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SAMPLING AND ANALYSIS PLAN FOR SITE 27 EQUIPMENT PARADE DECK FIBER OPTIC VAULT LIGHT NON-AQUEOUS PHASE LIQUID DELINEATION DRAFT ACTING AS FINAL

MCRD PARRIS ISLAND SC

1/1/2010

TETRA TECH NUS

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-04-D-0055

Rev. 0
01/10

Sampling and Analysis Plan
Site 27 - Equipment Parade Deck
Fiber Optic Vault LNAPL Delineation

for

Marine Corps Recruit Depot
Parris Island, South Carolina

Contract Task Order 0166

January 2010

U.S. EPA Identification Number SC6170022762

NAVFAC
Naval Facilities Engineering Command
NAVFAC SOUTHEAST

NAS Jacksonville
Jacksonville, Florida 32212-0030

TETRA TECH NUS, Inc.

SAP Worksheet #1 -- Title and Approval Page

(UFP-QAPP Manual Section 2.1)

SAMPLING AND ANALYSIS PLAN
SITE 27 - EQUIPMENT PARADE DECK
FIBER OPTIC VAULT
LIGHT NON-AQUEOUS PHASE LIQUID DELINEATION SAMPLING
MARINE CORPS RECRUIT DEPOT
PARRIS ISLAND, SOUTH CAROLINA

January 2010
Prepared for:
Naval Facilities Engineering Command
Southeast
NAS Jacksonville Building 103
Jacksonville, Florida 32212

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Prepared under:
Comprehensive Long-Term Environmental Action Navy
Contract No. N62467-04-D-0055
Contract Task Order 0166

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ACRONYMS

°C	Degrees Celsius
AR	Administrative Record
BFB	Bromofluorobenzene
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CA	Corrective Action
CCB	Continuing Calibration Blank
CCC	Calibration Check Compound
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CS	Confirmatory Sampling
CSM	Conceptual Site Model
CTO	Contract Task Order
CVAA	Cold Vapor Atomic Absorption
DFTPP	Decafluorotriphenylphosphine
DI	Deionized
DoD	Department of Defense
DPT	Direct-push Technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
DRO	Diesel Range Organics
DVM	Data Validation Manager
EE/CA	Engineering Evaluation/Cost Analysis
EPC	Exposure Point Concentration
EU	Exposure Unit
FID	Flame Ionization Detector
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOL	Field Operations Leader
FOV	Fiber Optic Vault
FS	Feasibility Study
FTMR	Field Task Modification Request
GC	Gas Chromatograph
GC/ECD	Gas Chromatography/Electron Capture Detector

GC/MS	Gas Chromatograph/Mass Spectrometer
GRO	Gasoline Range Organics
HASP	Health and Safety Plan
HCl	Hydrochloric Acid
HDPE	High Density Polyethene
HI	Hazard Index
HNO3	Nitric Acid
IAS	Initial Assessment Study
ICB	Initial Calibration Blank
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectroscopy
ICS	Interference Check Standard
IDW	Investigation-derived Waste
ILCR	Incremental Lifetime Cancer Risk
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
LNAPL	Light Non-aqueous Phase Liquid
MCCS	Marine Corps Community Services
MCRD	Marine Corps Recruit Depot
MDL	Method Detection Limit
MIP	Membrane Interface Probe
MPC	Measurement Performance Criterion
MS	Mass Spectrometry
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAD	North American Datum
NAVFAC SE	Naval Facilities Engineering Command, Southeast
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFESC	Naval Facilities Engineering Service Center
NGVD	National Geodetic Vertical Datum
NTCRA	Non-Time Critical Removal Action
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear Aromatic Hydrocarbons
PAL	Project Action Limit
PCB	Polychlorinated Biphenyl
PID	Photo-ionization Detector
PM	Project Manager
POC	Point of Contact
QA	Quality Assurance

QAM	Quality Assurance Manager
QL	Quantitation Limit
RAC	Remedial Action Contractor
RCRA	Resource Conservation and Recovery Act
RF	Response Factor
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SDG	Sample Delivery Group
SI	Site Inspection
SIM	Selected Ion Monitoring
SOP	Standard Operating Procedure
SPCC	System Performance Check Compound
SQL	Structured Query Language
SSL	Soil Screening Level
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBD	To Be Determined
TCL	Target Compound List
TOM	Task Order Manager
TSCA	Toxic Substances Control Act
TtNUS	Tetra Tech NUS, Inc.
UCL	Upper Confidence Limit
UFP	Uniform Federal Policy
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound
VS	Verification Step
VSI	Visual Site inspection

EXECUTIVE SUMMARY

Site 27, the Equipment Parade Deck, a 1-acre asphalt-covered area located in an industrial part of Marine Corps Recruit Depot (MCRD) Parris Island, was formerly used as a parade ground and is currently used for storage of miscellaneous equipment. For an unknown length of time, out-of-service storage tanks, concrete cylinders, boilers, scrap metal, and piping were stored here until suitable facilities for hauling, storage, or destruction of the materials were found. An unknown amount of hazardous materials was handled on the Parade Deck, possibly including waste petroleum products and metals. Additionally, transformers containing Polychlorinated Biphenyl (PCB) oils were reportedly stored in the northern portion of the Equipment Parade Deck; however, the exact location is not known. The asphalt is cracked or deteriorated in several areas.

MCRD Parris Island has initiated a military construction project that will relocate the Motor Transportation Facility to the area currently recognized as the Site 27 Equipment Parade Deck (re-named the Motor-T Area). The project will necessitate construction of a maintenance garaged and support facilities. Previous investigations in the area of Site 27 indicated the presence of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, and inorganic contaminants in the soil and VOCs and pesticides in the groundwater. The contaminants found at the highest concentrations include select VOCs and pesticides in both soil and groundwater. The area of highest concentrations of these contaminants is the area around the Fiber Optic Vault (FOV), located 200 feet east of the Motor-T Area.

During the installation of the FOV in 2001, light non-aqueous phase liquid (LNAPL) was discovered at the water table. In September 2001, a soil sample was collected next to the FOV and results indicated the presence of benzene, toluene, ethylbenzene, and xylenes (BTEX). The FOV was originally referred to as Site 55 but is now included as part of Site 27.

The FOV Area is located upgradient of the Motor-T Area and as a result, the contaminated soil and groundwater in the FOV Area may be impacting groundwater or subsurface soil within the Motor-T Area of Site 27. An investigation to determine if any contamination is present in the Motor-T Area and if there are unacceptable risks to construction workers, as well as future industrial worker, maintenance workers, and hypothetical residents from exposure to environmental media in this area is being conducted under a separate UFP-SAP.

The Navy has determined that a Non-Time Critical Removal Action (NTCRA) maybe needed to address the LNAPL and heavily contaminated soil in the FOV Area. In order to complete an Engineering Evaluation/Cost Analysis (EE/CA) and conduct the NCTRA, the LNAPL plume must be further delineated and the extent of contaminated soil must be defined in order to support selection of appropriate remedial

technologies. This investigation is being conducted to collect data for the human health risk assessment, such that a NTCRA, if appropriate for the site, can be selected by the MCRD Partnering Team.

An earlier Conceptual Site Model (CSM) suggested that activities conducted at several sites surrounding Site 27 and Site 55, including Sites 9 and 16 (which are located northeast of the FOV), may have contributed to potential contamination at Sites 27 and 55. Investigations to date seem to have disproved the earlier CSM and the source of contamination at Site 27 remains unknown. Contamination migrating from the FOV Area is believed to be the principal source of contamination at Site 27, although prior investigations indicate that other significantly smaller potential sources exist on Site 27.

Investigations at the sites in the area of Site 27 included the Initial Assessment Study (IAS) in 1986 (Sites 9 and 16), a Remedial Investigation (RI) Verification Step (VS) in 1988 (Site 16), a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA), which included a file review and Visual Site Inspection (VSI) in 1990 (Sites 9, 16, and 27), Relative Site Ranking efforts in 1995 (Sites 9 and 27), Site Inspection (SI)/Confirmatory Sampling (CS) in 1999 (Sites 9 and 27), Soil and Groundwater Field Screening in 2002 (Site 55), a Groundwater Investigation in 2003 (Site 55), and two phases of an RI (2007 and 2008). Some of these investigations included only a review of available files on the sites to determine if there was a possibility of contaminant release to the environment. Other investigations included field activities such as soil and groundwater sampling.

Remedial actions at the sites in the area of Site 27 included a soil removal at Site 9 in 1984 and, on several occasions, removal of petroleum hydrocarbons that had formed a LNAPL layer on the groundwater and that had accumulated in the FOV at Site 55.

VOCs, SVOCs [including polynuclear aromatic hydrocarbons (PAHs)], pesticides, PCBs, and metals were detected sporadically in the soil samples collected in 2007 and 2008 from around the Motor-T Area at concentrations below risk based screening criteria for most chemicals. PAHs were detected in two surface soil samples at concentrations above risk-based screening criteria. High concentrations of VOCs and pesticides (above screening criteria) were detected in soil samples collected from around the FOV and in soil samples downgradient of the FOV (including one in the Motor-T Area). As with previous investigations, wide-spread elevated concentrations of VOCs and pesticides (above screening criteria) were detected in the groundwater samples from around the FOV. Low concentrations of SVOCs and PAHs were also detected sporadically in groundwater samples from the area. This investigation, in part, tested the earlier CSM that the original source of groundwater contamination might have been Site 9 and/or Site 16. However, groundwater sampling results and groundwater surface elevation measurements did not support the earlier CSM.

Preliminary evaluation of the historic data and the Phase I and Phase II RI data indicates that contact with surface soil, subsurface soil, and groundwater in the Site 27 area may present unacceptable risks for human receptors (concentrations exceed risk based screening criteria). Therefore, a NTCRA may be conducted to address the LNAPL and heavily contaminated soil in the vicinity of the FOV. In order to complete the EE/CA and conduct the NTCRA, the LNAPL plume in the vicinity of the FOV must be further delineated and the extent of contaminated soil and groundwater must be defined in order to support selection of appropriate remedial technologies. Additionally, MCRD Parris Island is planning to relocate the Motor Transportation Facility. Because contaminated soil and groundwater from the Site 27 FOV Area may extend under the proposed Motor-T Area, additional soil samples are needed to determine the extent of contamination and to quantitate the unacceptable risks from exposure to the media in this area. These additional soil samples are being collected during a separate investigation presented in another UFP-SAP.

SAP Worksheet #2 -- SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number:	**Site 27 - Equipment Parade Deck**
Operable Unit:	**Not Applicable**
Contractor Name:	**Tetra Tech NUS, Inc. (TtNUS)**
Contract Number:	**N62467-04-D-0055**
Contract Title:	**Comprehensive Long-Term Environmental Action Navy (CLEAN)**
Work Assignment Number:	**Contract Task Order (CTO) 0166**

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the U.S. Environmental Protection Agency (USEPA) *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (USEPA, March 2005) and *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, (*USEPA, December 2002*)*.

2. Identify regulatory program:

   Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

3. This document is a project-specific SAP.

4. List dates of scoping sessions that were held:

   Data Quality Objective (DQO) Scoping Session, September Partnering Team Meeting - September 15 and 16, 2009

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

   Title *Date*

   Not applicable

6. List organizational partners (stakeholders) and connection with lead organization:

   MCRD Parris Island – tenant
   USEPA, Region 4 – regulatory oversight
   South Carolina Department of Health and Environmental Control (SCDHEC) – regulatory oversight

7. Lead organization

   Department of the Navy, Naval Facilities Engineering Command, Southeast (NAVFAC SE)

8. If any required UFP-SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

   All required elements are included in this SAP.

