per 20 samples	$\leq CRQL$	Per SW846	Laboratory analyst/FTL	$\leq CRQL$
LCS	1 per 20 samples	80-120%	Per SW846	Laboratory analyst/FTL	80-120%
Surrogates	For each sample and standard	75-125%	Per SW846	Laboratory analyst	Per Method
MS/MSD	1 per 20 samples	65-135% R	Per SW846	Laboratory analyst	RPD $\pm 30\%$
Field rinsate blank	1 per decontamination event per matrix; or 1 per day	$\leq CRQL$	Verify results; reanalyze	Laboratory analyst/FTL	$\leq CRQL$

QAPP Worksheet #28aa: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous

Analytical Group

Field Test Kits (Ferrous iron, hexavalent chromium, sulfate)

Analytical Method/SOP Reference

HACH 8146, 8023, and 8051

Laboratory QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Blank Check	Daily	No analyte > QL	Suspend analysis; re-prep and reanalyze	Field analyst	No analyte > QL
Field Duplicate	1 per 20 samples	None	Reanalyze. Re-perform calibration check if still outlying.	Field analyst	≤ 50% RPD for samples
Quality Control Sample check	1 per 20 samples	None	Identify source of problem, correct and reanalyze	Field analyst	80-120%R

QAPP Worksheet #28ab: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Wet Chemistry Anions-Ion Chromatography
Analytical Method/SOP Reference EPA 300

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank (PB)	1 per 20 samples	Result $\leq$ 1/2QL No analyte > QL	Suspend analysis; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Temperature Blank	1 per cooler	0 to degrees 6 C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	$\leq$ 10 degrees C for data validation
Laboratory Duplicate	1 per 20 samples	$\pm$ 20% RPD	Flag outliers	DESA or subcontract Laboratory Analyst	$\leq$ 40% RPD
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	$\leq$ 50% RPD, ABS $\leq$ 5xQL when either result $\leq$ QL
Spike Samples	1 per 20 samples	80-120%R-Method A of 300 75 – 125 %R-Method B of 300.	Flag outliers	DESA or subcontract Laboratory Analyst	75 – 125%R
Quality Control Sample	Quarterly	90-110%R	Identify source of problem, correct and reanalyze	DESA or subcontract Laboratory Analyst	90-110%R
Laboratory Fortified Blank	1 per 10 samples-method 300 or 1 per 20 samples (Specify in project-specific QAPP)	80-120%R	Flag outliers	DESA or subcontract Laboratory Analyst	80-120%R

Note:

1. This method applies to bromide, chloride, fluoride, nitrate, nitrite, nitrate/nitrite, and orthophosphate.
2. Control limits for the laboratory fortified blanks must be documented and provided.

QAPP Worksheet #28ac: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous

Analytical Group Wet Chemistry-Anions by Colorimetry; Spectrophotometry

Analytical Method/SOP Reference MCAWW Methods

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank (PB)	1 per 20 samples	None	Suspend analysis; check; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Increase coolant	CDM Smith FTL	≤ 10 degrees C for data validation
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Laboratory Duplicate	1 per 20 samples	None	Flag outliers	DESA or Subcontract Laboratory Analyst	≤ 40% RPD
Spike Samples	1 per 20 samples	None	Flag outliers	DESA or subcontract Laboratory Analyst	75 – 125%R
LCS	After calibration, every 20 samples and at end of day	None	Identify source of problem, correct and reanalyze	DESA or Subcontract Laboratory Analyst	80-120%R
Carbonate-bicarbonate standard-Alkalinity	1 per batch	± 10% of true value	Re-prep and re-analyze; recalibrate if still outlying	DESA or Subcontract Laboratory Analyst	± 20% of true value

Note:

1. Spectrophotometry can be applied to VOCs, SVOCs, hexavalent chromium, sulfate, sulfide, nitrite, ferrous iron, PAHs, PCB congeners, PCDD/PCDF, cyanide, metals, and mercury.
2. Colorimetry can be applied to hardness, hexavalent chromium, cyanide, ferrous iron, nitrate, nitrate/nitrite, sulfide, COD, sulfate, orthophosphorus, phosphorus, phosphate, alkalinity, and ammonia.
3. Control limits for the LCS must be documented and provided.

**QAPP Worksheet #28ad: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix

Aqueous

Analytical Group

Wet Chemistry-Titration or Potentiometer

Analytical Method/SOP Reference

MCAWW Methods

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank (PB)/	1 per 20 samples	None	Suspend analysis; check; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM ASC	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Laboratory Duplicate	1 per 20 samples	None	Flag outliers	DESA or subcontract Laboratory Analyst	≤ 40% RPD
LCS	After calibration, every 20 samples and at end of day	None	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	DESA or subcontract Laboratory Analyst	80-120%R
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation

Note:

1. Titrimetric analysis can be applied to AVS SEM VOCs, hardness, nitrate, alkalinity, bromide, ammonia, TKN, sulfide, COD, and sulfate.
2. Potentiometric analysis can be applied to ammonia.
3. Control limits for the LCS must be documented and provided.

QAPP Worksheet #28ae: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Hexavalent Chromium (Dissolved)
Analytical Method/SOP Reference SM3500 Cr-B and HACH 8023 Modified

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank (PB)/	1 per 20 samples	Per laboratory SOP	Suspend analysis; check; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM ASC	≤40% RPD if concentrations >5*QL
Laboratory Duplicate	1 per 20 samples	Per laboratory SOP	Flag outliers	DESA Laboratory Analyst	40% RPD
MS	1 per 20 samples		Investigate, re-prep and reanalyze		80 – 120 %R
Spike Samples	1 per 20 samples	None	Flag outliers	DESA Laboratory Analyst	75 – 125 %R
LCS	After calibration, every 20 samples and at end of day	Per laboratory SOP	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	DESA or subcontract Laboratory Analyst	80-120%R
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation

Notes:

- Control limits for the LCS must be documented and provided.
- Modifications and laboratory SOPs will be included in project-specific QAPPs.**

QAPP Worksheet #28af: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous

Analytical Group

Hexavalent Chromium

Analytical Method/SOP Reference

SW-846, 7196A

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank	1 per 20 samples	None	Suspend analysis; check; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM ASC	≤50% RPD
Laboratory Duplicate	1 per 20 samples	None	Flag outliers	DESA or subcontract Laboratory Analyst	≤ 25% RPD
Spike Samples	1 per 20 samples	None	Flag outliers	DESA or subcontract Laboratory Analyst	75 – 125%R
LCS	After calibration, every 20 samples and at end of day	None	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	DESA or subcontract Laboratory Analyst	80-120%R
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation

Note:

- Control limits for the LCS must be documented and provided.

QAPP Worksheet #28ag: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous

Analytical Group

Wet Chemistry-TSS

Analytical Method/SOP Reference

Standard Method 2540D

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation/ Method Blank	1 per batch of 20 samples	None	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise reanalyze and qualify data	DESA	No analyte > QL
Laboratory Duplicate	1/20 or per batch	Per laboratory SOP, $\leq$ 20 RPD	Flag outliers	DESA	$\leq$ 20 RPD; ABS $\leq$ QL for samples <5x QL
Split Samples and Field Duplicates	1 per 20 samples or per event	None	Data assessor to inform SM if MPC is exceeded; flag results in report	CDM Smith ASC	$\leq$ 40% RPD if > 5xQL otherwise ABS $\leq$ QL
LCS or Quality Control Sample	2 per batch of 20 samples	Average Recovery within the standard manufacture's limits or method limits; % RPD < 20	Identify source of problem, re-prepare and re-analyze or flag outliers	DESA	80-120%R or as stipulated by manufacturer or laboratory
LCS or Quality Control Sample Duplicate				DESA	$\leq$ 20% RPD
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	DESA	$\leq$ 10 degrees C for data validation

QAPP Worksheet #28ah: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Wet Chemistry –TDS
Analytical Method/SOP Reference SM2540C

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation/ Method Blank	1 per batch of 20 samples	None	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise reanalyze and qualify data	DESA	No analyte > QL
Laboratory Duplicate	1/20 or per batch	Per laboratory SOP, $\leq$ 20 RPD	Flag outliers	DESA	$\leq$ 20 RPD; ABS $\leq$ QL for samples <5x QL
Split Samples and Field Duplicates	1 per 20 samples or per event	None	Data assessor to inform SM if MPC is exceeded; flag results in report	CDM ASC	$\leq$ 40% RPD if > 5xQL otherwise ABS $\leq$ QL
Laboratory Control Sample or Quality Control Sample	2 per batch of 20 samples	Average Recovery within the standard manufacture's limits or method limits; % RPD < 20	Identify source of problem, re-prepare and re-analyze or flag outliers	DESA	80-120%R or as stipulated by manufacturer or laboratory
Laboratory Control Sample or Quality Control Sample Duplicate				DESA	$\leq$ 20% RPD
Temperature Blank	1 per cooler	0 to 6 degrees Celsius	Note outlier in laboratory narrative. Inform CDM of failure and need for additional coolant; check packing procedure	DESA	$\leq$ 10 degrees Celsius for data validation

QAPP Worksheet #28ai: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous

Analytical Group Wet Chemistry-Gravimetry

Analytical Method/SOP Reference MCAWW Methods

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank (PB)/ Method Blank	1 per 20 samples	None	Suspend analysis; check; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Laboratory Duplicate	1 per 20 samples	None	Flag outliers	DESA or subcontract Laboratory Analyst	≤ 40% RPD
LCS	After calibration, every 20 samples and at end of day	None	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	DESA or subcontract Laboratory Analyst	80-120%R
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation

Note:

1. Gravimetry can be applied to sulfate and TDS.
2. Control limits for the LCS must be documented and provided.

QAPP Worksheet #28aj: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous

Analytical Group

Wet Chemistry - BOD

Analytical Method/SOP Reference

SM5210B

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Water Control Blank	1 per 20 samples	BOD <0.2 mg/L	Suspend analysis; check; redigest and reanalyze	DESA or subcontract Laboratory Analyst	BOD <0.2 mg/L
Seeded Water Blank	1 per batch	DO uptake 0.6-1 mg/L	Verify results and reanalyze	DESA or subcontract Laboratory Analyst	DO uptake 0.6-1 mg/L
Laboratory Duplicate	1 per 20 samples	None	Flag outliers	DESA or subcontract Laboratory Analyst	None
Glucose glutamic acid check	After calibration, every 20 samples	Within laboratory control limits (mean $\pm$ 3 standard deviations)	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	DESA or subcontract Laboratory Analyst	Within laboratory control limits (mean $\pm$ 3 standard deviations)
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	$\leq$ 10 degrees C for data validation

QAPP Worksheet #28ak: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous

Analytical Group Wet Chemistry – TOC-Carbon analyzer + IR or FID detector

Analytical Method/SOP Reference MCAWW Method 415.2, SW-846 9060 or SM5310B

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per 20 samples	< QL	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Laboratory Duplicate	All samples duplicated	≤ 20% RPD; ±QL for samples <5x QL	Flag outliers	DESA or subcontract Laboratory Analyst	≤ 40% RPD
Matrix Spike	1 per batch of 20 samples	75-125%R	Flag outliers	DESA or subcontract Laboratory Analyst	75-125%R
LCS	1 per batch of 20 samples	80-120%R	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	DESA or subcontract Laboratory Analyst	80-120%R
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	≤50% RPD ABS ≤ 5xQL when either result ≤ QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation

Note: 1. Control limits for the LCS must be documented and provided.