UFP-SAP Worksheet #	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
1	Title and Approval Page	Not Applicable
2	Table of Contents SAP Identifying Information	Not Applicable
3	Distribution List	Not Applicable
4	Project Personnel Sign-Off Sheet	Not Applicable
Project Organization		
5	Project Organizational Chart	Not Applicable
6	Communication Pathways	Not Applicable
7	Personnel Responsibilities and Qualifications Table	Not Applicable
8	Special Personnel Training Requirements Table	Not Applicable
Project Planning/ Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	Not Applicable
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	Not Applicable
11	Site-Specific Project Quality Objectives	Not Applicable
12	Measurement Performance Criteria Table	Not Applicable
13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	Not Applicable
14	Summary of Project Tasks	Not Applicable
15	Reference Limits and Evaluation Table	Not Applicable
16	Project Schedule/Timeline Table	Not Applicable
B. Measurement Data Acquisition		
Sampling Tasks		
17	Sampling Design and Rationale	Not Applicable
18	Sampling Locations and Methods/ Standard Operating Procedure (SOP) Requirements Table/Sample Location Map(s)	Not Applicable
19	Analytical Methods/SOP Requirements Table	Not Applicable
20	Field Quality Control Sample Summary Table	Not Applicable
21	Project Sampling SOP References Table Sampling SOPs	Not Applicable
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	Not Applicable
Analytical Tasks		
23	Analytical SOPs Analytical SOP References Table	Not Applicable
24	Analytical Instrument Calibration Table	Not Applicable
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Not Applicable

UFP-SAP Worksheet #	Required Information	Crosswalk to Related Information
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	Not Applicable
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	Not Applicable
Quality Control Samples		
28	Quality Control Samples Table Screening/Confirmatory Analysis Decision Tree	Not Applicable
Data Management Tasks		
29	Project Documents and Records Table	Not Applicable
30	Analytical Services Table Analytical and Data Management SOPs	Not Applicable
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	Not Applicable
32	Assessment Findings and Corrective Action Responses Table	Not Applicable
33	Quality Assurance Management Reports Table	Not Applicable
D. Data Review		
34	Verification (Step I) Process Table	Not Applicable
35	Validation (Steps IIa and IIb) Process Table	Not Applicable
36	Validation (Steps IIa and IIb) Summary Table	Not Applicable
37	Usability Assessment	Not Applicable

SAP Worksheet #3 -- Distribution List

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipient	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address
Charles Cook	Navy Remedial Project Manager (RPM) (decision maker for NAVFAC SE)	NAVFAC SE	(904) 542-6409	charles.cook2@navy.mil
Tim Harrington	MCRD Parris Island Point of Contact (POC) (decision maker for MCRD Parris Island)	MCRD Parris Island	(843) 228-3423	timothy.j.harrington@usmc.mil
Lila Llamas	USEPA RPM (decision maker for USEPA)	USEPA Region 4	(404) 562-9969	Llamas.Lila@epa.gov
Meredith Amick	State RPM (decision maker for SCDHEC)	SCDHEC	(803) 896-4218	AmickMS@dhec.sc.gov
Mark Sladic	Task Order Manager (TOM) (decision maker for TtNUS)	TtNUS	(412) 921-8216	mark.sladic@tetratech.com
To Be Determined (TBD)	Field Operations Leader (FOL) (oversees overall field team effort)	TtNUS		
TBD	Site Safety Officer (SSO) (oversees safety of field team)	TtNUS		
Cathy Dover	Laboratory Project Manager (PM) (decision maker for laboratory)	CompuChem	(919) 379-4089	cdover@compuchemlabs.com
Bonnie Capito	Administrative Record (AR)/Librarian (maintains AR for NAVFAC)	NAVFAC Atlantic	(757) 322-4785	bonnie.capito@navy.mil

Each person listed in this table will be responsible for distributing copies of this SAP to appropriate personnel within their organization. For example, the TOM will be responsible for distributing copies of this SAP to all project personnel listed in Worksheet #4 (Personnel Sign-Off Sheet).

SAP Worksheet #4 -- Project Personnel Sign-Off Sheet

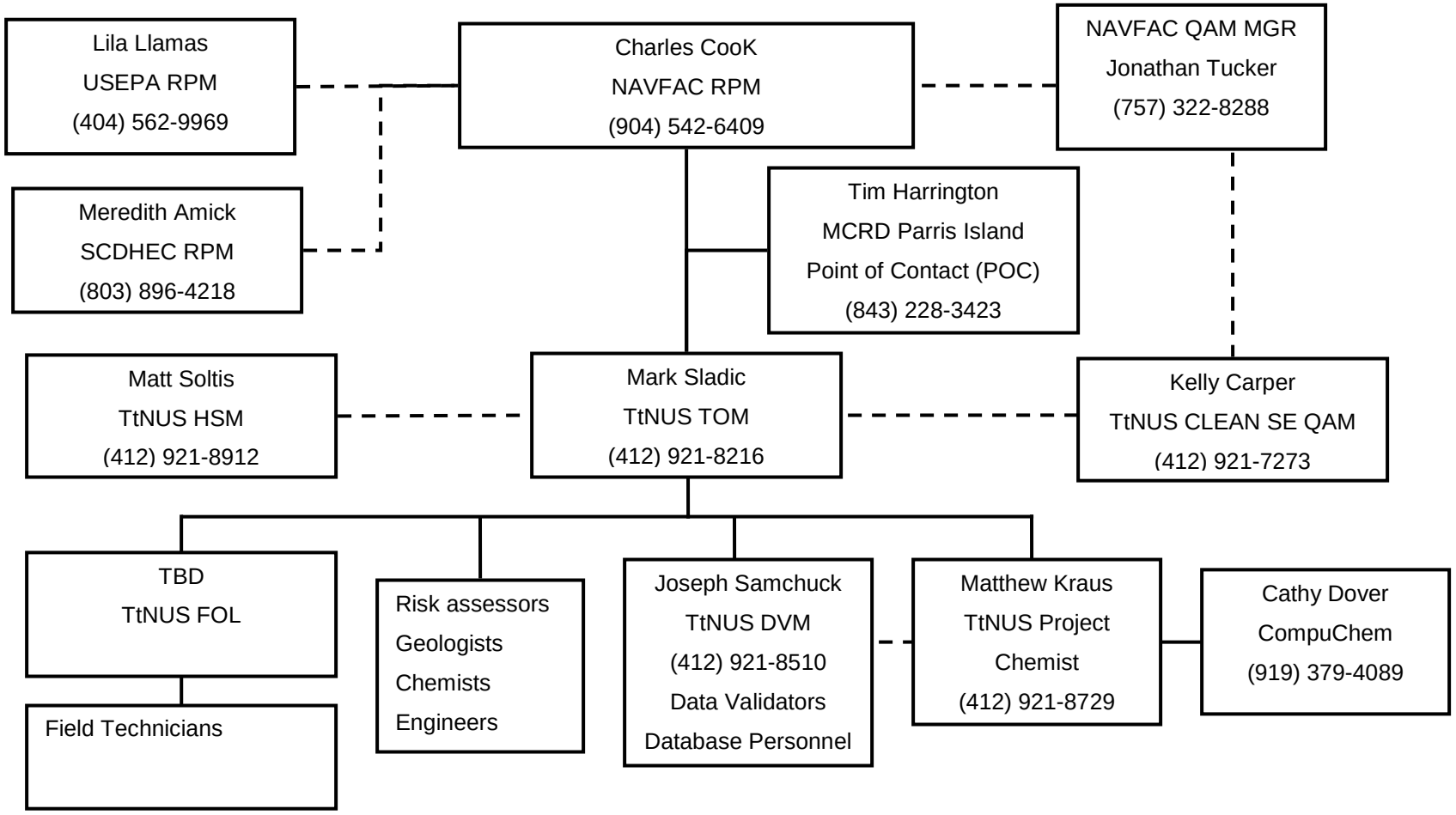
(UFP-QAPP Manual Section 2.3.2)

Name	Organization/Title/Role	Telephone Number	Signature/E-Mail receipt	SAP Section Reviewed	Date SAP Read
Mark Sladic	TtNUS/TOM (decision maker for TtNUS)	(412) 921-8216		All	
Greg Zimmerman	TtNUS/Project Engineer (assists with risk assessments)	(412) 921-8992		All	
Kelly Carper	TtNUS/CLEAN SE Quality Assurance Manager (QAM) (reviews SAP)	(412) 921-7273		All	
Matthew Kraus	TtNUS/Project Chemist (provides input on analytical methods, etc.)	(412) 921-8729		All	
Joseph Samchuck	TtNUS/Data Validation Manager (DVM) (oversees validation of data)	(412) 921-8510		Worksheets #12, #14, #15, #19, #20, #23-28, #30, #34-37	
TBD	TtNUS/FOL (oversees overall field team effort)			All and Health and Safety Plan (HASP)	
TBD	TtNUS/SSO (oversees safety of field team)			All and HASP	
Cathy Dover	CompuChem/PM (decision maker for laboratory)	(919) 379-4089		Worksheets #12, #14, #15, #19, #20, #23-28, #30, #34-36	

SAP Worksheet #5 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)

Lines of Authority ——— Lines of Communication ·····



SAP Worksheet #6 -- Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail Address	Procedure
Field Task Modification Requests (FTMRs) – Sampling	TtNUS FOL	TBD	TBD	Immediately obtain approval from TtNUS TOM. Document via FTMR Form within 72 hours. The TtNUS TOM will make immediate email notification to the PI Team. To the extent practical, Navy/TtNUS will work with the Team if any objections or concerns are identified by Team Members prior to implementation.
SAP Amendments	Navy RPM	Charles Cook	904.542.6409	Mail scope change to TtNUS Program Management Office within 1 week.
Schedule Changes	TtNUS TOM	Mark Sladic	412.921.8216	Inform Navy via e-mail or verbal communication within 48 hrs of realizing impact. Navy informs PI Team on the same day.
Field issues that require changes in the scope or implementation of field work	TtNUS TOM TtNUS FOL	Mark Sladic TBD	412.921.8216 TBD	FOL informs TOM via verbal communication within 24 hrs of recognizing need for change. TOM informs Navy RPM via verbal communication within 48 hrs of recognizing need for change. Navy RPM concurs with change within 2 days of recognizing need for change, after consulting with the PI Team for consensus, except where already approved in the SAP.
Stop work recommendations, for example, to protect workers from unsafe conditions or situations or to prevent a degradation in quality of work	TtNUS TOM TtNUS FOL TtNUS CLEAN SE QAM TtNUS HSM Navy RPM	Mark Sladic TBD Kelly Carper Matt Soltis Charles Cook	412.921.8216 TBD 412.921.7273 412.921.8912 904.542.6409	Responsible party immediately informs subcontractors, Navy, and project team within 1 week via e-mail or verbal communication. If stop work order is issued, document via letter or memorandum to file. Navy to inform PI Team on the same day.
Field or laboratory data issues	Compuchem TtNUS Project Chemist	Cathy Dover Matthew Kraus	919.379.4089 412.921.8729	Within 48 hours of noting a deficiency, notify TtNUS Project Chemist via e-mail or verbal communication. Notify Data Validation Staff and TtNUS TOM via e-mail or verbal communication within 24 hrs of identifying deficiency. TtNUS to

				notify the PI Team on the same day.

SAP Worksheet #7 -- Personnel Responsibilities and Qualification's Table

(UFP-QAPP Manual Section 2.4.3)

Name	Title/Role	Organizational Affiliation	Responsibilities
Mark Sladic	TOM, Decision maker for TtNUS	TtNUS	Oversees project, including financial, schedule, and day-to-day technical management of the project. • Ensures timely resolution of project-related technical, quality, and safety questions associated with TtNUS operations. • Functions as the primary TtNUS interface with the Navy RPM, MCRD POC, TtNUS field and office personnel, laboratory points of contact, USEPA RPM, and SCDHEC RPM. • Ensures that TtNUS health and safety issues related to this project are communicated effectively to all personnel and off-site laboratories. • Monitors and evaluates all TtNUS subcontractor performance. • Coordinates and oversees work performed by TtNUS field and office technical staff (including data validation, data interpretation, and report preparation). • Coordinates and oversees maintenance of all TtNUS project records. • Coordinates and oversees review of TtNUS project deliverables. • Prepares and issues final TtNUS deliverables to the Navy.
Kelly Carper	QAM, Provides quality assurance review of SAP	TtNUS	Reviews SAP, oversees preparation of laboratory scope, coordinates with laboratory, and conducts data quality reviews. Ensures quality aspects of the TtNUS NAVFAC SE CLEAN program. • Conducts systems and performance audits to monitor compliance with environmental regulations, contractual requirements, SAP requirements, and corporate policies and procedures. • Audits project records. • Monitors subcontractor quality controls and records. • Assists in the development of corrective action plans and ensures correction of non-conformances reported in internal or external audits. • Ensures that this SAP meets TtNUS, Navy, USEPA, and SCDHEC requirements. • Prepares Quality Assurance (QA) reports for management.

Name	Title/Role	Organizational Affiliation	Responsibilities
Matthew Kraus	Project Chemist, provides input on analytical requirements	TtNUS	Coordinates analyses with laboratory chemists, ensures that the scope is followed, reviews QA data packages, and communicates with TtNUS staff. • Ensures that the project meets objectives from the standpoint of laboratory performance • Provides technical advice to the TtNUS team on matters of project chemistry. • Monitors and evaluates subcontractor laboratory performance. • Ensures timely resolution of laboratory-related technical, quality, or other issues effecting project goals. • Functions as the primary interface with the subcontracted laboratories and the TtNUS TOM. • Coordinates and oversees work performed by the subcontracted laboratories. • Oversees the completion of TtNUS data validation. • Coordinates and oversees review of laboratory deliverables. • Recommends appropriate laboratory corrective actions.
Greg Zimmerman	Project Engineer, Assists with risk assessments	TtNUS	Assists project manager. • Coordinates and oversees work performed by TtNUS field and office technical staff (including data validation, data interpretation, risk assessment, and report preparation). • Coordinates and oversees review of TtNUS project deliverable. • Prepares and issues final TtNUS deliverables to the Navy.
Joseph Samchuck	DVM, Oversees validation of analytical data	TtNUS	Manages data validation activities.
TBD	Feasibility Study (FS) Engineer, Prepares Feasibility Study	TtNUS	Develops and evaluates remedial alternatives in an FS.

Name	Title/Role	Organizational Affiliation	Responsibilities
TBD	SSO, Ensures compliance with HASP	TtNUS	Responsible for training and monitoring site conditions. • Oversees specific health and safety-related field operations such as personnel decontamination, monitoring of worker heat or cold stress, and distribution of safety equipment. • Conducts and documents a daily health and safety briefing each day while on site. • Ensures that field personnel comply with all procedures established in the HASP. • Identifies assistant SSOs in his/her absence. • Terminates work if an imminent safety hazard, emergency situation, or other potentially dangerous situation is encountered. • Ensures the availability and the condition of health and safety monitoring equipment. • Coordinates with FOL and TOM to institute and document any necessary HASP modifications. • Ensures that facility personnel and subcontractors are adequately advised and kept clear of potentially contaminated materials.
TBD	FOL, Supervisor of Field Team	TtNUS	Supervises, coordinates, and performs field sampling activities. • Ensures that all health and safety requirements unique to this project are implemented. • Alerts off-site analytical laboratories of any special health and safety hazards associated with environmental samples. • Functions as the on-site communications link between field staff members, the SSO, MCRD POC, and TtNUS TOM. • Oversees the mobilization and demobilization of all field equipment and subcontractors. • Coordinates and manages the field technical staff. • Adheres to the work schedules provided by the TtNUS TOM. • Ensures the proper maintenance of site logbooks, field logbooks, and field recordkeeping. • Initiates FTMRs when necessary. • Identifies and resolves problems in the field via consultation with the MCRD POC, implementing and documenting corrective action procedures, and providing communication between the field team and project management.

Name	Title/Role	Organizational Affiliation	Responsibilities
Cathy Dover	PM, Decision maker for Laboratory	Compuchem	Coordinates analyses with lab chemist, ensures that scope is followed, reviews data packages, communicates with TtNUS staff. • Ensures that method- and project-specific requirements are properly communicated and understood by laboratory personnel. • Ensures that all laboratory resources are available on an as-required basis. • Ensures compliance with analytical and project QA requirements. • Reviews data packages for completeness, clarity, and compliance with project requirements. • Informs the TtNUS TOM of project status and any sample receipt or analytical problems. • Oversees the preparation of and approves final analytical reports before submittal to TtNUS.
Charles Cook	RPM, Decision maker for Navy	Navy	Oversees overall project, financial, schedule, and technical management of the project for the Navy. • Functions as the primary Navy interface with the TtNUS TOM, MCRD POC, USEPA RPM, and SCDHEC RPM.
Lila Llamas	RPM, Decision maker for USEPA	USEPA	Functions as the primary USEPA interface with the Navy RPM, MCRD POC, TtNUS TOM, and SCDHEC RPM.
Meredith Amick	RPM, Decision maker for SCDHEC	SCDHEC	Functions as the primary SCDHEC interface with the Navy RPM, MCRD POC, TtNUS TOM, and USEPA RPM.

In some cases, one person may be designated responsibilities for more than one position. For this UFP-SAP, the FOL may also be responsible for SSO duties and Site QA/QC responsibilities. This action will be performed only as credentials, experience, and availability permits.

SAP Worksheet #8 -- Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)

All field personnel will have appropriate training to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed a 40-hour course (and 8-hour refresher, if applicable) in health and safety training as described under Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(b)(4). Safety requirements are addressed in greater detail in the site-specific TtNUS HASP.

SAP Worksheet #9 -- Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)

Project Name: Site 27 Fiber Optic Vault LNAPL Delineation Projected Date(s) of Sampling: Spring 2010 Project Manager: Mark Sladic	Site Name: Site 27 - Equipment Parade Deck Site Location: MCRD Parris Island, South Carolina

Date of Session: September 15 and 16, 2009 (September Partnering Meeting)
Scoping Session Purpose: DQO Development.

Name	Title, Affiliation	Phone #	E-mail Address	Project Role
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Annie Gerry	Geologist/ Hydrologist, SCDHEC	(803) 896-4018	GerryAM@dhec.sc.gov	SCDHEC Geologist/ Hydrologist
Susan Byrd	Risk Assessor, SCDHEC	(803) 896-4255	Byrdsk@dhec.sc.gov	Risk Assessment Support

Comments/Decisions

Site 27 Path Forward

The ultimate goal is to have a ROD and remedy in place. A short-term goal is to determine how best to carry out CERCLA and remedial activities without hindering Depot construction activities. The Navy indicated that an EE/CA provides the Depot with better support because contamination in the vault is an operational hindrance (NAPL layer pumping, etc.) The Navy is trying to determine the appropriate

regulatory path to follow for any upcoming Site 27 work. USEPA and DHEC indicated that they cannot support an RI with data gaps and DHEC reminded the Team that LNAPL removal may be necessary.

The Navy indicated that funds for the Motor Transportation Facility construction at Site 27 will expire September 2012 and the construction needs to be started by March 2011.

Several alternatives for the path forward were discussed.

DQOs for the Motor-T Area were discussed.

Motor-T Area Analyte List – Target Compound List (TCL) VOCs (risk driver), SVOCs, pesticides (risk driver), PCBs, Target Analyte List (TAL) metals, PAHs.

Can previously collected data (1995, 2002, 2007, and 2008) be used in conjunction with new data for the risk assessment? Per DHEC, it is not reasonable to use 1995 data for current exposure scenarios. However, 2007 and 2008 data is acceptable.

Still to be done

1) Does a UFP SAP need to be completed? If yes, then Remedial Action Contractor (RAC) is to start writing UFP SAP. If no, then RAC to write the work plan.

2) Answer the following questions:

If principal threat waste is present, then …
If risk to construction workers is unacceptable, then …
If risk to industrial workers is unacceptable, then ...

Action Items

Mark Sladic is to arrange a conference call with Charles Cook, Peggy Churchill, and Mike Singletary to discuss if the RAC contractor can perform work at Site 27 without a UFP SAP.

Tim Harrington is to ensure the RAC will not disturb the area east of the fence line (proposed parking lot/vault area) during construction activities at Site 27 and confirm this is acceptable to Public Works.

Greg Zimmerman is to have a map made of Site 27 to include SVOCs, VOCs, and pesticide detections. Greg Zimmerman is to evaluate background data options for Site 27 (soil and sediment). Greg

Zimmerman is to review National Oil and Hazardous Substances Pollution (NCP) for definition of principal threat waste and applicability to 270,000 ppm DDT.

Consensus Decisions

Consensus Item: The Team reached consensus that completing the RI, following it with an EE/CA, and revising the RI is not an option for Site 27.

Consensus Item: The Team reached consensus that the proposed path forward for Site 27 (if it can be done without a UFP SAP) is for the RAC to delineate and to clear the construction site; prepare an EE/CA, Action Memo, and Removal Action Work Plan; perform a removal action if necessary; and conduct post-removal confirmation sampling. After the constructions site area is cleared (inside purple line box), the RAC will complete a UFP SAP for the remainder of the LNAPL delineation as well as the RI data gaps, mobilize to implement the UFP SAP, and use data to complete the RI and develop an FS. If a UFP SAP has to be completed prior to delineation of the construction site area, the RAC will prepare a UFP SAP for that effort.

Consensus Item: The Team reached consensus to perform data gap sampling at the Motor-T Area (Site 27 – inside purple box) while Tetra Tech evaluates current background data options and attempts to construct a background data set from existing Parris Island data. If adequate Parris Island data are not available, then consider a local (Beaufort) background data set. Evaluation will be conducted by the Team to determine the applicability and comparability of the background data set. If PAHs are a risk driver and an existing background data set is not applicable or comparable, a site specific PAH background data set will need to be collected.

Consensus Item: The Team reached consensus that 2007 and 2008 data can be used in the risk assessment for the Motor-T Area (Site 27).

The draft minutes of the September 15 and 16 Partnering Team Meeting are included in this SAP as Appendix A-1.

The draft minutes of the May 18 to 20, 2009 meeting are included in this SAP in Appendix A-1.

SAP Worksheet #10 -- Conceptual Site Model

(UFP-QAPP Manual Section 2.5.2)

10.1 SITE BACKGROUND

Site 27, the Equipment Parade Deck, a 1-acre asphalt-covered area located in an industrial part of MCRD Parris Island (Figure 10-1), was formerly used as a parade ground and is currently used for storage of miscellaneous equipment (Figure 10-2). For an unknown length of time, out-of-service storage tanks, concrete cylinders, boilers, scrap metal, and piping were stored here until suitable facilities for hauling, storage, or destruction of the materials were found. An unknown amount of hazardous materials were handled on the Parade Deck, possibly including waste petroleum products and metals. Additionally, transformers containing PCB oils were reportedly stored in the northern portion of the Equipment Parade Deck; however, the exact location is not known. The asphalt is cracked or deteriorated in several areas.

Site 27 is surrounded by several other sites that have contamination in soil or groundwater. Most importantly, the FOV (originally listed as Site 55) was installed in September 2001 and is located approximately 20 feet east of Atsugi Street, 100 feet southwest of Building 401, and 140 feet northwest of Building 405 (Figure 10-2). The vault is an oversized utility manhole used for the installation of fiber optic communications cables in this part of MCRD. There is no regular or routine access to the vault. The vault consists of pre-cast concrete with inner dimensions of 12 feet by 6 feet by 7 feet deep. The walls include blanked cutouts for fiber optic cables to enter the vault from the north, east, south, and west. The site is relatively flat with both grassy and paved areas. Overhead power lines are present near the vault, and an underground sewer line is located approximately 70 feet to the northeast. When the FOV was being installed, LNAPL was discovered floating on groundwater. In September 2001, a soil sample was collected next to the vault and results indicated the presence of BTEX (TtNUS, August 2004). The FOV Area (Site 55) is located just east of the Motor-T Area of Site 27 and based on prior investigations groundwater flows predominantly to the northwest from the FOV Area toward the Motor-T Area (and ultimately toward the 3rd Battalion Pond northwest of the Motor-T Area). Consequently, contaminants in the soil and groundwater in the FOV Area may be impacting groundwater and subsurface soil within the Motor-T Area of Site 27.

An earlier CSM suggested that activities conducted at several sites surrounding Site 27 and Site 55, including Sites 9 and 16 (which are located northeast of the FOV Area), may have contributed to potential contamination at Site 27 and 55 (Figure 10-2). Investigations to date seem to have disproved the earlier CSM and the source of contamination at Site 27 remains unknown. Contamination from FPV Area is believed to be the principal source of contamination at Site 27, although prior investigation indicates that other significantly smaller potential sources exist on Site 27. Section 10.2 provides a summary of the

results of the previous investigations and provides the basis for the assertion that the contaminated soil and groundwater in the FOV Area is the predominant source of contamination within Site 27.

Detailed historical building use information is not available for the buildings in the area of Site 27. MCRD Parris Island reports that Building 401 is a RCRA/Toxic Substances Control Act (TSCA)/Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)-compliant pest control facility that was constructed in the early 1990s and that Building 405 is a small warehouse that has been used by the 3rd Battalion and Marine Corps Community Services (MCCS) over the past 10 years or so. Building 852 (approximately 200 feet to the north) has housed administrative functions for at least the past 30 years, with no known pesticide handling activity at any time.