QAPP Worksheet #28a: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Wet Chemistry-DOC
Analytical Method/SOP Reference SM 5310B

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank /Calibration Blank	1 per 20 samples	< QL	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise redigest /reanalyze. Flag results or modify reporting limit.	DESA	No analyte > QL
ICV/CCV	1 per batch of 10 samples	85-115%R	Suspend analysis, find cause, and reanalyze associated samples	DESA	85-115%R
Laboratory Duplicate	All samples duplicated	≤ 20% RPD if values >5QL; otherwise ABS≤5QL	Flag outliers	DESA	RPD ≤ 20% if values >5QL; otherwise ABS≤5QL
Matrix Spike	1 per batch of 20 samples	80-120%R	Flag outliers	DESA	80-120%R
LCS/ Quality Control Sample	1 per batch of 20 samples	80-120%R	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze or flag outliers	DESA	80-120%R or as stipulated by manufacturer or laboratory
LCS or Quality Control Sample Duplicate		RPD ≤ 20%			RPD ≤ 20%
Split Samples and Field Duplicates	1 per 20 samples or per event	None	Data assessor to inform SM if MPC is exceeded; flag results in report	CDM Smith ASC	≤ 40% RPD if >5xQL; otherwise ABS≤QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure /need for additional coolant; check packing steps	DESA	≤ 10 degrees C for data validation

QAPP Worksheet #28am: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Aqueous

Analytical Group

Wet Chemistry-POC

Analytical Method/SOP Reference

MCAWW EPA Method 415.1 Modified by DESA

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank /Calibration Blank	1 per batch of 20 samples or less	< QL	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise redigest and reanalyze. Flag results or modify reporting limit.	DESA	No analyte > QL
Laboratory Duplicate	All samples duplicated	Per DESA SOP	Flag outliers	DESA	RPD $\leq$ 20 if values >5xQL otherwise ABS $\leq$ QL
ICV/CCV	ICV-prior to samples; CCV 1 per batch of 10 samples or every 12 hours	85-115%R	Suspend analysis, find cause, and reanalyze associated samples	DESA	90-110%R
LCS/Analytical Quality Control	1 per batch of 20 samples or less	80-120%R or as supplier certified	Identify source of problem, re-prepare and re-analyze or flag outliers	DESA	80-120%R or as supplier certified
LCS/Analytical Quality Control Duplicate		RPD $\leq$ 20%			RPD $\leq$ 20%
Sample splits and Field Duplicate	1 per 20 samples per event	None	Data assessor to inform SM if MPC is exceeded; flag results in report	CDM Smith ASC	RPD $\leq$ 40% if >5xQL otherwise ABS $\leq$ QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	DESA	$\leq$ 10 degrees C for data validation

QAPP Worksheet #28an: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Soil/Sediment

Analytical Group

AVS - SEM VOCs

Analytical Method/SOP Reference

EPA 376- Colorimeter/ titration-ICP AES/MS

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Refer to soil TAL metals worksheet for SEM criteria					
Refer to soil sulfide worksheet for AVS					

QAPP Worksheet #28ao: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment

Analytical Group TCL VOCs

Analytical Method/SOP Reference EPA 8260B

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample Splits and Field Duplicate	1 per 20 samples	NA	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤100% RPD ABS ≤ 5xQL when either result < CRQL
MS	1 per 20 samples	Compound specific, see laboratory internal limits	Assess data to determine whether there is a matrix effect or analytical error.	Laboratory Analyst or Section Supervisor	Compound specific, see laboratory internal limits
MSD	1 per 20 samples	30% RPD	Analyze LCS for failed target analytes. Re-analyze.		30% RPD
LCS	1 per analytical batch	Compound specific, see laboratory internal limits	Correct problem then reanalyze.	Laboratory Analyst/Section Supervisor	Compound specific, see laboratory internal limits
Field Blank	1 per decontamination event not to exceed 1 per day	≤QL	Verify results; re-analyze. Flag outliers. Check decontamination procedures	Laboratory analyst / CDM Smith SM	≤QL
Method Blank	1 per analytical batch	No analyte > CRQL	Assess data. Correct problem. If necessary, reprep and analyze method blank and all samples processed with the contaminated blank.	DESA/ CLP Laboratory GC/MS Technician	No analyte > CRQL

QAPP Worksheet #28ap: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment

Analytical Group TCL VOCs

Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample Splits and Field Duplicate	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤100% RPD ABS ≤ 5xQL when either result < 2*CRQL
Temperature Blank	1 per cooler	0 to 6 °C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures	Laboratory analyst / CDM Smith SM	≤ CRQL
Method Blank	1 every 12 hours	No analyte > CRQL*	Suspend analysis unit source recertified	DESA/ CLP Laboratory GC/MS Technician	No analyte > CRQL*

*With the exception of methylene chloride, 2-butanone & acetone which can be up to 2 times the CRQL. (EPA CLP National Functional Guidelines, Final, July 2007)

QAPP Worksheet #28ap
Analytical Quality Control and Corrective Action
(TCL VOCs Soils continued)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Deuterated Monitoring Compounds	all samples	Vinyl chloride-d3	68-122 %R	Check calculations and instruments, reanalyze affected samples; up to 3 DMCs per sample may fail to meet necessary limits (Section 11.3.4, Page D45 of SOM01.2)	DESA/ CLP Laboratory GC/MS Technician	Vinyl chloride-d3	68-122 %R
		Chloroethane-d5	61-130 %R			Chloroethane-d5	61-130 %R
		1,1-Dichloroethene-d2	45-132 %R			1,1-Dichloroethene-d2	45-132 %R
		2-Butanone-d5	20-182 %R			2-Butanone-d5	20-182 %R
		Chloroform-d	72-123 %R			Chloroform-d	72-123 %R
		1,2-Dichloroethane-d4	79-122 %R			1,2-Dichloroethane-d4	79-122 %R
		Benzene-d6	80-121 %R			Benzene-d6	80-121 %R
		1,2-Dichloropropane-d6	74-124 %R			1,2-Dichloropropane-d6	74-124 %R
		Toluene-d8	78-121 %R			Toluene-d8	78-121 %R
		trans-1,3-Dichloropropene-d4	72-130 %R			trans-1,3-Dichloropropene -d4	72-130 %R
		2-Hexanone-d5	17-184 %R			2-Hexanone-d5	17-184 %R
		1,4-Dioxane-d8	50-150 %R			1,4-Dioxane-d8	50-150 %R
		1,1,2,2-Tetrachloroethane-d2	56-161 %R			1,1,2,2-Tetrachloroethane -d2	56-161 %R
		1,2-Dichlorobenzene-d4	70-131 %R			1,2-Dichlorobenzene-d4	70-131 %R
Internal Standards	all samples	50-200% of area, $\pm$ 30 second retention time shift		Check calculations/ instruments reanalyze affected samples	DESA or CLP Laboratory GC/MS Technician	50-100% of area, $\pm$ 30 second retention time shift	

QAPP Worksheet #28ap
Analytical Quality Control and Corrective Action
(TCL VOCs Soils continued)

Matrix Soil/Sediment

Analytical Group TCL VOCs

Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Matrix Spike (Not Required)	1 per 20 samples or less (if requested)	1,1-Dichloroethene	59-172 %R	Flag outliers	DESA/ CLP Laboratory GC/MS Technician	1,1-Dichloroethene	59-172 %R
		Trichloroethene	62-137 %R			Trichloroethene	62-137 %R
		Benzene	66-142 %R			Benzene	66-142 %R
		Toluene	59-139 %R			Toluene	59-139 %R
		Chlorobenzene	60-133 %R			Chlorobenzene	60-133 %R
Matrix Spike Duplicate (Not Required)	1 per 20 samples or less (if requested)	1,1-Dichloroethene	0-22 %RPD	Flag outliers		1,1-Dichloroethene	0-22 %RPD
		Trichloroethene	0-24 %RPD			Trichloroethene	0-24 %RPD
		Benzene	0-21 %RPD			Benzene	0-21 %RPD
		Toluene	0-21 %RPD			Toluene	0-21 %RPD
		Chlorobenzene	0-21 %RPD			Chlorobenzene	0-21 %RPD

QAPP Worksheet #28aq: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Soil/Sediment

Analytical Group

TCL SVOCs

Analytical Method/SOP Reference

SOM01.2

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample Splits and Field Duplicate	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤100% RPD ABS ≤ 5xCRQL when either results ≤ 2*CRQL
Temperature Blank	1 per cooler	0 to 6 degrees C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL
Method Blank	1 per 20 samples or less whenever samples are extracted	No analyte > CRQL*	Suspend analysis and reanalyze blank and affected sample	DESA or CLP Laboratory GC/MS Technician	No analyte > CRQL*

*with the exception of bis (2-Ethylhexyl) phthalate which can be up to 5 times the CRQL. (EPA CLP National Functional Guidelines, Final, July 2007)