10.2 PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

Previous investigations at the sites in the area of Site 27 included the IAS in 1986 (Sites 9 and 16), a RI VS in 1988 (Site 16), a RFA, which included a file review and VSI in 1990 (Sites 9, 16, and 27), Relative Site Ranking efforts in 1995 (Sites 9 and 27), a SI/CS in 1999 (Sites 9 and 27), Soil and Groundwater Field Screening in 2002 (Site 55), and a Groundwater Investigation in 2003 (Site 55). Some of these investigations involved only a review of available files on the sites to determine if there was a possibility of contaminant release to the environment. Other investigations included field activities such as soil and groundwater sampling.

Remedial actions at the sites in the area of Site 27 included a soil removal at Site 9 in 1984 and, on several occasions, removal of petroleum hydrocarbons that had formed a LNAPL layer on the groundwater that had accumulated in the Fiber Optic Vault at Site 55.

10.2.1 Site Inspection/Confirmatory Sampling – Sites 9 and 27 (1999)

The SI/CS addressed seven sites at MCRD Parris Island, including Sites 9 and 27. The SI/CS report also included the results of samples collected in 1995 as part of the Navy's Relative Site Ranking effort. Two groundwater samples were collected at Site 9 and three surface soil samples were collected at Site 27 in December 1999.

Three soil samples were collected from approximately 6 inches below ground surface (bgs) at Site 9 during the relative site ranking effort. Results indicated concentrations of three VOCs, 12 SVOCs (including 10 PAHs), four pesticides, one PCB, and 18 metals were detected in soil above human health and/or ecological screening criteria. Additionally, two temporary monitoring wells were installed at Site 9 in December 1999. VOCs were not detected in the groundwater samples collected at Site 9 and, while

several metals were detected in the groundwater, only aluminum was detected at a concentration that exceeded any of the 2002 screening criteria.

Evaluation of the 1995 soil data indicated that past use of Site 27 as a transformer storage area did not impacte the soil with PCBs. However, detections of VOCs, PAHs, pesticides, and metals in these soil samples indicate that some impact has occurred. In addition, PCBs were not detected in the three surface soil samples collected in 1999 at Site 27.

The SI/CS Report recommended that land use controls be implemented at Sites 9 and 27 to prohibit residential development of the sites. The SI/CS Report also recommended that if the industrial setting at Sites 9 or 27 were to change in the future, a reevaluation of the decision to implement land use controls should be considered (TtNUS, July 2002).

10.2.2 Petroleum Hydrocarbons Removal – Site 55 (2001 and 2003)

In September 2001, following installation of the vault, petroleum hydrocarbons (LNAPL) and water were observed within the vault. In late October 2001, approximately 0.5 inch of free product was observed in the vault floating on approximately 1 foot of water. Efforts were made to remove the free product and stop the infiltration of groundwater into the vault by applying a sealing compound to the internal concrete surfaces. In late fall 2001, the free product and water in the vault were pumped out and the vault was steam cleaned. During early 2002, the water table had fallen and the lower row of cutouts was capped to prevent additional accumulation of fluids. Water/free product was also removed from the vault by TtNUS in March 2003, and the internal concrete surface was resealed at this time.

10.2.3 Soil and Groundwater Field Screening – Site 55 (2002)

In July 2002, soil and groundwater field screening was performed using a direct-push technology (DPT) rig equipped with a membrane interface probe (MIP).

Although the key contaminants are not good MIP responders and the results are inconclusive, the results of the field screening indicated that the shallow surficial aquifer was contaminated (TtNUS, August 2004). Floating product was detected in one boring, but was not detected in the adjacent boring. The highest concentrations of contaminants including BTEX, chlorobenzene, MTBE, and naphthalene were found in borings west of the FOV and one boring located immediately east of the FOV. However, soil analytical data obtained during the screening indicated minimal soil contamination within the DPT borings. Chlorobenzene and naphthalene were the only analytes detected in the soil borings (TtNUS, August 2004).

10.2.4 Groundwater Investigation – Site 55 (2003)

Site 55 was initially investigated under the Underground Storage Tank (UST) program but, based on the results of the 2002 field screening (Section 10.2.3), SCDHEC requested that the site be transferred to the Bureau of Land and Waste Management RCRA Program for oversight (TtNUS, August 2004). The results of the July 2002 field screening were used to select the locations for 21 monitoring wells that were installed in December 2002 in the Site 55 area. Groundwater in the FOV Area flows predominantly to the northwest from the FOV Area toward the Motor-T Area. Twelve of the monitoring wells were developed and sampled in July 2003 to isolate/confirm a source area, to characterize the intermediate and deep portions of the surficial aquifer, and to investigate the downgradient shallow surficial aquifer. Because the site had been switched to the IR Program, the analytical program for these groundwater samples was expanded to include VOCs, SVOCs, pesticides, and PCBs. Because of the limited surface soil detections observed during the 2002 field screening, a soil sampling program was not conducted during the July 2003 investigation.

Free product was encountered at monitoring well PAI-27-MW06S when the wells were installed in December 2002, but was not encountered in any of the monitoring wells sampled during the July 2003 groundwater sampling event. The 2003 analytical results indicated the presence of 11 VOCs, 10 SVOCs, and seven pesticides in the groundwater samples collected from the monitoring wells in the Site 55 area and confirmed the presence of chlorobenzene, BTEX, and naphthalene (detected in the 2002 field screening). However, the concentrations of these compounds in the 2003 samples were significantly lower than the concentrations detected in the 2002 field screening samples. The Preliminary Assessment/Site Inspection and Confirmatory Sampling Report for Site 55 recommended that Site 55 proceed to a focused remedial investigation to further characterize the nature and extent of contamination related to a potential petroleum and/or pesticide release and to quantify risks posed to human health and the environment (TtNUS, August 2004).

10.2.5 Remedial Investigation – Site 27 (2007 and 2008)

MCRD Parris Island identified a need for a military construction project at Site 27 and, as a consequence, the need for further investigation of the Site 27 area. The investigations at Site 55 identified impacts to Site 27 groundwater from Site 55, therefore the Site 27 Phase I and Phase II RI field activities included a larger area, which encompassed Sites 9 and 16, the Equipment Parade Deck Area, and the FOV Area. Because the investigation described in this UFP-SAP is specific to the Equipment Parade Deck area for purposes of assessing risk to construction workers, the Equipment Parade Deck will now be referred to as the Motor-T Area when describing results from the Site 27 RI.

Phase I of the Site 27 RI was conducted in July 2007. Data were collected to characterize the nature and extent of contamination and to assess the human health risks associated with potential direct contact with contaminants. Phase II of the Site 27 RI was conducted in August 2008. Data were collected to define the extent of the pesticide and chlorobenzene (and other VOCs) contamination in groundwater and to determine if there was a soil source of pesticides and VOCs in the Site 27/Site 55 area.

Twenty-six temporary monitoring wells (12 shallow, 13 intermediate, and one deep) and 17 permanent monitoring wells (nine shallow and eight intermediate) were installed in 2007 and 2008. Groundwater samples were collected from the 26 temporary monitoring wells, the 17 newly installed permanent monitoring wells, and from existing permanent monitoring wells. Soil samples were collected from soil samples around the perimeter of the Motor-T Area in 2007 and from around the FOV in 2008. One sample of the LNAPL was collected in 2008 from an existing monitoring well.

VOCs, SVOCs (including PAHs), pesticides, PCBs, and metals were detected sporadically in the soil samples collected in 2007 and 2008 from around the Motor-T Area at concentrations below risk-based screening criteria, for most chemicals, PAHs were detected in two surface soil samples at concentrations above risk-based screening criteria. High concentrations of VOCs and pesticides (above screening criteria) were detected in soil samples collected from around the FOV and in soil samples downgradient of the FOV (including one in the Motor-T Area). As with previous investigations, wide-spread elevated concentrations of VOCs and pesticides (above screening criteria) were detected in the groundwater samples from around the FOV. Low concentrations of SVOCs and PAHs were also detected sporadically in the groundwater samples from the area. This investigation, in part, tested the earlier CSM that the original source of groundwater contamination might have been Site 9 and/or Site 16. However, groundwater sampling results and groundwater surface elevation measurements did not support the earlier CSM.

Figure 10-3 shows exceedances of regulatory criteria in all soil samples collected from the Site 27 area and Figure 10-4 shows exceedances of regulatory criteria in ground water samples collected from the Site 27 area in 2007 and 2008.

10.3 CONCEPTUAL SITE MODEL

The CSM is shown on Figure 10-5. The source of contaminants within the FOV Area appears to be a petroleum hydrocarbon material including pesticides mixed with fuel oil for pesticide application purposes. The material has impacted surface soil, subsurface soil, and groundwater in the FOV Area as evidenced by the presence of the LNAPL and by high concentrations of pesticides and VOCs in the soil and groundwater. This contamination may be impacting groundwater or subsurface soil within the Motor-T

Area at Site 27 as groundwater flow direction in the vicinity is generally east to west from the FOV Area toward the Motor-T Area (although there is a radial component groundwater flow in the vicinity of the FOV). In this case, fuel oil acts as a co-solvent and transports the dissolved pesticides through surface and subsurface soil allowing them to eventually reach the water table.

Because of the contaminated soil and groundwater within the FOV Area, human health risks to maintenance workers, industrial workers, and construction workers from exposure to contaminants in surface soil via dermal contact, incidental ingestion, and inhalation of dust and vapors are possible. Construction workers may be also exposed to contaminants in the groundwater via ingestion, dermal contact, and inhalation of vapors when groundwater is uncovered during excavation. Future maintenance workers and future industrial workers may be exposed to contaminants in the groundwater via inhalation of vapors intruding into a future building. All of these exposure pathways will be evaluated during this investigation. Although Site 27 in general and the FOV Area in particular are not expected to be redeveloped for residential purposes, exposures to a future hypothetical resident will be evaluated for completeness. These exposures include dermal contact, incidental ingestion, and inhalation of dust and vapors associated with soil and inhalation of vapors volatilizing from groundwater and intruding into a future hypothetical residence. Although groundwater is not used as a source of drinking water, exposures to future hypothetical residents from using groundwater as a source of drinking water (i.e., ingestion, dermal contact, and inhalation of dissolved constituents) will be evaluated.

Soil data from the FOV Area (Site 55) indicates the presence of pesticides above human health screening criteria. Groundwater contamination within the Site 55 area indicates the presence of VOC and pesticides well above MCLs, and as a localized floating layer. In order to address the potential for Site 55 to act as a continuing source of contamination to Site 27, refined delineation is necessary to support a NTCRA. This delineation data will be evaluated during this investigation.

Ecological receptors (small mammals and birds) may be exposed to contaminants in surface soil via direct contact with soil and ingestion of contaminated food items. However, exposure of small mammals and birds to the contaminants in the surface soil is severely limited by the lack of viable habitat in the Site 27 and Site 55 areas and will not be evaluated as part of this investigation.

SAP Worksheet #11 -- Data Quality Objectives: Site 27

(UFP-QAPP Manual Section 2.6.1)

11.1 PROBLEM STATEMENT

Preliminary evaluation of the historic data and the Phase I and Phase II RI data indicates that contact with surface soil, subsurface soil, and groundwater in the Site 27 area may present unacceptable risks to human receptors (concentrations exceed risk based screening criteria). Therefore, a NTCRA may be conducted to address the LNAPL and heavily contaminated soil in the vicinity of the FOV. In order to complete the EE/CA and conduct the NTCRA, the LNAPL plume must be further delineated and the extent of contaminated soil and groundwater must be defined in order to support selection of appropriate remedial technologies. Additionally, MCRD Parris Island is planning to relocate the Motor Transportation Facility. Because contaminated soil and groundwater from the Site 27 FOV Area may extend under the proposed Motor-T Area, additional soil samples are needed to determine the extent of contamination and to quantitate the unacceptable risks from exposure to the media in this area. These additional soil samples are being collected during a separate investigation presented in another UFP-SAP. This investigation is being conducted in order to collect data for the human health risk assessment (as outlined in Appendix B), such that a NTCRA that is appropriate for the site can be selected by the Project Team

11.2 IDENTIFY THE INPUTS TO THE DECISION

1. Previously Collected Data: Phase I and II RI Data collected in 2007 and 2008 will be used for risk assessment and site characterization purposes.

2. Field screening results: Field screening for DDT and TPH will be conducted to delineate the extent of soil contamination and LNAPL and to select samples to be submitted to the fixed-base laboratory for analysis.

3. Chemical Data: Soil [TCL VOCs and pesticides (based on previous results), SVOCs, PAHs, PCBs, and TAL metals (based on regulator request), gasoline range organics (GRO) and diesel range organics (DRO) (reported by compound as indicators of petroleum contamination), pH, TOC, TCLP Organic Compounds and Inorganic Analytes (only 40 CFR 261), Flashpoint, Reactive Cyanide and Sulfide, and pH]. The list of all chemical analytes is presented in Worksheet 15. The sampling methods are presented in Worksheet 18 and the analytical methods are presented in Worksheet 19. The selected target analytes represent those analytes that are likely to be associated with historic site activities as described in the CSM.

4. Project Action Limits (PALs): A comprehensive listing of the relevant environmental and medium-specific risk-based screening levels for this investigation is presented in Worksheet 15 and include the following:

   - USEPA Regions 3, 6 and 9 Regional Screening Levels for Chemical Contaminants at Superfund Sites: Residential and Industrial Soil Values and Risk-Based Migration to Groundwater Soil Screening Level (SSL) values.

   - Soil Field Screening Values – for total DDT, a field screening value of 1.4 mg/kg (residential Regional Screening Level for Chemical Contaminants at Superfund Sites for DDE) will be used and for TRPH, a field screening value of 10 mg/kg (South Carolina Risk-Based Corrective Action for Petroleum Releases, May 2001) will be used.

   To conduct comparisons of Site data to screening values for surface soil and subsurface soil, the selected laboratory must be able to achieve Quantitation Limits (QLs) that are low enough to measure constituent concentrations below the PALs. In some cases, this will not be achievable. The rationale for allowing these deviations is described in the footnotes to Worksheet No. 15. The Project Team will accept "J" qualified laboratory analytical results when the PAL is between the Method Detection Limit (MDL) and the QL. When the PAL is less than the MDL for a particular analyte or analytes, an evaluation of detection limits and the impact on data usability will be discussed in the uncertainty section of the risk assessment.

11.3 DEFINE THE STUDY BOUNDARIES

The horizontal boundary for the FOV Exposure Unit (EU) is presented in Figure10-3. The horizontal boundary is intended to include the soil and groundwater populations of interest that represent a receptor's exposure across the entire exposure unit.

The vertical boundary for surface soil is the 0-1 foot interval, while the subsurface soil vertical boundary is defined by the foot of soil just above the water table, which varies, but is typically 5-8 feet bgs.

11.4 DEVELOP DECISION RULES

There are two main aspects of this investigation. One is comparison of laboratory analytical sample results to PALs to determine an appropriate course of action designed to mitigate potential unacceptable risks. The other is delineation of contamination, which requires decisions to be made in the field based on test kit results for DDT and TRPH concentrations and interpretation of laboratory results by the Project Team to determine areas of the site that are contaminated and areas of the site that are uncontaminated.

Decision making will be conducted using the following approaches provided below for the FOV Area risk assessment, contamination delineation and site characterization.

Risk Assessment Analytic Approach:

For each chemical in each investigated medium, if the maximum measured chemical concentration exceeds its human health screening value for a particular environmental medium, the chemical will be classified as a COPC for that medium and exposure scenario. Otherwise, that chemical will be excluded from further consideration in the risk assessment.

If any COPCs are selected, the site risk assessor will calculate human health risks as described in Appendix B using the 95% upper confidence limit (UCL) as exposure point concentrations (EPCs) in the risk assessment. If the calculated risks and hazard indices (HIs) for all receptors are acceptable [i.e., the total incremental lifetime cancer risk (ILCR) is less than or equal to 1×10^{-4} and the total HI is less than 1), then no further action is necessary and construction and redevelopment can proceed as planned. Otherwise, the MCRD Partnering Team will determine what actions will be necessary to protect construction workers during construction and future onsite receptors (maintenance workers, industrial workers, and hypothetical residents) after construction is completed. This may include conducting a NTCRA to remove contaminated soil from the area, or implementing land use controls to prevent access to contaminated media.

Delineation Analytic Approach:

In order to delineate the extent of contamination, step-out soil samples will be collected from additional soil borings in the event that concentrations of DDT or TRPH in perimeter soil samples exceed field screening values. Each perimeter surface and both subsurface soil samples will be measured with the DDT and TRPH Field test kits. If the DDT measured concentration is greater than 1.4 mg/kg (Residential USEPA Regional Screening level for DDE) and/or the TRPH measured concentration is greater than 10 mg/kg (conservative action level for TRPH), then additional soil borings will be installed equidistant from the previously location and in a direction that is toward anticipated lower contaminant concentrations. If more than two additional borings are required in any one direction, the collection of additional soil borings will be based on the FOL's discretion and in consultation with the MCRD Parris Island Partnering Team. If all measured DDT and TRPH perimeter soil concentrations are less than the field screening value, then delineation is complete and no more soil borings will be installed. Based on the field screening results, selected samples will be submitted to a fixed-base laboratory for analysis.

11.5 SPECIFY TOLERABLE LIMITS ON DECISION ERROR

Data will be collected in the FOV Area where LNAPL is present or where odors from soil borings or monitoring wells have been recorded and where the highest DDT concentrations in soil are located. A risk assessment and delineation of contamination will be completed during this investigation such that an EE/CA can be prepared and an appropriate Removal Action can be selected. After data are collected, the project team will use the data validation criteria and the criteria described in Worksheet #37 to determine whether data of sufficient type, quantity, and quality have been collected to support project objectives. The tendency will be to declare the data set to be sufficient if all intended data have been collected and no significant quality issues are identified. If any data gaps are identified, the Project Team will determine, based on the number and severity of data gaps, whether to collect more data or to accept the limitations incurred as a result of the data gaps.

Figure 17-1 presents the sample locations (three soil samples will be collected per location).

11.6 OPTIMIZE THE DESIGN

The sample design and rationale is presented in Worksheet No. 17.

SAP Worksheet #12 -- Measurement Performance Criteria Table – All Matrices

(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table – Field QC Samples

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Blank	All Fractions	One per source water.	Accuracy/Bias/ Contamination	No analytes ≥ ½ QL, except common lab contaminants, which must be < QL.	S&A
Equipment Rinsate Blanks	All Fractions	One per 20 field samples per matrix per sampling equipment[1].	Accuracy/Bias/ Contamination	No analytes ≥ ½ QL, except common lab contaminants, which must be < QL.	S&A
Trip Blanks	VOCs	One per cooler containing VOC samples.	Accuracy/Bias/ Contamination	No analytes ≥ ½ QL, except common lab contaminants, which must be < QL.	S&A
Field Duplicate	All Fractions	One per 10 field samples collected.	Precision	Values > 5X QL: Relative Percent Difference (RPD) ≤30%[2,] (aqueous); ≤ 50%[2,3] (solid).	S
Cooler Temperature Indicator	All Fractions	One per cooler.	Representativeness	Temperature between 2 and 6 degrees Celsius (°C) (4 ± 2 °C).	S

1 – Equipment rinsate blanks will be collected if non-dedicated submersible pumps or other equipment are used.
2 – If duplicate values for non-metals are < 5x QL, the absolute difference should be < 2x QL.
3 – If duplicate values for metals are < 5x QL, the absolute difference should be < 4x QL.

QL = Quantitation Limit

SAP Worksheet #13 -- Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Historical Data	TtNUS, July 2002. Draft Site Inspection/Confirmatory Sampling Report for Site/SWMU 4, Site/SWMU 5, Site/SWMU 7, Site 9/SWMU 8, Site 13C/SWMU 13, Site/SWMU 16, SWMU 27 and SWMU 35, MCRD Parris Island.	NAVFAC SE	Background information was used in planning of the sampling effort.	None, the data were fully validated.
Historical Data	TtNUS, August 2004. Preliminary Assessment/Site Inspection and Confirmatory Sampling Report for Site/SWMU 55, Fiber Optic Vault, MCRD Parris Island.	NAVFAC SE	Background information was used in planning of the sampling effort.	None, the data were fully validated.
Historical Data	TtNUS, June 2009. Conceptual Site Model, Site 27, Equipment Parade Deck, MCRD Parris Island	NAVFAC SE	Background information was used in planning of the sampling effort.	None, the data were fully validated.

SAP Worksheet #14 -- Summary of Project Tasks

(UFP-QAPP Manual Section 2.8.1)

The field tasks associated with the Site 27 RI sampling are summarized below along with short descriptions of these tasks. All data recording and management procedures are described in Worksheet #29.

- Mobilization/demobilization
- Soil sampling
- Surveying
- Monitoring equipment calibration
- Field decontamination procedures
- Field documentation procedures
- Waste handling
- Site restoration
- Sample custody and shipment tasks

Mobilization/Demobilization

Mobilization will consist of the delivery of all equipment, materials, and supplies to the site, the complete assembly in satisfactory working order of all such equipment at the site, and the satisfactory storage at the site of all such materials and supplies. TtNUS will coordinate with the base to identify locations for the storage of equipment and supplies.

Site-specific health and safety training for all Tetra Tech field staff and subcontractors will be provided as part of the mobilization activities. Health and safety requirements such as daily tailgate meetings are described in detail in the site-specific TtNUS HASP.

Demobilization will consist of the prompt and timely removal of all equipment, materials, and supplies from the site following completion of the work.

Soil Sampling

Soil samples will be collected in the FOV Area to delineate the extent of LNAPL and contaminated soil to be removed during the NTCRA. After sampling, each borehole will be backfilled to within 6 inches of grade using the soil cuttings removed from the borehole. A minimum 6-inch thick grout/bentonite seal will then be placed to grade at each boring. The holes in any paved surface will be backfilled and patched with ready-mix concrete.

A Geoprobe subcontractor will advance the proposed soil borings to an estimated total depth of 8 feet bgs (the water table averages about 7 feet bgs). MacrocoreTM (or approved equal) soil sampling will proceed continuously from the land surface to the total depth of each boring. The Geoprobe subcontractor will provide appropriately sized plastic sleeves capable of containerizing each 4-foot interval. Sampling will be in accordance with SOP SA-2.5 and SOP SA-1.3 (Appendix C).

Soil samples will be collected from the 0-1 foot bgs interval, the mid-depth (4-5 feet bgs) interval, and from the interval that is just above the water table (7-8 feet bgs) and will be analyzed in the field for DDT and TRPH according to the field test kit manufacturer's instructions (Appendix C). Select samples will be sent to a fixed-base laboratory for analysis.

Soil samples to be shipped to the fixed-base laboratory will be placed in sample jars, labeled, and placed immediately in an iced cooler for shipment. These soil samples will be analyzed for TCL VOCs, SVOCs, PAHs, pesticides, PCBs, TAL metals, GRO, DRO, pH, and TOC.

A soil boring log will be prepared for each boring with soil descriptions and all relevant information, observations, depth to saturated soils/water table, and photo-ionization detector (PID) field screening results as per SOP SA-6.3 (Appendix C). Sample depths will be included on each log.

Surveying

The locations and elevations of all newly installed soil borings will be surveyed. The North American Datum (NAD) 1983 will be used as the horizontal datum. Sample locations will be surveyed to the nearest 0.10 foot. Vertical elevations will be referenced to 1988 National Geodetic Vertical Datum (NGVD).

Monitoring Equipment Calibration

Monitoring equipment calibration procedures are described in Worksheet #22.

Field Decontamination Procedures

Decontamination of major equipment and sampling equipment will be in accordance with the Master FSP (B&R Environmental, 1998) and SOP SA-7.1 (Decontamination of Field Equipment and Waste Handling) (Appendix C). An area for the decontamination pad and a source of potable water for steam washing will be arranged by the FOL through MCRD personnel.

Field Documentation Procedures

Field documentation will be performed in accordance with SOP SA-6.3 presented in Appendix C.

A summary of all field activities will be properly recorded in a bound logbook with consecutively numbered pages that cannot be removed. Logbooks will be assigned to field personnel and will be stored in a secured area when not in use.

At a minimum, the following information will be recorded in the site logbook:

- Name of the person to whom the logbook is assigned.
- Project name.
- Project start date.
- Names and responsibilities of on-site project personnel including subcontractor personnel.
- Arrival/departure time of site visitors.
- Arrival/departure time of equipment.
- Sampling activities and sample log sheet references.
- Descriptions of subcontractor activities.
- Sample pick-up information including chain of custody numbers, air bill numbers, carriers, times, and dates.
- Descriptions of borehole or monitoring well installation activities and operations.
- Health and safety issues.
- Descriptions of photographs including date, time, photographer, roll and picture number, location, and compass direction of photograph.