QAPP Worksheet #28aq
Analytical Quality Control and Corrective Action
(TCL SVOC Soils continued)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria	
TCL SVOCs – Soil Continued								
Deuterated Monitoring Compounds	all samples	Phenol-d5	17-103 %R	Check calculations and instruments, reanalyze affected samples; up to 4 DMCs may fail to meet recovery limits (Section 11.3.4, Page D48/SVOC of SOM01.2)	DESA or CLP Laboratory GC/MS Technician	Accuracy	Phenol-d5	17-103 %R
		Bis(2-chloroethyl)ether-d8	12-98 %R				Bis(2-chloroethyl)ether-d8	12-98 %R
		2-Chlorophenol-d4	13-101 %R				2-Chlorophenol-d4	13-101 %R
		4-Methylphenol-d8	8-100 %R				4-Methylphenol-d8	8-100 %R
		Nitrobenzene-d5	16-103 %R				Nitrobenzene-d5	16-103 %R
		2-Nitrophenol-d4	16-104 %R				2-Nitrophenol-d4	16-104 %R
		2,4-Dichlorophenol-d3	23-104 %R				2,4-Dichlorophenol-d3	23-104 %R
		4-Chloroaniline-d4	1-145 %R				4-Chloroaniline-d4	1-145 %R
		Dimethylphthalate-d6	43-111 %R				Dimethylphthalate-d6	43-111 %R
		Acenaphthylene-d8	20-97 %R				Acenaphthylene-d8	20-97 %R
		4-Nitrophenol-d4	16-166 %R				4-Nitrophenol-d4	16-166 %R
		Fluorene-d10	40-108 %R				Fluorene-d10	40-108 %R
		4,6-Dinitro-2-methylphenol-d2	1-121 %R				4,6-Dinitro-2-methylphenol-d2	1-121 %R
		Anthracene-d10	22-98 %R				Anthracene-d10	22-98 %R
		Pyrene-d10	51-120 %R				Pyrene-d10	51-120 %R
		Benzo(a)pyrene-d12	43-111 %R				Benzo(a)pyrene-d12	43-111 %R
Internal Standards	all samples	50-200% of area, ± 30 second retention time shift		Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/MS Technician	Accuracy	50-200% of area, ± 30 second retention time shift	

QAPP Worksheet #28aq
Analytical Quality Control and Corrective Action
(TCL SVOCs Soils continued)

Matrix Soil/Sediment

Analytical Group TCL SVOCs

Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Matrix Spike (Not Required)	1 per 20 samples or less (if requested)	Phenol	26-90 %R	Flag outliers	DESA/ CLP Laboratory GC/MS Technician	Phenol	26-90 %R
		2-Chlorophenol	25-102 %R			2-Chlorophenol	25-102 %R
		N-Nitroso-di-n-propylamine	41-126 %R			N-Nitroso-di-n-propylamine	41-126 %R
		4-Chloro-3-methylphenol	26-103 %R			4-Chloro-3-methylphenol	26-103 %R
		Acenaphthene	31-137 %R			Acenaphthene	31-137 %R
Matrix Spike Duplicate (Not Required)	1 per 20 samples if requested (if requested)	Phenol	0-35 %RPD	Flag outliers		Phenol	0-35 %RPD
		2-Chlorophenol	0-50 %RPD			2-Chlorophenol	0-50 %RPD
		N-Nitroso-di-n-propylamine	0-38 %RPD			N-Nitroso-di-n-propylamine	0-38 %RPD
		4-Chloro-3-methylphenol	0-33 %RPD			4-Chloro-3-methylphenol	0-33 %RPD
		Acenaphthene	0-19 %RPD			Acenaphthene	0-19 %RPD

QAPP Worksheet #28ar: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group PAHs
Analytical Method/SOP Reference EPA 8270C/D

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	per extract batch	Per laboratory SOP	Investigate and correct per laboratory SOP	Laboratory Analyst	No analyte > QL
Laboratory Duplicate (MS/MSD)	1 per 20 samples	Per laboratory SOP	Investigate and correct; reanalyze affected samples. Flag outliers	Laboratory Analyst	± 20% of mean if sample concentration >10x DL
Matrix Spike	1 per 20 samples or with each group of field samples	Per laboratory SOP	Investigate and correct. Document in data summary	Laboratory Analyst	50-200% Recovery per laboratory SOP
Perdeuterated Surrogate	Every field and QC sample, standards, blanks	Per laboratory SOP	Identify source of problem, make other adjustments and reanalyze	Laboratory Analyst	50-130% Recovery or as per laboratory SOP
Sample splits and field duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5*QL)
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

QAPP Worksheet #28as: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group PCDD/PCDF
Analytical Method/SOP Reference EPA 1613B

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per 20 samples	Per laboratory SOP	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise redigest and reanalyze	Laboratory Analyst	No analyte > QL
Laboratory Duplicate	1 per 20 samples	Per laboratory SOP	Investigate and correct; Flag outliers	Laboratory Analyst	± 20% of mean if sample concentration >10x DL
Initial Precision and Recovery	Prior to sample analysis	Per laboratory SOP	Investigate and correct	Laboratory Analyst	Per method/laboratory SOP
Ongoing Precision and Recovery	1 per batch of 20 samples	Per laboratory SOP	Identify source of problem, make other adjustments; redigest if needed and reanalyze	Laboratory Analyst	Individual laboratory established limits per SOP
Sample splits and field duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

QAPP Worksheet #28at: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix
Analytical Group
Analytical Method/SOP Reference

Soil
PCDD/PCDF
EPA 8290 or DLM02.2

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank (MB)	1 per 20 samples	No analyte > CRQL (DLM02.2) No 2378-TCDD, or 2378-TCDF signal >20 ppt for soil samples; other isomers MB area<1/10 area of internal standard [8290]	Assess data/correct problem, redigest and reanalyze blank and associated samples	Laboratory Analyst	No analyte > CRQL (DLM02.2) No signal >0.2 ppt for water samples; other isomers MB area<1/10 area of internal standard [8290] [8290]
Laboratory Duplicate	1 per 20 samples	± 20% mean for concentrations >10*QL	Investigate and correct; Flag outliers	Laboratory Analyst	± 20% of mean if sample concentration >10x DL ²
Sample splits and field duplicates	1 per 20 samples	None	Inform SM if MPC fails; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
LCS [DLM02.2]	1 per 20 samples	70-130%R; Individual limits per Table 6 in DLM02.2 [up to 3 failures allowed]	Correct problem and reanalyze. if out, re-prepare blank and samples.	Laboratory Analyst	70-130%R; Individual limits per Table 6 in DLM02.2 [up to 3 failures allowed]
Fortified Blank Sediment [8290]	1 per 20 samples	50-150%R	Assess data for analytical error or matrix effect. Analyze LCS for failed analytes. Report problem to project chemist.	Laboratory Analyst	50-150%R
MS/MSD (8290)	1 per 20 samples	60-140%R or laboratory established limits (No criteria listed in 8290)		Laboratory Analyst	50-150%R RPD <20%
Internal Standards	1 sample/standard	40-135%R or per laboratory SOP if internal standard method is used	Investigate and correct	Laboratory Analyst	40-135%R
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

QAPP Worksheet #28au: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group TCL Pesticides
Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Sample Splits and Field Duplicate	1 per 20 samples	None		Notify SM and flag duplicate results	CDM Smith ASC and SM	≤100% RPD ABS ≤ 5xCRQL when a results ≤ 2*CRQL	
Temperature Blank	1 per cooler	0 to 6 degrees C		Laboratory will inform and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation	
Field Blank	1 per decon- tamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL	
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	DESA or CLP Laboratory GC/ECD Technician	No analyte > CRQL	
Matrix Spike	1 per 20 samples	gamma-BHC (Lindane)	46-127 %R	Flag outliers	DESA or CLP Laboratory GC/ECD Technician	gamma-BHC (Lindane)	46-127 %R
		Heptachlor	35-130 %R			Heptachlor	35-130 %R
		Aldrin	34-132 %R			Aldrin	34-132 %R
		Dieldrin	31-134 %R			Dieldrin	31-134 %R
		Endrin	42-139 %R			Endrin	42-139 %R
		4,4-DDT	23-134 %R			4,4-DDT	23-134 %R
Matrix Spike Duplicate	1 per 20 samples	gamma-BHC	0-50 %RPD	Flag outliers	DESA or CLP Laboratory GC/ECD Technician	gamma-BHC	0-50 %RPD
		Heptachlor	0-31 %RPD			Heptachlor	0-31 %RPD
		Aldrin	0-43 %RPD			Aldrin	0-43 %RPD
		Dieldrin	0-38 %RPD			Dieldrin	0-38 %RPD
		Endrin	0-45 %RPD			Endrin	0-45 %RPD
		4,4-DDT	0-50 %RPD			4,4-DDT	0-50 %RPD

QAPP Worksheet #28au
Analytical Quality Control and Corrective Action
(continued)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
LCS	all samples	gamma-BHC	50-120 %R	Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	gamma-BHC	50-120 %R
		Heptachlor epoxide	50-150 %R			Heptachlor epoxide	50-150 %R
		Dieldrin	30-130 %R			Dieldrin	30-130 %R
		4,4'-DDE	50-150 %R			4,4'-DDE	50-150 %R
		Endrin	50-120 %R			Endrin	50-120 %R
		Endosulfan sulfate	50-120 %R			Endosulfan sulfate	50-120 %R
		gamma-Chlordane	30-130 %R			gamma-Chlordane	30-130 %R
Surrogate	all samples	30-150 %R		Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	30-150 %R	

QAPP Worksheet #28av: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group Chlorinated Pesticides
Analytical Method/SOP Reference EPA 1699

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	per extract batch	Per laboratory SOP	Investigate and correct per laboratory SOP	Laboratory Analyst	No analyte > QL
Laboratory Duplicate	1 per 20 samples	Per laboratory SOP	Investigate and correct; Flag outliers	Laboratory Analyst	± 20% of mean if sample concentration >10x DL
Initial Calibration	Prior to sample analysis	Per laboratory SOP	Investigate and correct	Laboratory Analyst	Per laboratory SOP
Calibration Verification; Certified Reference Material	Beginning of each 12-hour shift; Periodically at least quarterly	Per laboratory SOP	Check standards; recalibrate if required	Laboratory Analyst	Laboratory SOP
Ongoing Precision and Recovery/ MS	1 per batch of 20 samples prior to sample analysis	50-130% Recovery per laboratory SOP	Identify source of problem, make other adjustments as per laboratory SOP	Laboratory Analyst	See method limits; for individual compound limits laboratory SOP
Sample splits and field duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 100% RPD (for results ≥ 5QL)
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

Provide Laboratory SOPs in Project-specific QAPPs

QAPP Worksheet #28aw: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Soil/Sediment