All entries will be written in ink, and no erasures will be made. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; the person making the correction will initial and date the change.

Waste Handling

All solid and liquid wastes generated as a result of this investigation will be handled in accordance with the procedures described in Section 2.11 of the Master FSP (B&R Environmental, 1998) and SOP SA-7.1 (Decontamination of Field Equipment and Waste Handling) (Appendix C).

Soil cuttings will be placed in drums, and these cuttings will be tested and then disposed off site. Purge water and decontamination water will be collected in drums, and based on test results, the water will be either discharged to the sanitary sewer or taken off site for disposal.

Personal protective equipment (gloves, wipes, discarded paper towels, etc.) will be properly discarded on-base in a solid waste dumpster.

Site Restoration

If investigation activities such as soil sampling disturb or alter the landscape, vegetation, or other features of the sites, site surfaces may require restoration to re-establish conditions existing prior to the investigation. If vegetation is stressed or damaged as a result of investigation activities, the affected area will be reseeded. Asphalt and concrete patching will occur in FOV Area or if locations are drilled in sidewalks or roadways. Additionally, all equipment used during the investigation and all investigation-derived waste (IDW) will be removed from the site.

Sample Custody and Shipment Tasks

Sample custody and shipment tasks are defined in SOP SA-6.1 (Appendix C).

SAP Worksheet #15 -- Reference Limits and Evaluation Table

(UFP-QAPP Manual Section 2.8.1)

Matrix: Aqueous QC
Analytical Group: VOCs

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (ug/L)	CompuChem	
					Quantitation Limit (ug/L)	Method Detection (ug/L)
1,1-DICHLOROETHANE	75-34-3	NA	NA	NA	0.5	0.05
1,1,1-TRICHLOROETHANE	71-55-6	NA	NA	NA	0.5	0.05
1,1,2-TRICHLOROETHANE	79-00-5	NA	NA	NA	0.5	0.09
1,1,2,2-TETRACHLOROETHANE	79-34-5	NA	NA	NA	0.5	0.1
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	NA	NA	NA	0.5	0.2
1,1-DICHLOROETHENE	75-35-4	NA	NA	NA	0.5	0.08
1,2-DICHLOROBENZENE	95-50-1	NA	NA	NA	0.5	0.06
1,2-DICHLOROETHANE	107-06-2	NA	NA	NA	0.5	0.06
1,2,3-TRICHLOROBENZENE	87-61-6	NA	NA	NA	0.5	0.09
1,2,4-TRICHLOROBENZENE	120-82-1	NA	NA	NA	0.5	0.1
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	NA	NA	NA	0.5	0.2
1,2-DIBROMOETHANE	106-93-4	NA	NA	NA	NA	0.06
1,2-DICHLOROPROPANE	78-87-5	NA	NA	NA	0.5	0.07
1,3-DICHLOROBENZENE	541-73-1	NA	NA	NA	0.5	0.05
1,4-DICHLOROBENZENE	106-46-7	NA	NA	NA	0.5	0.04
1,4-DIOXANE	123-91-1	NA	NA	NA	25	8
2-BUTANONE	78-93-3	NA	NA	NA	3	0.4
2-HEXANONE	591-78-6	NA	NA	NA	3	0.4
4-METHYL-2-PENTANONE	108-10-1	NA	NA	NA	3	0.4
ACETONE	67-64-1	NA	NA	NA	3	1

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (ug/L)	CompuChem	
					Quantitation Limit (ug/L)	Method Detection (ug/L)
BENZENE	71-43-2	NA	NA	NA	0.5	0.03
BROMOCHLOROMETHANE	74-97-5	NA	NA	NA	0.5	0.1
BROMODICHLOROMETHANE	75-27-4	NA	NA	NA	0.5	0.06
BROMOFORM	75-25-2	NA	NA	NA	0.5	0.2
BROMOMETHANE	74-83-9	NA	NA	NA	0.5	0.5
CARBON DISULFIDE	75-15-0	NA	NA	NA	0.5	0.06
CARBON TETRACHLORIDE	56-23-5	NA	NA	NA	0.5	0.07
CHLOROBENZENE	108-90-7	NA	NA	NA	0.5	0.04
CHLOROETHANE	75-00-3	NA	NA	NA	0.5	0.1
CHLOROFORM	67-66-3	NA	NA	NA	0.5	0.05
CHLOROMETHANE	74-87-3	NA	NA	NA	0.5	0.1
CIS-1,2-DICHLOROETHENE	156-59-2	NA	NA	NA	0.5	0.06
CIS-1,3-DICHLOROPROPENE	10061-01-5	NA	NA	NA	0.5	0.05
CYCLOHEXANE	110-82-7	NA	NA	NA	0.5	0.09
CHLORODIBROMOMETHANE	124-48-1	NA	NA	NA	0.5	0.08
DICHLORODIFLUOROMETHANE	75-71-8	NA	NA	NA	0.5	0.04
ETHYLBENZENE	100-41-4	NA	NA	NA	0.5	0.05
ISOPROPYLBENZENE	98-82-8	NA	NA	NA	0.5	0.04
METHYL ACETATE	79-20-9	NA	NA	NA	0.5	0.4
METHYL TERT-BUTYL ETHER	1634-04-4	NA	NA	NA	0.5	0.06
METHYL CYCLOHEXANE	108-87-2	NA	NA	NA	0.5	0.05
METHYLENE CHLORIDE	75-09-2	NA	NA	NA	0.5	0.06
STYRENE	100-42-5	NA	NA	NA	0.5	0.06
TETRACHLOROETHENE	127-18-4	NA	NA	NA	0.5	0.1
TOLUENE	108-88-3	NA	NA	NA	0.5	0.04

O-XYLENE	95-47-6	NA	NA	NA	0.5	0.06
M+P-XYLENES	TTNUS054	NA	NA	NA	1	0.06
TRANS-1,2-DICHLOROETHENE	156-60-5	NA	NA	NA	0.5	0.05
TRANS-1,3-DICHLOROPROPENE	10061-02-6	NA	NA	NA	0.5	0.04
TRICHLOROETHENE	79-01-6	NA	NA	NA	0.5	0.06
TRICHLOROFLUOROMETHANE	75-69-4	NA	NA	NA	0.5	0.08
VINYL CHLORIDE	75-01-4	NA	NA	NA	0.5	0.08

Matrix: Aqueous QC
Analytical Group: SVOCs

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (ug/L)	CompuChem	
					Quantitation Limit (ug/L)	Method Detection (ug/L)
1,1-BIPHENYL	92-52-4	NA	NA	NA	5	0.7
1,2,4,5-TETRACHLOROBENZENE	**95-94-3**	NA	NA	NA	**5**	**0.8**
2,2'-OXYBIS(1-CHLOROPROPANE)	***108-60-1***	NA	NA	NA	***5***	***0.6***
2,3,4,6-TETRACHLOROPHENOL	58-90-2	NA	NA	NA	5	0.7
2,4,5-TRICHLOROPHENOL	95-95-4	NA	NA	NA	5	0.8
2,4,6-TRICHLOROPHENOL	88-06-2	NA	NA	NA	5	0.6
2,4-DICHLOROPHENOL	120-83-2	NA	NA	NA	5	0.7
2,4-DIMETHYLPHENOL	105-67-9	NA	NA	NA	5	1
2,4-DINITROPHENOL	51-28-5	NA	NA	NA	5	1
2,4-DINITROTOLUENE	***121-14-2***	NA	NA	NA	***5***	***0.6***
2,6-DINITROTOLUENE	**606-20-2**	NA	NA	NA	**5**	**0.7**
2-CHLORONAPHTHALENE	91-58-7	NA	NA	NA	5	0.9
2-CHLOROPHENOL	95-57-8	NA	NA	NA	10	0.9
2-METHYLNAPHTHALENE	91-57-6	NA	NA	NA	5	0.6
2-METHYLPHENOL	95-48-7	NA	NA	NA	5	0.5
2-NITROANILINE	88-74-4	NA	NA	NA	10	0.7
2-NITROPHENOL	88-75-5	NA	NA	NA	5	1
3,3'-DICHLOROBENZIDINE	***91-94-1***	NA	NA	NA	***5***	***4***
3-NITROANILINE	99-09-2	NA	NA	NA	10	0.6
4,6-DINITRO-2-METHYLPHENOL	***534-52-1***	NA	NA	NA	***10***	***0.5***
4-BROMOPHENYL PHENYL ETHER	101-55-3	NA	NA	NA	5	0.5
4-CHLORO-3-METHYLPHENOL	59-50-7	NA	NA	NA	5	0.5
4-CHLOROANILINE	***106-47-8***	NA	NA	NA	***5***	***0.7***

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (ug/L)	CompuChem	
					Quantitation Limit (ug/L)	Method Detection (ug/L)
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	NA	NA	NA	5	0.6
4-METHYLPHENOL	106-44-5	NA	NA	NA	10	0.6
4-NITROANILINE	**100-01-6**	NA	NA	NA	**5**	**1**
4-NITROPHENOL	100-02-7	NA	NA	NA	10	0.5
ACENAPHTHENE	83-32-9	NA	NA	NA	5	0.6
ACENAPHTHYLENE	208-96-8	NA	NA	NA	5	0.8
ACETOPHENONE	98-86-2	NA	NA	NA	5	0.8
ANTHRACENE	120-12-7	NA	NA	NA	5	0.5
ATRAZINE	***1912-24-9***	NA	NA	NA	***5***	***2***
BENZALDEHYDE	100-52-7	NA	NA	NA	5	1
BENZO(A)ANTHRACENE	***56-55-3***	NA	NA	NA	***5***	***1***
BENZO(A)PYRENE	***50-32-8***	NA	NA	NA	***5***	***1***
BENZO(B)FLUORANTHENE	***205-99-2***	NA	NA	NA	***5***	***1***
BENZO(G,H,I)PERYLENE	191-24-2	NA	NA	NA	5	1
BENZO(K)FLUORANTHENE	***207-08-9***	NA	NA	NA	***5***	***0.8***
BIS(2-CHLOROETHOXY)METHANE	111-91-1	NA	NA	NA	5	1
BIS(2-CHLOROETHYL)ETHER	***111-44-4***	NA	NA	NA	***5***	***0.9***
BIS(2-ETHYLHEXYL)PHTHALATE	**117-81-7**	NA	NA	NA	**5**	**2**
BUTYL BENZYL PHTHALATE	**85-68-7**	NA	NA	NA	**5**	**2**
CAPROLACTAM	105-60-2	NA	NA	NA	5	2
CARBAZOLE	86-74-8	NA	NA	NA	5	2
CHRYSENE	**218-01-9**	NA	NA	NA	**5**	**1**
DIBENZO(A,H)ANTHRACENE	***53-70-3***	NA	NA	NA	***5***	***1***
DIBENZOFURAN	132-64-9	NA	NA	NA	5	0.6
DIETHYL PHTHALATE	84-66-2	NA	NA	NA	5	0.6

DIMETHYL PHTHALATE	131-11-3	NA	NA	NA	5	0.6
DI-N-BUTYL PHTHALATE	84-74-2	NA	NA	NA	5	1
DI-N-OCTYL PHTHALATE	117-84-0	NA	NA	NA	5	1
FLUORANTHENE	206-44-0	NA	NA	NA	5	0.6
FLUORENE	86-73-7	NA	NA	NA	5	0.7
HEXACHLOROBENZENE	***118-74-1***	NA	NA	NA	***5***	***0.6***
HEXACHLOROBUTADIENE	***87-68-3***	NA	NA	NA	***5***	***0.9***
HEXACHLOROCYCLOPENTADIENE	77-47-4	NA	NA	NA	5	0.7
HEXACHLOROETHANE	**67-72-1**	NA	NA	NA	**5**	**0.9**
INDENO(1,2,3-CD)PYRENE	***193-39-5***	NA	NA	NA	***5***	***0.5***
ISOPHORONE	78-59-1	NA	NA	NA	5	0.7
NAPHTHALENE	***91-20-3***	NA	NA	NA	***5***	***0.8***
NITROBENZENE	***98-95-3***	NA	NA	NA	***5***	***0.8***
N-NITROSODIPHENYLAMINE	86-30-6	NA	NA	NA	5	0.6
N-NITROSO-DI-N-PROPYLAMINE	***621-64-7***	NA	NA	NA	***5***	***1***
PENTACHLOROPHENOL	***87-86-5***	NA	NA	NA	***10***	***0.8***
PHENANTHRENE	85-01-8	NA	NA	NA	5	0.6
PHENOL	108-95-2	NA	NA	NA	5	0.6
PYRENE	129-00-0	NA	NA	NA	5	1