Analytical Group

Organochlorine Pesticides

Analytical Method/SOP Reference

EPA 8081B

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per extract batch (up to 20 samples)	No target compounds >QL	Identify source and attempt to eliminate. Re-extract and/or reanalyze blank and affected samples (if sufficient sample remains). Alert Project Team if repeated or widespread exceedances impact project DQOs. Report results if sample results >5x blank result or sample results ND. If contamination is widespread or reoccurring, analyses must stop and the source of contamination must be eliminated or reduced before analyses can continue.	Laboratory Analyst/Section Supervisor	No Target Compounds >QL
Equipment Rinsate Blank	1 per decon event or 1 per day	No Target Compounds >QL	Evaluate impacts on data on a case-by-case basis.	Data validation staff	No Target Compounds >QL
Surrogates	Every sample	Per laboratory SOP	Check calculations and instrument performance; recalculate, reanalyze.	Laboratory Analyst/Section Supervisor	30%-150% R
LCS	1 per batch (up to 20 samples)	Per laboratory SOP	Reprepare and/or reanalyze affected samples. Qualify data as needed.	Laboratory Analyst/Section Supervisor	50%-150% R
MS/MSD	1 per batch (up to 20 samples)	Per laboratory SOP	Flag data. Discuss in narrative. Reprepate and reanalyze to verify matrix interference for recoveries <10%.	Laboratory Analyst/Section Supervisor	50%-150% R; RPD ≤35%
Sample Splits and Field Duplicate	1 per 20 field samples	RPD ≤50% if both results are >5xQL. Difference ≤2xQL if results are ≤5x QL.	Evaluate during data validation.	Data validation staff	RPD ≤100% if both results are >5xQL otherwise ABS ≤2xQL
PE Sample	1 per method per year. SRM/CRM may be analyzed in lieu of PE samples.	Supplier Certified Limits	PE Sample: Laboratory reanalyze another PE sample or utilize a different laboratory with acceptable PE sample results. SRM/CRM: Qualify data, reprepare and/or reanalyze as needed.	Project Chemist/ Laboratory Staff	Supplier Certified Limits

QAPP Worksheet #28ax: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix: Soil/Sediment
Analytical Group/Concentration Level: Herbicides and Organophosphate Pesticides
Analytical Method/SOP Reference: EPA 8321A/B, 8141A/B, and EPA 633 & 632 Modified

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Temperature blank	1 per cooler	0 to 6 degrees C	Inform field crew to use adequate coolant	Laboratory analyst	≤ 10 degrees C for data validation
Method blank	Per Method	≤ QL	Per Method	Laboratory analyst	≤ QL
Splits/ Field Duplicate	10% of PRP's samples/ 1 per 20 samples	None	Data assessor to inform SM if RPD or ABS exceeds MPC	FTL	RPD ≤ 100 if both results are >5*QL Otherwise ABS ≤ 2X QL
Surrogates	Per Method 633	Per Method	Per Method	Laboratory analyst	Per Method 633
MS/MSD and LCS	1 per 20 samples	Per Method	Per Method	Laboratory analyst	50-110%; RPD 20
MS/MSD and LCS	1 per 20 samples	Per Method 632	Per Method	Laboratory analyst	50-120%, RPD 20
MS/MSD and LCS	1 per 20 samples	Per Method 633	Per Method	Laboratory analyst	70-130%, RPD 20
MS/MSD and LCS	1 per 20 samples	Per Method 8141	Per Method	Laboratory analyst	MS 25-155%, LCS 30-155%, RPD 60

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

Modifications and laboratory SOPs will be included in project-specific QAPPs.

**QAPP Worksheet #28ay: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix Soil/Sediment
Analytical Group Chlorinated Herbicides
Analytical Method/SOP Reference EPA 8151A

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
MB	1 per batch (up to 20 samples)	No Target Compounds >QL	Identify source and attempt to eliminate. Re-extract and/or reanalyze blank and affected samples (if sufficient sample remains). Alert Project Team if repeated or widespread exceedances impact project DQOs. Qualify data as needed. Report results if sample results >5x blank result or sample results ND. If contamination is widespread or reoccurring, analyses must stop and the source of contamination must be eliminated or reduced before analyses can continue.	Laboratory Analyst/Section Supervisor	No Target Compounds >QL
Equipment Rinsate Blank	1 per 20 field samples	No Target Compounds >QL	Evaluate impacts on data on a case-by-case basis.	Data Validation Staff	No Target Compounds >QL
Surrogates	Every sample	Laboratory specified	Check calculations and instrument performance; recalculate, reanalyze.	Laboratory Analyst/Section Supervisor	Laboratory specified
LCS	1 per batch (up to 20 samples)	50%-150%R	Re-prepare and/or reanalyze affected samples. Qualify data as needed.	Laboratory Analyst/Section Supervisor	50%-150% R
MS/MSD	1 per batch (up to 20 samples)	50%-150% R; RPD ≤35%	Flag data. Discuss in narrative. Re-prepare and/or reanalyze if recoveries <10% to verify matrix interference.	Laboratory Analyst/Section Supervisor	50-150%, RPD ≤ 35%
Sample Splits and Field Duplicate	1 per 20 field samples	RPD ≤50% if both results are >5x QL	Evaluate during data validation.	Data validation staff	RPD ≤50% if both results are >5x QL
PE Sample	1 per method per year	Supplier Certified Limits	Provide feedback to laboratory/laboratory reviews data.	Project Chemist/ Laboratory Staff	Supplier Certified Limits

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

QAPP Worksheet #28az: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group TCL PCBs
Analytical Method/SOP Reference SOM01.2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits		Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	
Sample Splits and Field Duplicate	1 per 20 samples	None		Notify SM and flag duplicate results	CDM Smith ASC and SM	≤100% RPD ABS ≤ 5xCRQL when either results ≤ 2*CRQL	
Temperature Blank	1 per cooler	0 to 6 degrees C		Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation	
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL		Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL	
Method Blank	1 per 20 samples or whenever samples extracted	No analyte > CRQL		Suspend analysis unit source recertified	DESA or CLP Laboratory GC/ECD Technician	No analyte > CRQL	
Matrix Spike	1 per 20 samples	Aroclor-1016	29-135 %R	Flag outliers	DESA or CLP Laboratory GC/ECD Technician	Aroclor-1016	29-135 %R
		Aroclor-1260	29-135 %R			Aroclor-1260	29-135 %R
Matrix Spike Duplicate	1 per 20 samples	Aroclor-1016	0-15 %RPD	Flag outliers	DESA or CLP Laboratory GC/ECD Technician	Aroclor-1016	0-15 %RPD
		Aroclor-1260	0-20 %RPD			Aroclor-1260	0-20 %RPD
LCS	all samples	Aroclor-1016	50-150 %R	Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	Aroclor-1016	50-150 %R
		Aroclor-1260	50-150 %R			Aroclor-1260	50-150 %R
Surrogate	all samples	30-150%R		Check calculations and instruments, reanalyze affected samples	DESA or CLP Laboratory GC/ECD Technician	30-150%R	

QAPP Worksheet #28ba: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group PCB Congeners
Analytical Method/SOP Reference EPA 1668A

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per 20 samples	< QL	If samples non-detect or if lowest sample result is >10 times the blank-no action; otherwise redigest and reanalyze	Laboratory Analyst	No analyte > QL
Laboratory Duplicate	1 per 20 samples	≤ 20% RPD; ±QL for samples <10x QL	Flag outliers	Laboratory Analyst	RPD ≤ 20%
Certified Reference Material or Quality Control Sample	Periodically at least quarterly	70-130%R;	Check standards; recalibrate if required	Laboratory Analyst	70-130%R;
Calibration Verification Sample	Beginning of each 12-hour shift	70-130%R;	Adjust and/or recalibrate	Laboratory Analyst	70-130%R;
Initial Precision and Recovery	Prior to sample analysis	Per laboratory SOP	Investigate and correct	Laboratory Analyst	60-140%R ≤ 40% RSD
Ongoing Precision and Recovery	1 per batch of 20 samples	Per laboratory SOP	Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	Laboratory Analyst	Warning 70-130%R; Accept 50-150%R
Sample splits and field duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
Temperature Blank	1 per cooler	0 to 6 degrees C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

QAPP Worksheet #28bb: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group TAL Metals
Analytical Method/SOP Reference ISM01.3 or current method

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample Splits and Field Duplicate	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤100% RPD ABS ≤ 5xCRQL when either result ≤ 2*CRQL
Temperature Blank	1 per cooler	0 to 6 degrees C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL
Preparation Blank	1 per 20 samples	No constituent > CRQL	Suspend analysis until source rectified; re-digest and reanalyze affected samples	DESA or CLP Laboratory ICP-AES/ICP-MS Technician	No constituent > CRQL
Spike	1 per 20 samples	75-125%R*	Flag outliers		75-125%R*
Laboratory Duplicate	1 per 20 samples	≤35% RPD**	Flag outliers		≤ 35% RPD**
Post-Digestion Spike	after any analyte (except Ag and Hg) fails spike %R	75-125%R	Flag outliers		75-125%R
Interference Check Sample [ICP Analysis Only]	beginning, end and periodically during run (2 times every 8 hours)	Within ± 2 times CRQL of true value or ± 20% of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples		Within ± 2 times CRQL of true value or ± 20% of true value, whichever is greater
LCS	1 per 20 samples	Control limits established by EPA*	Suspend analysis rectify source; re-digest and reanalyze affected samples		Control limits established by EPA*

*except when the sample concentration is greater than 4 times the spike concentration, then disregard the recoveries; no data validation action taken.

**Reference EPA Region 2 SOP No. HW-2, Revision 13/Evaluation of Metals Data for CLP - (include ABS criteria)

except when the sample and/or duplicate concentration is less than 5 times the CRQL.

*** If the EPA LCS is unavailable, other EPA QC samples or other certified materials may be used. In such cases, control limits for the LCS must be documented and provided.

QAPP Worksheet #28bc: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group Metals (no mercury)
Analytical Method/SOP Reference EPA 6010B/6020

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample splits and field duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 100% RPD (for results ≥ 5QL)
Temperature Blank	1 per cooler	0 to 6 degrees C	Note in laboratory narrative. CDM Smith will use more coolant; check packing procedure	Laboratory Analyst	≤ 10 degrees C for data validation
Preparation Blank	1 per 20 samples	No constituent > CRQL	Suspend analysis until source rectified; re-digest and reanalyze affected samples	Laboratory Analyst	No result > CRQL
Laboratory duplicate	1 per 20 samples or each group	≤ 20% RPD	Investigate and correct; Flag outliers; Note in case narrative	Laboratory Analyst	≤ 35% RPD if result > 5CRQL
Spike	1 per 20 samples	75-125%R	Flag outliers	Laboratory Analyst	75-125%R
Post-Digestion Spike	after any analyte (except Ag) fails spike %R	75-125%R	Flag outliers	Laboratory Analyst	75-125%R
Interference Check Sample [ICP Analysis Only]	beginning, end and periodically during run (twice each 8 hr)	± 2 *CRQL of true value or ± 20% of true value, whichever is greater	Check calculations and instruments, reanalyze affected samples	Laboratory Analyst	± 2 CRQL of true value or ± 20% of true value, whichever is greater
LCS	1 per 20 samples	Per laboratory SOP	Suspend analysis rectify source; re-digest and reanalyze affected samples	Laboratory Analyst	90-110%R

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

**QAPP Worksheet #28bd: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix Soil/Sediment
Analytical Group TAL –Total Mercury
Analytical Method/SOP Reference ISM01.3, SW-846 7471 or current method – Cold Vapor Atomic Absorption (CVAA)