Matrix: Aqueous QC
Analytical Group: Pesticides

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (ug/L)	CompuChem	
					Quantitation Limit (ug/L)	Method Detection (ug/L)
4,4'-DDD	72-54-8	NA	NA	NA	0.1	0.005
4,4'-DDE	72-55-9	NA	NA	NA	0.1	0.005
DDT	50-29-3	NA	NA	NA	0.1	0.005
ALDRIN	309-00-2	NA	NA	NA	0.05	0.005
ALPHA-BHC	319-84-6	NA	NA	NA	0.05	0.005
ALPHA-CHLORDANE	5103-71-9	NA	NA	NA	0.05	0.005
BETA-BHC	319-85-7	NA	NA	NA	0.05	0.005
DELTA-BHC	319-86-8	NA	NA	NA	0.05	0.005
DIELDRIN	60-57-1	NA	NA	NA	0.05	0.0026
ENDOSULFAN I	959-98-8	NA	NA	NA	0.05	0.005
ENDOSULFAN II	33213-65-9	NA	NA	NA	0.1	0.0044
ENDOSULFAN SULFATE	1031-07-8	NA	NA	NA	0.1	0.005
ENDRIN	72-20-8	NA	NA	NA	0.1	0.0055
ENDRIN ALDEHYDE	7421-93-4	NA	NA	NA	0.1	0.005
ENDRIN KETONE	53494-70-5	NA	NA	NA	0.1	0.006
GAMMA-BHC (LINDANE)	58-89-9	NA	NA	NA	0.05	0.006
GAMMA-CHLORDANE	5103-74-2	NA	NA	NA	0.05	0.0046
HEPTACHLOR	76-44-8	NA	NA	NA	0.05	0.045
HEPTACHLOR EPOXIDE	1024-57-3	NA	NA	NA	0.05	0.0055
METHOXYCHLOR	72-43-5	NA	NA	NA	0.5	0.025
TOXAPHENE	8001-35-2	NA	NA	NA	5.0	1.0

Matrix: Aqueous QC
Analytical Group: PCBs

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (ug/L)	CompuChem	
					Quantitation Limit (ug/L)	Method Detection (ug/L)
AROCLOR-1016	12674-11-2	NA	NA	NA	1.3	0.36
AROCLOR-1221	11104-28-2	NA	NA	NA	3.8	1.3
AROCLOR-1232	11141-16-5	NA	NA	NA	1.8	0.58
AROCLOR-1242	53469-21-9	NA	NA	NA	1.0	0.32
AROCLOR-1248	12672-29-6	NA	NA	NA	1.3	0.42
AROCLOR-1254	11097-69-1	NA	NA	NA	0.63	0.16
AROCLOR-1260	11096-82-5	NA	NA	NA	0.93	0.28
AROCLOR-1262	37324-23-5	NA	NA	NA	1.0	0.3
AROCLOR-1268	11100-14-4	NA	NA	NA	1.0	0.3

Matrix: Aqueous QC
Analytical Group: Metals

Analyte	CAS Number	Project Action Limit[1] (ug/L)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (ug/L)	CompuChem	
					Quantitation Limit (ug/L)	Method Detection (ug/L)
ALUMINUM	7429-90-5	NA	NA	NA	200	28.9
ANTIMONY	***7440-36-0***	NA	NA	NA	***10.0***	***3.5***
ARSENIC	***7440-38-2***	NA	NA	NA	***5.0***	***1.8***
BARIUM	7440-39-3	NA	NA	NA	200	1.4
BERYLLIUM	**7440-41-7**	NA	NA	NA	**5.0**	**0.8**
CADMIUM	**7440-43-9**	NA	NA	NA	**5.0**	**0.65**
CALCIUM	7440-70-2	NA	NA	NA	5000	35.6
CHROMIUM	7440-47-3	NA	NA	NA	10.0	1.1
COBALT	**7440-48-4**	NA	NA	NA	**10.0**	**0.84**
COPPER	7440-50-8	NA	NA	NA	5.0	1.6
IRON	7439-89-6	NA	NA	NA	100	24.6
LEAD	7439-92-1	NA	NA	NA	3.0	1.5
MERCURY	***7439-97-6***	NA	NA	NA	***0.2***	***0.088***
MAGNESIUM	7439-95-4	NA	NA	NA	5000	31.0
MANGANESE	7439-96-5	NA	NA	NA	10.0	0.16
NICKEL	7440-02-0	NA	NA	NA	5.0	0.9
POTASSIUM	7440-09-7	NA	NA	NA	5000	21.9
SELENIUM	7782-49-2	NA	NA	NA	5.0	1.1
SILVER	7440-22-4	NA	NA	NA	5.0	0.68
SODIUM	7440-23-5	NA	NA	NA	5000	87.5
THALLIUM	***7440-28-0***	NA	NA	NA	***5.0***	***3.0***
VANADIUM	**7440-62-2**	NA	NA	NA	**20.0**	**0.43**
ZINC	7440-66-6	NA	NA	NA	20.0	2.7

Matrix: Soil
Analytical Group: VOCs

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
1,1-DICHLOROETHANE	***75-34-3***	***0.0007***	***Soil to GW***	***0.0002***	***0.005***	***0.001***
1,1,1-TRICHLOROETHANE	71-55-6	0.072	Soil to GW	0.02	0.005	0.001
1,1,2-TRICHLOROETHANE	**79-00-5**	**0.0017**	**Soil to GW**	**0.0006**	**0.005**	**0.001**
1,1,2,2-TETRACHLOROETHANE	***79-34-5***	***0.000028***	***Soil to GW***	***0.000009***	***0.005***	***0.001***
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	150	Soil to GW	50	0.005	0.001
1,1-DICHLOROETHENE	**75-35-4**	**0.0026**	**Soil to GW**	**0.0009**	**0.005**	**0.001**
1,2-DICHLOROBENZENE	95-50-1	0.01	Eco	0.003	0.005	0.001
1,2-DICHLOROETHANE	**107-06-2**	**0.0015**	**Soil to GW**	**0.0005**	**0.005**	**0.001**
1,2,3-TRICHLOROBENZENE	87-61-6	0.01	Eco	0.003	0.005	0.001
1,2,4-TRICHLOROBENZENE	***120-82-1***	***0.01***	***Eco***	***0.003***	***0.05***	***.018.***
1,2-DIBROMO-3-CHLOROPROPANE	***96-12-8***	***0.000092***	***Soil to GW***	***0.00003***	***0.005***	***0.001***
1,2-DIBROMOETHANE	***106-93-4***	***0.000015***	***Soil to GW***	***0.000005***	***0.005***	***0.001***
1,2-DICHLOROPROPANE	**78-87-5**	**0.0017**	**Soil to GW**	**0.0006**	**0.005**	**0.001**
1,3-DICHLOROBENZENE	541-73-1	0.01	Eco	0.003	0.005	0.001
1,4-DICHLOROBENZENE	106-46-7	0.01	Eco	0.003	0.005	0.001
1,4-DIOXANE	***123-91-1***	***0.0012***	***Soil to GW***	***0.0004***	***0.3***	***0.06***
2-BUTANONE	78-93-3	1.5	Soil to GW	0.5	0.01	0.003
2-HEXANONE	591-78-6	NC			0.01	0.003
4-METHYL-2-PENTANONE	108-10-1	0.44	Soil to GW	0.2	0.01	0.003
ACETONE	67-64-1	4.4	Soil to GW	2	0.01	0.007
BENZENE	**71-43-2**	**0.0028**	**Soil to GW**	**0.0009**	**0.005**	**0.001**
BROMOCHLOROMETHANE	74-97-5	NC			0.005	0.001
BROMODICHLOROMETHANE	***75-27-4***	***0.000033***	***Soil to GW***	***0.00001***	***0.005***	***0.001***

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
BROMOFORM	**75-25-2**	**0.0023**	**Soil to GW**	**0.0008**	**0.005**	**0.001**
BROMOMETHANE	**74-83-9**	**0.0022**	**Soil to GW**	**0.0007**	**0.005**	**0.002**
CARBON DISULFIDE	75-15-0	0.27	Soil to GW	0.09	0.005	0.001
CARBON TETRACHLORIDE	**56-23-5**	**0.001**	**Eco**	**0.0003**	**0.005**	**0.001**
CHLOROBENZENE	108-90-7	0.05	Eco	0.02	0.005	0.001
CHLOROETHANE	75-00-3	6	Soil to GW	2	0.005	0.001
CHLOROFORM	***67-66-3***	***0.000055***	***Soil to GW***	***0.00002***	***0.005***	***0.001***
CHLOROMETHANE	74-87-3	0.049	Soil to GW	0.02	0.005	0.001
CIS-1,2-DICHLOROETHENE	156-59-2	0.021	Soil to GW	0.007	0.005	0.001
CIS-1,3-DICHLOROPROPENE	***10061-01-5***	***0.00016***	***Soil to GW***	***0.00005***	***0.005***	***0.001***
CYCLOHEXANE	110-82-7	0.1	Eco	0.03	0.005	0.001
CHLORODIBROMOMETHANE	***124-48-1***	***0.00004***	***Soil to GW***	***0.00001***	***0.005***	***0.001***
DICHLORODIFLUOROMETHANE	75-71-8	0.61	Soil to GW	0.2	0.005	0.001
ETHYLBENZENE	100-41-4	0.05	Eco	0.02	0.005	0.001
ISOPROPYLBENZENE	98-82-8	1.3	Soil to GW	0.4	0.005	0.001
METHYL ACETATE	79-20-9	7.6	Soil to GW	3	0.005	0.001
METHYL TERT-BUTYL ETHER	**1634-04-4**	**0.0027**	**Soil to GW**	**0.0009**	**0.005**	**0.001**
METHYL CYCLOHEXANE	108-87-2	0.1	Eco	0.03	0.005	0.001
METHYLENE CHLORIDE	**75-09-2**	**0.0013**	**Soil to GW**	**0.0004**	**0.005**	**0.001**
STYRENE	100-42-5	0.1	Eco	0.03	0.005	0.001
TETRACHLOROETHENE	**127-18-4**	**0.0024**	**Soil to GW**	**0.0008**	**0.005**	**0.002**
TOLUENE	108-88-3	0.05	Eco	0.02	0.005	0.001
O-XYLENE	95-47-6	0.05	Eco	0.02	0.005	0.001
M+P-XYLENES	**TTNUS054**	**0.05**	**Eco**	**0.02**	**0.05**	**0.01**
TRANS-1,2-DICHLOROETHENE	156-60-5	0.032	Soil to GW	0.01	0.005	0.001

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
TRANS-1,3-DICHLOROPROPENE	10061-02-6	1.7	Residential	0.6	0.005	0.001
TRICHLOROETHENE	**79-01-6**	**0.001**	**Eco**	**0.0003**	**0.005**	**0.001**
TRICHLOROFLUOROMETHANE	75-69-4	0.84	Soil to GW	0.3	0.005	0.001
VINYL CHLORIDE	***75-01-4***	***0.0007***	***Soil to GW***	***0.0002***	***0.005***	***0.001***

Matrix: Soil
Analytical Group: SVOCs

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal [2] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
1,1-BIPHENYL	92-52-4	23	Soil to GW	8	0.2	0.06
1,2,4,5-TETRACHLOROBENZENE	***95-94-3***	***0.01***	***Eco***	***0.003***	***0.2***	***0.03***
2,2'-OXYBIS(1-CHLOROPROPANE)	***108-60-1***	***0.00009***	***Soil to GW***	***0.00003***	***0.2***	***0.09***
2,3,4,6-TETRACHLOROPHENOL	58-90-2	4.6	Soil to GW	2	0.2	0.03
2,4,5-TRICHLOROPHENOL	95-95-4	4	Eco	1	0.2	0.08
2,4,6-TRICHLOROPHENOL	***88-06-2***	***0.016***	***Soil to GW***	***0.005***	***0.2***	***0.08***
2,4-DICHLOROPHENOL	***120-83-2***	***0.003***	***Eco***	***0.001***	***0.2***	***0.08***
2,4-DIMETHYLPHENOL	105-67-9	1.2	Soil to GW	0.4	0.2	0.06
2,4-DINITROPHENOL	***51-28-5***	***0.068***	***Soil to GW***	***0.02***	***0.3***	***0.09***
2,4-DINITROTOLUENE	***121-14-2***	***0.0002***	***Soil to GW***	***0.00007***	***0.2***	***0.09***
2,6-DINITROTOLUENE	***606-20-2***	***0.034***	***Soil to GW***	***0.01***	***0.2***	***0.07***
2-CHLORONAPHTHALENE	91-58-7	1	Eco	0.3	0.2	0.09
2-CHLOROPHENOL	**95-57-8**	**0.2**	**Soil to GW**	**0.07**	**0.2**	**0.1**