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample Splits and Field Duplicate	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤100% RPD ABS ≤ 5xCRQL when either result ≤ 2*CRQL
Temperature Blank	1 per cooler	0 to 6 degrees C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL
Preparation Blank (PB)	1 per ≤20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	DESA or CLP Laboratory Technician	No analyte > CRQL
Laboratory Duplicate	1 per ≤20 samples	≤ 20% RPD	Flag outliers	DESA or CLP Laboratory Technician	≤ 35% RPD
Spike Sample	1 per ≤20 samples	75 – 125 %R	Flag outliers	DESA or CLP Laboratory Technician	75 – 125 %R

QAPP Worksheet #28be: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group Total Mercury
Analytical Method/SOP Reference EPA 1631

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample splits and field duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
Preparation Blank	3 per 20 samples or batch	Per laboratory SOP	Reanalyze. Suspend analysis until source rectified; re-distill and reanalyze affected samples if results are <10 times the blank	Laboratory Analyst	No result > 5MDL
Laboratory duplicate	1 per 20 samples	Per laboratory SOP	Investigate and correct; Flag outliers; Note in case narrative. Multiple failures require re-distillation and reanalysis.	Laboratory Analyst	≤ 35% RPD if result >5CRQL
Certified Reference Material or Ongoing Precision and Recovery Samples	1 per 20 samples or with each group of field samples	Per laboratory SOP	Check calculations and instruments, reanalyze affected samples. Report in case narrative.	Laboratory Analyst	70-130%R for OPR <20 RSD for IPR 75-125%R for CRM/IPR
MS/MSD	1 per 20 samples or with each group of field samples	Per laboratory SOP	Investigate matrix effects and note in data narrative.	Laboratory Analyst	70-130%R
				Laboratory Analyst	RPD ≤35% (30 per method)

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

QAPP Worksheet #28bf: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group Methyl Mercury
Analytical Method/SOP Reference EPA 1630

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample splits and field duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in data quality assessment	CDM Smith ASC	≤ 40% RPD (for results ≥ 5QL)
Preparation Blank	3 per 20 samples or batch	No constituent > QL Per laboratory SOP	Suspend analysis until source rectified; re-distill and reanalyze affected samples if results are <10 times the blank	Laboratory Analyst	No result > 5*MDL
Laboratory duplicate	1 per 20 samples	≤ 35% RPD or ± 2 x PQL if sample < 5PQL or per laboratory SOP	Investigate and correct; Flag outliers; Note in case narrative. Multiple failures require re-distillation and reanalysis.	Laboratory Analyst	≤ 35% RPD if result >5QL
Certified Reference Material or Ongoing Precision and Recovery Samples	1 per 20 samples or with each group of field samples	Per laboratory SOP	Check calculations and instruments, reanalyze affected samples	Laboratory Analyst	67-133%R of true value
MS/MSD	1 per 20 samples or with each group of field samples	Per laboratory SOP	Investigate matrix effects and note in data narrative.	Laboratory Analyst	65-135%R
				Laboratory Analyst	RPD ≤35%

Laboratory and SOPs are TBD. The laboratory will be assigned per FASTAC policy.

**QAPP Worksheet #28bg: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix

Soil/Sediment

Analytical Group

TAL – Total Cyanide

Analytical Method/SOP Reference

ISM01.3 or current method– Colorimeter or Spectrophotometer

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Sample Splits and Field Duplicate	1 per 20 samples	None	Notify SM and flag duplicate results	CDM Smith ASC and SM	≤100% RPD ABS ≤ 5xCRQL when either result ≤ 2*CRQL
Temperature Blank	1 per cooler	0 to 6 degrees C	Laboratory will inform RSCC/CDM Smith and note in data narrative. CDM Smith will check packing procedure and increase coolant	Laboratory Analyst and CDM Smith FTL	≤ 10 degrees C for data validation
Field Blank	1 per decontamination event not to exceed 1 per day	≤ CRQL	Verify results; re-analyze. Flag outliers. Check decontamination procedures.	Laboratory analyst / CDM Smith SM	≤ CRQL
Preparation Blank (PB)	1 per ≤20 samples	No analyte > CRQL	Suspend analysis; redigest and reanalyze	DESA or CLP Laboratory Technician	No analyte > CRQL
Laboratory Duplicate	1 per ≤20 samples	± 20% RPD	Flag outliers	DESA or CLP Laboratory Technician	≤ 35% RPD
Spike Sample	1 per ≤20 samples	75 – 125 %R	Flag outliers	DESA or CLP Laboratory Technician	75 – 125 %R

**QAPP Worksheet #28bh: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix: Soil

Analytical Group: TPH (DRO and GRO)

Analytical Method/SOP Reference: EPA Method 8015 B/C

QC Sample	Frequency / Number	Method /SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Field rinsate blank	1 per decontamination event per matrix; or 1 per day	Not > QL	Verify results; reanalyze	Laboratory analyst/FTL	Results ≤ QL
Temperature blank	1 per cooler	0 to 6 degrees C	Inform field crew to use adequate coolant	Laboratory analyst/FTL	≤ 10 degrees C for data validation
Surrogates	Per Sample	Per Method	Per Method	Laboratory Personnel (TBD)	60-125% R
Sample Splits and Field Duplicate	1 per 20 samples	None	Field problem resample/ estimate (J) data	Laboratory analyst/FTL	RPD ≤ 100% ABS ≤ 2xQL
Matrix Spike	1 per 20 samples	Per Method	Per Method; per or in-house laboratory established criteria	Laboratory Personnel (TBD)	Recovery 75-125%; 50% RPD
Laboratory Duplicate	1 per 20 samples	Per Method	Per Method	Laboratory Personnel (TBD)	%35 RPD
LCS	1 per 20 samples	Per Method	Per Method	Laboratory analyst/FTL	80-120% recovery

QAPP Worksheet #28bi: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/ Sediment

Analytical Group TOC using Carbon analyzer + IR or FID detector

Analytical Method/SOP Reference Lloyd Kahn with Additional QC requirements

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank	1 per 20 samples	≤ 100 mg/kg	Verify results; reanalyze; recalibrate if still outlying	DESA or subcontract Laboratory Analyst	$\leq$ QL
Laboratory Duplicate	Every sample	$\leq 20\%$ RPD	Re-run sample; flag outliers	DESA or subcontract Laboratory Analyst	$\leq 35\%$ RPD
Quadruplicate analysis	Per batch	$< 3 \times$ Standard deviation	Identify error and re-analyze	Laboratory analyst	$< 3 \times$ Standard deviation
Detection Limit Verification Standard	1 per sample run	$\pm 25\%$ of true value	Identify error and re-analyze	Laboratory analyst	$\pm 25\%$ of true value
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	$\leq 100\%$ RPD ABS $\leq 5 \times$ QL when either result $\leq 2 \times$ QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation

QAPP Worksheet #28bj: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group Hexavalent Chromium/Colorimeter or spectrophotometer
Analytical Method/SOP Reference SW-846, 7196A; extraction by 3060A

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	≤100% RPD ABS ≤ 5xQL when either result ≤ 2*QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation
Method Blank	1 per 20 samples	None	Suspend analysis; check; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Laboratory Duplicate	1 per 20 samples	≤ 20% RPD	Flag outliers	DESA or subcontract Laboratory Analyst	≤35% RPD
Matrix Spike	1 per 20 samples	75 – 125 %R	Per method - typically Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	DESA or subcontract Laboratory Analyst	75 – 125 %R
LCS	After calibration, every 20 samples and at end of day	80-120%R		DESA or subcontract Laboratory Analyst	80-120%R

Note:

Control limits for the LCS must be documented and provided.

QAPP Worksheet #28bk: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group Sulfide/Colorimeter or titration
Analytical Method/SOP Reference EPA 376, extraction by 9031

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	≤100% RPD ABS ≤ 5xQL when either result ≤ 2*QL
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation
Method Blank	1 per 20 samples	None	Suspend analysis; check; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Laboratory Duplicate	1 per 20 samples	Not provided - Laboratory established limits	Flag outliers	DESA or subcontract Laboratory Analyst	≤ 40% RPD
Matrix Spike	1 per 20 samples	Not provided - Laboratory established limits	Per method - typically Identify source of problem, recalibrate if needed/ make other adjustments and reanalyze	DESA or subcontract Laboratory Analyst	50 – 150 %R
LCS	After calibration, every 20 samples and at end of day	Not provided - Laboratory established limits		DESA or subcontract Laboratory Analyst	70-130%R

Note:

Control limits for the LCS must be documented and provided.

QAPP Worksheet #28bl: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group Perchlorate/Ion Chromatography
Analytical Method/SOP Reference EPA 314 with modification for soil extraction

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank	1 per 20 samples	Result $\leq 1/2QL$ No analyte > QL	Suspend analysis; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
Laboratory Duplicate	1 per 20 samples	None noted for soil – use laboratory established limits	Flag outliers	DESA or subcontract Laboratory Analyst	$\pm 40\%$ RPD
Spike Samples	1 per 20 samples	None noted for soil – use laboratory established limits	Flag outliers	DESA or subcontract Laboratory Analyst	75 – 125%R
Quality Control Sample	Quarterly	None noted for soil – use laboratory established limits	Identify source of problem, correct and reanalyze	DESA or subcontract Laboratory Analyst	90-110%R
Laboratory Fortified Blank	1 per 10 samples-method 300 1 per 20 samples	None noted for soil – use laboratory established limits	Flag outliers	DESA or subcontract Laboratory Analyst	80-120%R
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	$\leq 100\%$ RPD ABS $\leq 5 \times QL$ when either result $\leq 2 \times QL$
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation

Notes:

- Control limits for the LCS must be documented and provided.
- Perchlorate limits should be reevaluated for project-specific QAPP.

**QAPP Worksheet #28bm: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix Soil/Sediment
Analytical Group Cation Exchange Capacity
Analytical Method/SOP Reference SW-846 9080/9081, ISM01.3, or 6010B modified

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation Blank	1 per batch of 20 samples	None noted for soil – use laboratory established limits	Suspend analysis; redigest and reanalyze	DESA or subcontract Laboratory Analyst	No analyte > QL
LCS/Matrix Spike	1 per batch of 20 samples	None noted for soil – use laboratory established limits	Identify source of problem, correct and reanalyze	DESA or subcontract Laboratory Analyst	80-120%R; 75-125%R
Laboratory Duplicate - Cation exchange capacity	1 per 20 samples	None noted for soil – use laboratory established limits	Re-run sample; flag outliers	DESA or subcontract Laboratory Analyst	≤ 35-100% RPD
Split Samples and Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; flag duplicate results	CDM Smith ASC	≤100% RPD
Temperature Blank	1 per cooler	0 to 6 degrees C	Inform field crew of failure and need for additional coolant; check packing procedure	DESA or subcontract Laboratory Analyst	≤ 10 degrees C for data validation

Modifications and laboratory SOPs will be included in project-specific QAPPs.

QAPP Worksheet #28bn: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix

Soil/ Sediment

Analytical Group

Grain Size

Analytical Method/SOP Reference

ASTM D421-85 and ASTM D422-63

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Laboratory Duplicate / Sample Splits and Field Duplicate	1 per sample	None	Flag outliers. Data assessor will inform project manager of variability. Data validator will recommend which results set is to be used.	DESA or subcontract Laboratory Analyst	$\leq$ 100% RPD

QAPP Worksheet #28bo: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Soil/Sediment
Analytical Group Moisture
Analytical Method/SOP Reference SM2540G/ASTM D2216

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Laboratory duplicate	1 per 20 samples or with each group of field samples	≤ 20% RPD	Investigate and correct; reanalyze affected samples. Flag outliers Document in case narrative	Laboratory Analyst	≤ 20% RPD

**QAPP Worksheet #28bp: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix Soil/Sediment
Analytical Group Rigid Wall Permeability
Analytical Method/SOP Reference ASTM D2434

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Laboratory Duplicate / Split Samples and Field Duplicates	1 per sample	None	Flag outliers. Data assessor will inform project manager of variability. Data validator will recommend which results set is to be used.	DESA or subcontract Laboratory Analyst	≤ 100% RPD

**QAPP Worksheet #28bq: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)**

Matrix Soil/Sediment
Analytical Group pH, Bulk Density, Specific Gravity, Atterberg Limit
Analytical Method/SOP Reference SW-846, 9045D; ASTM2937; ASTM D 854; SW-846 9080/9081, ASTM D4318

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Buffer standard solution check – pH only	Daily	± 0.05 pH units (of true value)	Verify results; check probe for coating and clean if needed; check buffer solutions; reanalyze	DESA or subcontract Laboratory Analyst	± 0.05 pH units (of true value)
Laboratory Duplicate - pH	Every sample	≤ 20% RPD	Re-run sample; flag outliers	DESA or subcontract Laboratory Analyst	± 0.05 pH units
Duplicate Sample –Bulk Density, Atterberg Limit and Specific Gravity	Every sample	TBD	Re-run sample; flag outliers	DESA or subcontract Laboratory Analyst	≤100% RPD

These QC samples may not be applicable to all projects. Determine this for project-specific uses.

QAPP Worksheet #29: Project Documents and Records
(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

This worksheet is used to record information for all documents and records that will be generated for the project. It describes how information will be collected, verified, and stored. Its purpose is to support data completeness, data integrity, and ease of retrieval.

Sample Collection and Field Records			
Record	Generation	Verification	Storage location/archival
Field logbook or data collection sheets	Field Sampler or FTL or Designee	RI Task Manager	Project File
Scribe Chain-of-Custody Forms	Sample Manager or Designee	FTL or Designee	Project File
Air Bills	Sample Manager or Designee	FTL or Designee	Project File
Sample Tracking Forms	Sample Manager or Designee	FTL or Designee	Project File
Daily QC Reports	FTL or Designee	RI Task Manager or Designee	Project File
Deviations – Field Change Notification Forms	FTL or Designee	RI Task Manager or Designee	Project File
Corrective Action Reports	Site Manager	Site Manager or Designee	Project File
Correspondence	Site Manager	Site Manager or Designee	Project File
ANSETS	Site Manager	ASC	Project File
Soil Boring /Groundwater logs	FTL or Designee	Field Geologist or Designee	Project File
Water Quality Data Logs	FTL or Designee	Field Geologist or Designee	Project File
Equipment Calibration and Maintenance Log	FTL or Designee	Field Scientist or Designee	Project File
Photographs	FTL or Designee	Field Scientist or Designee	Project File
Inspection and maintenance records	FTL or Designee	Field Geologist or Designee	Project File
Well Construction Diagrams	FTL or Designee	Field Geologist or Designee	Project File
Sample Disposal and Waste Manifests	FTL or Designee	Field Scientist or Designee	Project File

QAPP Worksheet #29: Project Documents and Records
(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

Project Assessments			
Record	Generation	Verification	Storage location/archival
Audit plans and reports	Auditor	QA Manager or Designee	Project File
Field audit checklists	Auditor	QA Manager or Designee	Project File
Corrective action report	QA Manager	Site Manager	Project File
Self-Assessment Checklist	Site Manager or Designee	QA Specialist	Project File
Data verification checklists	FTL or Designee	ASC	Project File
Data validation report	Data validator	Chemist	Project File
Data usability assessment report	ASC or Designee	Chemist	Project File
Laboratory Records			
Record	Generation	Verification	Storage location/archival
Bid Sheets, scopes of work	RI Task Manager or Designee	Technical Reviewer and Procurement Specialist	Procurement File
Subcontract Laboratory certifications	Laboratory QA Officer	Chemist or QA Specialist	Procurement File
Subcontract Laboratory QA Plans	Laboratory QA Officer	Chemist or QA Specialist	Procurement File
SOPs	Laboratory QA Officer	Chemist or QA Specialist	Procurement File

QAPP Worksheet #29: Project Documents and Records
(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

Laboratory Data Deliverables				
Record	Organics*	Metals*	Wet Chemistry*	Other*
Narrative	X	X	X	X
COC	X	X	X	X
Summary Results	X	X	X	X
Analytical sample results	X	X	X	X
QC Results	X	X	X	X
Chromatograms	X	NA	NA	TBD
Sample Preparation Log	X	X	X	X
Sample Run Log	X	X	X	X
Tentatively Identified Compounds (TICs)	X	NA	NA	NA
Raw Data	X	X	X	X

Notes:

*- This worksheet will be included in Project-Specific QAPPs and will detail the analyses and appropriate records.

**QAPP Worksheet #30:
COMBINED WITH WORKSHEET #19**

QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action
(UFP-QAPP Manual Sections 4.1.1 and 4.1.2)
(EPA 2106-G-05 Section 2.4 and 2.5.5)

This worksheet is used to document responsibilities for conducting project assessments, responding to assessment findings and implementing corrective action. Appropriately scheduled assessments (e.g., field sampling technical systems audits (TSA) at the beginning of sampling) allow management to implement corrective action in a timely manner, thereby correcting nonconformance and minimizing their impact on DQOs/PQOs. Assessment checklists should be included in the QAPP or referenced.

**QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action
(UFP-QAPP Manual Sections 4.1.1 and 4.1.2)
(EPA 2106-G-05 Section 2.4 and 2.5.5)**

Assessment Type	Number/ Frequency	Organization	Responsible Party	Assessment Deliverable and Due Dates	Party to Identify and Implement Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
					Title and Organizational Affiliation	
Subcontract Laboratory Technical Systems/ Performance Audits	As needed	CDM Smith or Laboratory	Project Chemist or Laboratory QA Manager	Memorandum (Phone notification- 24 hours, Draft memorandum due 30 days)	Laboratory Manager	CDM Smith Project Chemist(Auditor) or Laboratory QA Manager
Performance Evaluation Samples	If EPA requests	Laboratory	Laboratory Analyst	Electronic Report (30 days)	Laboratory Manager or QA Manager	CDM Smith Project Chemist or Data Validator or EPA CLP PO
Project Readiness Review	Prior to field work	CDM Smith	FTL	Immediately; to within 24 hours of review	RITM or SM, CDM Smith	SM, CDM Smith
Sample Collection and Documentation	Once	CDM Smith	FTL	Email within 24 hours	RITM or SM, CDM Smith	Jeniffer Oxford (QAS) or field auditor, CDM Smith
Health and Safety	Once if warranted	CDM Smith	FTL and SM, CDM Smith	Memorandum & Checklist (Notify by phone immediately. Report 1 week after audit)	RITM or SM, CDM Smith	Shawn Oliveira, H&S Manager or designee, SSHO, CDM Smith
Field Audit	Once	CDM Smith	Approved field auditor	Corrective Action Plan & Memorandum (Summary provided to field/project team on day of audit. Internal Draft Report due within 30 days of audit)	CDM Smith Project Geologist and field staff	Field Auditor, CDM Smith
Office Audit	Once	CDM Smith	Approved QA Staff		SM, CDM Smith	Jeniffer Oxford (QAS) or designee, SM, CDM Smith
QAPP	Annually	CDM Smith	Approved CDM Smith QA Staff or QA Coordinator	E-mail / FCN if required.	RITM, CDM Smith	SM, CDM Smith
Data Review	Once	CDM Smith	Vanessa Macwan (ASC) or designee,	Memorandum based on project requirements	Project Chemist, FTL, or SM depending on nature of issue	SM, CDM Smith

Notes:

1. The CDM Smith QA Manager (QAM) will determine the need for any field or office audits. If a site manager requests self-assessments in lieu of the project audit, the QAM will review and approve or reject the self-assessments being considered. The frequency and need for Quality Assessments are outlined in the RAC 2 Region 2 QMP (CDM Smith 2012).
2. Field auditors are selected based on level of experience and technical specialty. Office audits are performed by trained and approved QA Staff members. Oversight projects typically have a series of self-assessments at the discretion of the QAM.
3. Findings and deviations from plans will require corrective actions which will be documented and discussed appropriately. The EPA RPM will be notified by the SM.
4. No formal audits will be performed on oversight assignments.

QAPP Worksheet #34: Data Verification and Validation Inputs
(UFP-QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

This worksheet is used to list the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and laboratory records. Data verification is a check that all specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records (objective evidence) are available to proceed to data validation. Data validation is the evaluation of conformance to stated requirements, including those in the contract, methods, SOPs and the QAPP. Examples of records subject to verification and validation are listed below. The actual inputs required should be based on the graded approach, as defined during project planning.

QAPP Worksheet #34: Data Verification and Validation Inputs
(UFP-QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

Item	Input	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records				
1	QAPP	All planning documents will be available to reviewers to allow reconciliation with planned activities and objectives.	X	X
2	Contract QMP		X	
3	Field TSOPs		X	X
4	Laboratory SOPs		X	X
Field Records				
5	Field logbooks	Field notes will be prepared daily by the Field Team and will be complete, appropriate to the project tasks, and legible. The FTL will review logbooks and records for accuracy and completeness. Upon completion of field work, logbooks and records will be placed in the project files. Field reports will be verified to ensure correct reporting of information. Review will be conducted prior to completion of each report.	X	X
6	Equipment calibration records		X	X
7	COC	Sample manager, FTL or designee will review the COC forms against the samples packed in the each cooler prior to shipment. COCs will be sent with the samples to the laboratory and copies retained for the Trip Report and project files. The data validator will be review upon completion of analytical activities and verified against the laboratory report.	X	X
8	Sampling Trip Reports	FTL or designee will prepare weekly or end of short sampling event; Laboratory coordinator will review these for each case of a field event using a CLP laboratory. Information will be reviewed against the COC forms, and potential discrepancies will be discussed with field personnel to verify locations, dates, etc.	X	X
9	Sampling Figures/ Diagrams/Surveys	Data user will review during evaluation and completion of data report.	X	X
10	Drilling logs	Geologist will review during data evaluation.	X	X
11	Geophysical logs		X	X
12	Correspondence	Relevant correspondence will be used to reconcile field records and data.	X	X

QAPP Worksheet #34: Data Verification and Validation Inputs
(UFP-QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

Item	Input	Description	Verification (completeness)	Validation (conformance to specifications)
13	Field Change Requests	ASC and data evaluator will review during completion of each data usability assessment/measurement report.	X	X
Analytical Data Package				
14	Laboratory analytical data packages	Laboratory analyst and QA officer will review/verify internally the completeness and technical accuracy of data prior to submittal. All laboratory data will be verified by the laboratory performing the analysis prior to submittal. EPA DV contractor-data validator or CDM Smith data validator will review data packages for content and sample information upon receipt. Data packages will be evaluated for completeness and compliance. Table 9 of the IDQTF UFP-QAPP shows items for compliance review.	X	X
15	Communication Records	Relevant correspondence will be used to reconcile analytical data.	X	X
16	Electronic Data Deliverables (EDDs) fields	Data Manager will determine whether required EQuIS compatible EDD fields and format were provided.	X	X
17	Outputs of the EQuIS database	Project task leader and team will compile the project data results in a sample project report. Data tables, figures and reported entries will be reviewed/ verified against hardcopy information or EQuIS output.	X	X
18	Data validation and audit reports, QAPP, and FCNs	Data assessor will prepare the project data quality and usability assessment report. The data will be evaluated against project DQOs and measurement performance criteria, such as completeness. Evaluate whether field sampling procedures were followed with respect to equipment and proper sampling support.	X	X

QAPP Worksheet #35: Data Verification Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

This worksheet documents procedures that will be used to verify project data. It applies to both field and laboratory records. Data verification is a completeness check to confirm that all required activities were conducted, all specified records are present, and the contents of the records are complete. As illustrated in the following example, verification often is performed at more than one step by more than one person.

Requirement Documents	Records Reviewed	Process Description	Responsible Person /Organization
QAPP, TSOP 4-1	Field logbook	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Daily - FTL and At conclusion of field activities - Project QC staff
SOPs	Field logbook and FCNs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved. Determine potential impacts from noted/approved deviations, in regard to PQOs.	CDM Smith Task Leader or ASC
QAPP, TSOP 1-2	Chain-of-custody forms	Verify the completeness of chain-of-custody records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Daily - FTL At conclusion of field activities - Project Chemist or Data Assessor
QAPP, TSOP 1-2	COC	Examine traceability of data from sample collection to generation of project reported data. Provides sampling dates and time; verification of sample ID; and QC sample information.	At conclusion of field activities - Project QC staff (data coordinator, data validator)
QAPP	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.). Determine potential impacts from noted/approved deviations, in regard to PQOs.	ESAT Data Validation Personnel, EPA Region 2 or CDM Smith Data validator

**QAPP Worksheet #35: Data Verification Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)**

Requirement Documents	Records Reviewed	Process Description	Responsible Person /Organization
QAPP	Laboratory Deliverable	Verify that the laboratory deliverable contains all records specified in the subcontract SOW. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with the COCs to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Before release – Laboratory QAM Upon receipt - Project Chemist or Data Validator [ESAT or CDM Smith Data Validation Personnel or ASC]
	Audit Reports, Corrective Action Reports	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	Contract QAS
	Field duplicates	Compare results of field duplicate (or replicate) analyses with RPD criteria.	CDM Smith ASC, Data Validator or Data Assessor
	Methods	Verify that records support implementation of the SOP - sampling and analysis.	
	Data Narrative	Determine deviations from methods and contract and the impact.	
	Audit Report	Confirm reports are used to validate compliance of field sampling, handling and analysis activities with the QAPP.	
	Project Quantitation Limit	Verify achievement of PQLG as established in the QAPP and that the laboratory successfully analyzed a standard at the QL.	
	Field and Laboratory data and QC report	A summary of all QC samples and results will be verified for measurement performance criteria, completeness, and 10 percent verified to field and laboratory data reports from vendors. A report on meeting the established criteria shall be prepared within 30 days of receipt.	

QAPP Worksheet #36: Data Validation Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

This worksheet documents procedures that will be used to validate project data. Data validation is an analyte and sample-specific process for evaluating compliance with contract requirements, methods/SOPs, and MPC. The scope of data validation will be defined during project planning because it affects the type and level of documentation required for both field and laboratory activities. Data validation procedures contained in an SOP or other document will be referenced in this table and included as an attachment to the QAPP. The procedures provided below comes from terminology contained in *Guidance for Labeling Externally Validated Laboratory Data for Superfund Use*, EPA 540-R-08-005, which was developed to promote the use of consistent terminology by external data reviewer to describe the scope and content of data review activities. The validation code and label identifier table is presented after Worksheet #36. Any checklists to be used will be appended to project-specific QAPPs. Any additional data qualifiers to be applied by the data validator will be defined in project-specific QAPPs. Of particular importance, the CDM Smith data validator (third party validator) will NOT reject data (noted by the designation of the “R” data qualifier). Data validation will note when performance criteria are not met, but the final rejection of any data and their use is a decision reserved specifically for the project team.

QAPP Worksheet #36: Data Validation Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Analytical Group/ Method	Data deliverable requirements	Analytical specifications	Measurement performance criteria	Percent of data packages to be validated ¹	Percent raw data review/% results to recalculate	Validation Procedure ³	Validation code	Electronic validation program/ version	Data Validator
FASTAC Tiers 1 and 2 (DESA or CLP)									
VOCs - trace	SEDD Stage 3	WS 28, SOM01.2	WS 12, & 28	100%	100%/10%	SOP HW-34, Rev 3, DESA Worksheet #35	S3VEM	EXES	ESAT DV Staff, or DESA
VOCs - low		WS 28, SOM01.2				SOP HW-33, Rev 3, DESA Worksheet #35			
SVOCs		WS 28, SOM01.2				SOP HW-35, Rev 3, DESA Worksheet #35			
TAL Metals (ICP-AES)	SEDD Stage 2B	WS 28, ISM01.3				SOP HW-2a Rev 15, or DESA WS 35	S2BVEM		
TAL Metals (ICP-MS)						SOP HW-2b Rev 15, DESA WS 35			
TAL Metals (Hg, and CN)						SOP HW-2c Rev 15, DESA WS 35			
Pesticides	SEDD Stage 3	WS 28, SOM01.2				SOP HW-36, rev 0	S3VEM		
Aroclors (PCBs)		WS 28, SOM01.2				SOP HW-37 rev 0			
Herbicides		WS 28, SW-846, 8151A				SOP HW-36, rev 0 modified for method			
TPH-GRO, -DRO		WS 28, SW-846, 8015				SOP HW-36, rev 0 modified for method			
TCLP Organics	SEDD Stage 2	WS 28, SW-846, 1311 and SOM01.2				See organics criteria above			
TCLP Metals		WS 28, SW-846, 1311 and ISM01.3				SOP HW-2a/b Rev 15, or DESA WS 35			
VOCs	SEDD Stage 3	WS 28, SW-846, 8260	WS 12, & 28	100%	100%/10%	DESA WS 35 or NFG	S3VEM	EXES	DESA
SVOCs or PAHs, Pesticides, PCBs	SEDD Stage 3	WS 28, SW-846, 8270D, 8081B, 8082A				DESA WS 35 or NFG			

**QAPP Worksheet #36: Data Validation Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)**

Analytical Group/ Method	Data deliverable requirements	Analytical specifications	Measurement performance criteria	Percent of data packages to be validated ¹	Percent raw data review/% results to recalculate	Validation Procedure ³	Validation code	Electronic validation program/ version	Data Validator
TAL Metals (ICP-AES)	SEDD Stage 2B	WS 28, SW-846, 6010C				NFG	S2BVEM		
TAL Metals (ICP-MS)		WS 28, SW-846, 6020A				NFG			
TAL Metals (Hg, and CN)		WS 28, SW-846, 7470A/7471B and 9010C/9012B				NFG			
FASTAC Tier 3 (Alternate EPA contracts) and Tier 4 (CDM Smith Subcontract Laboratory)									
Air VOCs	SEDD Stage 3	WS 28, TO-15	WS 12, & 28	100%	100%/10%	SOP HW-31, rev 4	S3VEM	EXES if accepted by CLP	ESAT DV Staff, or CDM Smith
Air PCBs		WS 28, TO-10				National Functional Guidelines (NFG)		TBD	
PCB Congeners		WS 28, & CBC01.2 or EPA 1668A or D				SOP HW-46, rev 0 or NFG*		EXES	
Dioxin/ Furans		WS 28, & DFLM01.1 or SW-846, 8280	EPA SOP HW-11, Revision 3 or NFG	EXES	ESAT DV Staff, or CDM Smith				
		WS 28, & SW-846, 8290	WS 12, & 28	100%	100%/10%	EPA SOP HW-19, Revision 1.1 or NFG	S3VEM	EXES	ESAT DV Staff, or CDM Smith
		WS 28, & EPA 1613B (Isotope dilution)	WS 12, & 28	100%	100%/10%	EPA SOP HW-25, Revision 3 or NFG	S3VEM	EXES	ESAT DV Staff, or CDM Smith
FASTAC Tier 1 [DESA] and Tier 4 (CDM Smith Subcontract Laboratory)									
Soil Gas	EQuIS Region 2 compliant EDD	WS 28, Method 8260C	WS 12, & 28	100%	100%/10%	SOP HW-31, rev 4	S2BVM	NA ⁴	DESA, or CDM Smith Chemist
Methane, ethane, ethene		WS 28, DESA or subcontract SOP				DESA Worksheet #35 or NFG			

QAPP Worksheet #36: Data Validation Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Analytical Group/ Method	Data deliverable requirements	Analytical specifications	Measurement performance criteria	Percent of data packages to be validated ¹	Percent raw data review/% results to recalculate	Validation Procedure ³	Validation code	Electronic validation program/ version	Data Validator
Wet Chemistry ²		WS 28, DESA or subcontract SOP				DESA Worksheet #35 or CDM Smith 029A SOP			
TOC, DOC, POC, and SSC		WS 28, DESA or subcontract SOP				DESA Worksheet #35 or CDM Smith 029A SOP			
Dissolved inorganic carbon		WS 28, DESA or subcontract SOP				DESA SOP or CDM Smith 029A SOP			
Hexavalent chromium		WS 28, DESA or subcontract SOP				DESA SOP or CDM Smith 029A SOP			DESA, or CDM Smith ASC/ designee
Methyl mercury		WS 28, EPA 1630				NFG modified by WS #12,15,19 and 24			
Total mercury		WS 28, EPA 1631				NFG modified by WS #12,15,19 and 24			
CEC, TOC, pH, AVS-SEM		WS 28, DESA or subcontract SOP				DESA SOP or CDM Smith 029A SOP			
Specific gravity, bulk density, grain size, RCRA Characterization Atterberg Limit	EQuIS Region 2 compliant EDD	WS 28, DESA or subcontract SOP	WS 12, & 28	0	0	No data validation	NA	NA	NA

Notes:

1. Project-specific QAPPs will indicate if any streamlining of the data validation procedures is required. For example, how screening and geotechnical analysis data will be evaluated.
2. Wet Chemistry = Alkalinity, ammonia, bromide, chloride, fluoride, hardness, nitrate-nitrite, sulfate, chloride, fluoride, ortho-phosphate, total phosphorus, TSS, TDS, TKN, COD, DOC, and TOC
3. Method requirements will also be used to evaluate the data during data validation.
4. May be applicable through DESA.

*EPA CLP National Functional Guidelines for Organic Data Review. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. EPA 540-R-08-011. June 2008. EPA CLP National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation (OSRTI). EPA 540-R-11-016. September 2011.

Validation Code and Label Identifier Table

Validation Code*	Validation Label	Description/Reference	
S1VE	Stage 1 Validation Electronic	Stage 1 Validation - Verification and validation based only on completeness and compliance of sample receipt condition checks.	EPA 540-R-08-005
S1VM	Stage 1 Validation Manual		
S1VEM	Stage 1 Validation Electronic and Manual		
S2aVE	Stage 2a Validation Electronic	Stage 2A Validation - Verification and validation based on completeness and compliance checks of sample receipt conditions and ONLY sample-related QC results.	
S2aVM	Stage 2a Validation Manual		
S2aVEM	Stage 2a Validation Electronic and Manual		
S2bVE	Stage 2b Validation Electronic	Stage 2B Validation - Verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results.	
S2bVM	Stage 2b Validation Manual		
S2bVEM	Stage 2b Validation Electronic and Manual		
S3VE	Stage 3 Validation Electronic	Stage 3 Validation - Verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, AND recalculation checks.	
S3VM	Stage 3 Validation Manual		
S3VEM	Stage 3 Validation Electronic and Manual		
S4VE	Stage 4 Validation Electronic	Stage 4 Validation - Verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs.	
S4VM	Stage 4 Validation Manual		
S4VEM	Stage 4 Validation Electronic and Manual		
NV	Not Validated		

Note:

The following data qualifiers will be applied during data validation by a third party. Potential impacts on project data quality objectives will be discussed in the data validation report.

- NM – Measurement Performance Criteria contained in WS 12 were not met.
- J – The result is an estimated value. The nature of the bias will be discussed in the data validation report.
- E – Erroneous result (e.g., improper calculation, peak integration, etc.)

**QAPP Worksheet #37: Data Usability Assessment
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)**

This worksheet documents procedures that will be used to perform the data usability assessment. The data usability assessment is performed at the conclusion of data collection activities, using the outputs from data verification and data validation. It is the data interpretation phase, which involves a qualitative and quantitative evaluation of environmental data to determine if the project data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective evaluation of the systematic planning process, and, like the systematic planning process, involves participation by key members of the project team. The data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

The data usability assessment process will be summarized to include statistics, equations, and computer algorithms used to analyze the data. *The steps below should be completed on a project-specific basis:*

Step 1	Review the project's objectives and sampling design Review the key outputs defined during systematic planning (i.e., PQOs or DQOs and MPCs) to make sure they are still applicable. Review the sampling design for consistency with stated objectives. This provides the context for interpreting the data in subsequent steps.
Step 2	Review the data verification and data validation outputs Review available QA reports, including the data verification and data validation reports. Perform basic calculations and summarize the data (using graphs, maps, tables, etc.). Look for patterns, trends, and anomalies (i.e., unexpected results). Review deviations from planned activities (e.g., number and locations of samples, holding time exceedances, damaged samples, non-compliant PT sample results, and SOP deviations) and determine their impacts on the data usability. Evaluate implications of unacceptable QC sample results.
Step 3	Verify the assumptions of the selected statistical method Verify whether underlying assumptions for selected statistical methods (if documented in the QAPP) are valid. Common assumptions include the distributional form of the data, data independence, dispersion characteristics, homogeneity, etc. Depending on the robustness of the statistical method, minor deviations from assumptions are usually not critical to statistical analysis and data interpretation. If serious deviations from assumptions are discovered, then another statistical method may need to be selected.
Step 4	Implement the statistical method Implement the specified statistical procedures for analyzing the data and review underlying assumptions. For decision projects that involve hypothesis testing (e.g., "concentrations of lead in groundwater are below the action level") consider the consequences for selecting the incorrect alternative; for estimation projects (e.g., establishing a boundary for surface soil contamination), consider the tolerance for uncertainty in measurements.
Step 5	Document data usability and draw conclusions Determine if the data can be used as intended, considering implications of deviations and corrective actions. Discuss DQIs. Assess the performance of the sampling design and identify limitations on data use. Update the conceptual site model and document conclusions. Prepare the data usability summary report in the form of text and/or a table.

QAPP Worksheet #37: Data Usability Assessment
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Personnel (organization and position/title) responsible for participating in the data usability assessment: These staff will be documented in project-specific QAPP and may include: Site Manager, Project QA Specialist, Risk Assessor, Geologist/Hydrogeologist, Project Chemist, Task Leader, Data Coordinator, Validator, and Statistician.

The usability assessment will be documented as follows:

The Data Usability Assessment will be performed by a team of personnel at CDM Smith. The SM will be responsible for information in the Usability Assessment and will also be responsible for assigning task work to the individual task members who will be supporting the Data Usability Assessment. Note that the Data Usability Assessment will be conducted on validated or reviewed data. After the Data Usability Assessment has been performed, data deemed appropriate for use will then be used in the subsequent project evaluation. The results of the Data Usability Assessment will be presented in the *project measurement report such as the Risk Assessment, RI or other report*. Tables will be prepared of the samples and analytical parameters, field and trip blank results; field duplicates comparison, and completeness of the data set. The following items will be assessed and conclusions drawn based on their results.

Precision – Results of laboratory duplicates will be assessed during data validation and data will be qualified according to the data validation procedures cited on Worksheet #36. Field duplicates will be assessed by matrix using the RPD for each pair of results reported above CRQL for organic and inorganic analyses respectively. RPD acceptance criteria, presented in Worksheet #12, will be used to assess field sampling precision. Absolute difference will be used for low results as described in worksheets 12 and 28. A discussion summarizing the results of laboratory and field precision and any limitations on the use of the data will be described.

Field duplicates - The SM will review the extent of exceedance of the field duplicate criteria. For groundwater, the sample results will be flagged according to the data validation protocol. For soils/sediment, the exceedances will be compared with the field lithological logs and grain size results, if available. Based on this review, the site manager will determine whether the exceedance is due to inherent soil heterogeneity or the result of sample handling in the field or laboratory. This information will be included in the data assessment report. As an added measure, the FTL will be asked to inspect the soil coning and quartering procedures and re-train staff if needed. The data assessor will review the data validation report. If the field duplicate comparison is not included, it will be performed by the assessor.

Accuracy/Bias Contamination –Laboratory blank results will be assessed as part of data validation. During the data validation process the validator will qualify the data following the procedures listed on Worksheet #36. A discussion summarizing the results of laboratory accuracy and bias based on contamination will be presented and limitations on the use of the data will be described.

QAPP Worksheet #37: Data Usability Assessment
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Overall Accuracy/Bias – The results of instrument calibration and matrix spike recoveries will be reviewed and data will be qualified according to the data validation procedures cited on Worksheet #36. A discussion summarizing the results of laboratory accuracy and any limitations on the use of the data will be described.

Sensitivity – Data results will be compared to criteria provided on Worksheet #15. A discussion summarizing any conclusions about sensitivity of the analyses will be presented and any limitations on the use of the data will be described.

Representativeness – A review of adherence to the sampling plan, field procedures and of project QA audits will be performed in order to assess the representativeness of the sampling program. Data validation narratives will also be reviewed and any conclusions about the representativeness of the data set will be discussed.

Comparability – Study results will be used in conjunction with existing data to make qualitative and quantitative assessments of the data to be used to produce the Site reports.

Reconciliation – The DQIs presented in Worksheet #12 will be examined to determine if the MPCs were met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of major impacts observed from data validation, DQIs and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. As a result of the quality determined, the usability of the data for each analysis will be established. After the combined usability of the data from all analyses for an objective is determined, it will be concluded if the DQIs were met and whether project goals were achieved. As part of the reconciliation of each objective, conclusions will be drawn and any limitations on the usability of any of the data will be described.

Completeness - The Environmental database will be queried to summarize the number of sample results in each analytical fraction that are rejected versus the total data set. This data will be used along with the planned samples indicated in the QAPP to calculate the completeness of the obtained data set.

Data validation reports will be reviewed to determine the quality of the data and potential impacts on data usability. Field duplicates will be evaluated against the MPCs outlined in worksheet #12. Non-compliant data will be discussed in the usability report. The following equations will be used:

1. To calculate field duplicate precision:

$$\text{RPD} = 100 \times 2 |X1 - X2| / (X1 + X2) \quad \text{where } X1 \text{ and } X2 \text{ are the reported concentrations for each duplicate or replicate}$$

2. To calculate completeness:

$\% \text{ Completeness} = V/n * 100$ where V= number of measurements judged valid; n = total number of measurements made and

$\% \text{ Completeness} = C/X * 100$ where C= number of samples collected; X = total number of measurements planned

The results will be evaluated using temporal and spatial relationships of the data. This activity will be performed during the data usability evaluation and RI reporting. Not all “J” qualified data is usable so all lines of evidence to support data use will be evaluated. Although “J” data are reasonable for use, CDM Smith will also document the evaluation of all qualified results against the values, data quality, and bias of surrounding data. If needed, qualified results at plume edges will be mapped and evaluated. Validated results will be further examined during data evaluation and re-coded in accordance with EPA Region 2 directives.

For qualified results that are outliers or at the edge of contaminated areas:

- a) Discuss how data outliers will be addressed
- b) Evaluate against all issues such as geology, hydrogeology, depth, past history
- c) Consider whether qualified data are reasonable based on surrounding data (e.g., data qualified due to missed holding time may be lower than we expect)
- d) Address data quality bias and reason for qualification
- e) Evaluate effect of data qualification on the data