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal [2] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
2-METHYLNAPHTHALENE	91-57-6	0.9	Soil to GW	0.3	0.2	0.09
2-METHYLPHENOL	95-48-7	0.5	Eco	0.2	0.2	0.1
2-NITROANILINE	***88-74-4***	***0.033***	***Soil to GW***	***0.01***	***0.3***	***0.08***
2-NITROPHENOL	88-75-5	7	Eco	2	0.2	0.07
3,3'-DICHLOROBENZIDINE	***91-94-1***	***0.0023***	***Soil to GW***	***0.0008***	***0.2***	***0.08***
3-NITROANILINE	***99-09-2***	***0.033***	***Soil to GW***	***0.01***	***0.3***	***0.07***
4,6-DINITRO-2-METHYLPHENOL	***534-52-1***	***0.0051***	***Soil to GW***	***0.002***	***0.3***	***0.08***
4-BROMOPHENYL PHENYL ETHER	101-55-3	NC			0.2	0.06
4-CHLORO-3-METHYLPHENOL	59-50-7	NC			0.2	0.08
4-CHLOROANILINE	***106-47-8***	***0.00012***	***Soil to GW***	***0.00004***	***0.2***	***0.08***
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	NC			0.2	0.08
4-METHYLPHENOL	**106-44-5**	**0.19**	**Soil to GW**	**0.06**	**0.3**	**0.08**
4-NITROANILINE	***100-01-6***	***0.001***	***Soil to GW***	***0.0003***	***0.3***	***0.06***
4-NITROPHENOL	100-02-7	7	Eco	2	0.3	0.08
ACENAPHTHENE	83-32-9	27	Soil to GW	9	0.2	0.08
ACENAPHTHYLENE	208-96-8	27	Soil to GW	9	0.2	0.08
ACETOPHENONE	98-86-2	1.1	Soil to GW	0.4	0.2	0.08
ANTHRACENE	120-12-7	29	Eco	10	0.2	0.07
ATRAZINE	***1912-24-9***	***0.00005***	***Eco***	***0.00002***	***0.2***	***0.02***
BENZALDEHYDE	100-52-7	0.97	Soil to GW	0.3	0.2	0.02
BENZO(A)ANTHRACENE	***56-55-3***	***0.014***	***Soil to GW***	***0.005***	***0.2***	***0.06***
BENZO(A)PYRENE	***50-32-8***	***0.015***	***Residential***	***0.005***	***0.2***	***0.06***
BENZO(B)FLUORANTHENE	***205-99-2***	***0.047***	***Soil to GW***	***0.02***	***0.2***	***0.06***
BENZO(G,H,I)PERYLENE	191-24-2	1.1	Eco	0.4	0.2	0.07

BENZO(K)FLUORANTHENE	207-08-9	0.46	Soil to GW	0.2	0.2	0.1
BIS(2-CHLOROETHOXY)METHANE	***111-91-1***	***0.023***	***Soil to GW***	***0.008***	***0.2***	***0.08***
BIS(2-CHLOROETHYL)ETHER	***111-44-4***	***0.0000027***	***Soil to GW***	***9E-07***	***0.2***	***0.09***
BIS(2-ETHYLHEXYL)PHTHALATE	**117-81-7**	**0.1**	**Eco**	**0.03**	**0.2**	**0.08**
BUTYL BENZYL PHTHALATE	**85-68-7**	**0.1**	**Eco**	**0.03**	**0.2**	**0.07**
CAPROLACTAM	105-60-2	5.7	Soil to GW	2	0.2	0.04
CARBAZOLE	86-74-8	NC			0.2	0.03
CHRYSENE	218-01-9	1.1	Eco	0.4	0.2	0.07
DIBENZO(A,H)ANTHRACENE	***53-70-3***	***0.015***	***Soil to GW***	***0.005***	***0.2***	***0.07***
DIBENZOFURAN	132-64-9	NC			0.2	0.08
DIETHYL PHTHALATE	84-66-2	13	Soil to GW	4	0.2	0.08
DIMETHYL PHTHALATE	131-11-3	200	Eco	67	0.2	0.09
DI-N-BUTYL PHTHALATE	84-74-2	11	Soil to GW	4	0.2	0.07
DI-N-OCTYL PHTHALATE	**117-84-0**	**0.1**	**Eco**	**0.03**	**0.2**	**0.07**
FLUORANTHENE	206-44-0	29	Eco	10	0.2	0.08
FLUORENE	86-73-7	29	Eco	10	0.2	0.08
HEXACHLOROBENZENE	***118-74-1***	***0.0025***	***Eco***	***0.0008***	***0.2***	***0.07***
HEXACHLOROBUTADIENE	***87-68-3***	***0.0019***	***Soil to GW***	***0.0006***	***0.2***	***0.09***
HEXACHLOROCYCLOPENTADIENE	**77-47-4**	**0.18**	**Soil to GW**	**0.06**	**0.2**	**0.07**
HEXACHLOROETHANE	***67-72-1***	***0.0032***	***Soil to GW***	***0.001***	***0.2***	***0.09***
INDENO(1,2,3-CD)PYRENE	**193-39-5**	**0.15**	**Residential**	**0.05**	**0.2**	**0.06**
ISOPHORONE	***78-59-1***	***0.022***	***Soil to GW***	***0.007***	***0.2***	***0.09***
NAPHTHALENE	***91-20-3***	***0.00055***	***Soil to GW***	***0.0002***	***0.2***	***0.09***
NITROBENZENE	***98-95-3***	***0.000071***	***Soil to GW***	***0.00002***	***0.2***	***0.08***
N-NITROSODIPHENYLAMINE	**86-30-6**	**0.17**	**Soil to GW**	**0.06**	**0.2**	**0.07**
N-NITROSO-DI-N-PROPYLAMINE	***621-64-7***	***0.000011***	***Soil to GW***	***0.000004***	***0.2***	***0.09***
PENTACHLOROPHENOL	***87-86-5***	***0.007***	***Soil to GW***	***0.002***	***0.3***	***0.08***
PHENANTHRENE	85-01-8	29	Eco	10	0.2	0.08

PHENOL	***108-95-2***	***0.05***	***Eco***	***0.02***	***0.2***	***0.1***
PYRENE	129-00-0	1.1	Eco	0.4	0.2	0.06

Matrix: Soil
Analytical Group: PAHs

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal[(2)] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
1-METHYLNAPHTHALENE	90-12-0	0.015	Soil to GW	0.005	0.008	0.0007
2-METHYLNAPHTHALENE	91-57-6	0.9	Soil to GW	0.3	0.008	0.0007
ACENAPHTHENE	83-32-9	27	Soil to GW	9	0.008	0.0006
ACENAPHTHYLENE	208-96-8	27	Soil to GW	9	0.008	0.0005
ANTHRACENE	120-12-7	29	Eco	10	0.008	0.0004
BENZO(A)ANTHRACENE	56-55-3	0.014	Soil to GW	0.005	0.008	0.0006
BENZO(A)PYRENE	50-32-8	0.015	Residential	0.005	0.008	0.0004
BENZO(B)FLUORANTHENE	205-99-2	0.047	Soil to GW	0.02	0.008	0.0006
BENZO(G,H,I)PERYLENE	191-24-2	1.1	Eco	0.4	0.008	0.0004
BENZO(K)FLUORANTHENE	207-08-9	0.46	Soil to GW	0.2	0.008	0.0004
CHRYSENE	218-01-9	1.1	Eco	0.4	0.008	0.0006
DIBENZO(A,H)ANTHRACENE	53-70-3	0.015	Soil to GW	0.005	0.008	0.0003
FLUORANTHENE	206-44-0	29	Eco	10	0.008	0.001
FLUORENE	86-73-7	29	Eco	10	0.008	0.0005
INDENO(1,2,3-CD)PYRENE	193-39-5	0.15	Residential	0.05	0.008	0.0004
NAPHTHALENE	***91-20-3***	***0.00055***	***Soil to GW***	***0.0002***	***0.008***	***0.0007***
PHENANTHRENE	85-01-8	29	Eco	10	0.008	0.001
PYRENE	129-00-0	1.1	Eco	0.4	0.008	0.0006

Matrix: Soil

Analytical Group: Pesticides

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
4,4'-DDD	**72-54-8**	**0.021**	**Eco**	**0.007**	**0.0033**	**0.00033**
4,4'-DDE	72-55-9	0.021	Eco	0.007	0.0033	0.00033
4,4'-DDT	50-29-3	0.021	Eco	0.007	0.0033	0.0005
ALDRIN	***309-00-2***	***0.00084***	***Soil to GW***	***0.00028***	***0.0017***	***0.00017***
ALPHA-BHC	***319-84-6***	***0.000074***	***Soil to GW***	***0.000025***	***0.0017***	***0.00017***
ALPHA-CHLORDANE	5103-71-9	0.1	Eco	0.033	0.0017	0.00017
BETA-BHC	***319-85-7***	***0.00026***	***Soil to GW***	***0.000087***	***0.0033***	***0.00033***
DELTA-BHC	***319-86-8***	***0.000074***	***Soil to GW***	***0.000025***	***0.0017***	***0.00017***
DIELDRIN	***60-57-1***	***0.00009***	***Soil to GW***	***0.00003***	***0.0033***	***0.00033***
ENDOSULFAN I	959-98-8	0.1	Eco	0.033	0.0017	0.00017
ENDOSULFAN II	33213-65-9	0.1	Eco	0.033	0.0033	0.00033
ENDOSULFAN SULFATE	1031-07-8	0.1	Eco	0.033	0.0033	0.00033
ENDRIN	**72-20-8**	**0.001**	**Eco**	**0.00033**	**0.0033**	**0.00033**
ENDRIN ALDEHYDE	**7421-93-4**	**0.001**	**Eco**	**0.00033**	**0.0033**	**0.00033**
ENDRIN KETONE	**53494-70-5**	**0.001**	**Eco**	**0.00033**	**0.0033**	**0.00033**
GAMMA-BHC (LINDANE)	***58-89-9***	***0.00005***	***Eco***	***0.000017***	***0.0017***	***0.00023***
GAMMA-CHLORDANE	5103-74-2	0.1	Eco	0.033	0.0017	0.00017
HEPTACHLOR	76-44-8	0.042	Soil to GW	0.014	0.0017	0.00017
HEPTACHLOR EPOXIDE	1024-57-3	0.0021	Soil to GW	0.0007	0.0017	0.00017
METHOXYCHLOR	72-43-5	0.1	Eco	0.033	0.017	0.0022
TOXAPHENE	8001-35-2	0.1	Eco	0.033	0.010	0.0011

Matrix: Soil
Analytical Group: PCBs

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal [2] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
AROCLOR-1016	***12674-11-2***	***0.0018***	***Soil to GW***	***0.0006***	***0.0075***	***0.0024***
AROCLOR-1221	***11104-28-2***	***0.00014***	***Soil to GW***	***0.000047***	***0.006***	***0.002***
AROCLOR-1232	***11141-16-5***	***0.00014***	***Soil to GW***	***0.000047***	***0.0025***	***0.00075***
AROCLOR-1242	**53469-21-9**	**0.003**	**Soil to GW**	**0.001**	**0.0035**	**0.0011**
AROCLOR-1248	12672-29-6	0.003	Soil to GW	0.001	0.0025	0.00075
AROCLOR-1254	11097-69-1	0.0051	Soil to GW	0.0017	0.002	0.00067
AROCLOR-1260	11096-82-5	0.014	Soil to GW	0.0047	0.003	0.001
AROCLOR-1262	37324-23-5	NC			0.003	0.001
AROCLOR-1268	11100-14-4	NC			0.003	0.001

Matrix: Soil
Analytical Group: Metals

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	CompuChem	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
ALUMINUM	7429-90-5	50	Eco	17.0	20.0	3.5
ANTIMONY	**7440-36-0**	**0.27**	**Eco**	**0.09**	**1.0**	**0.18**
ARSENIC	**7440-38-2**	**0.29**	**Soil to GW**	**0.097**	**1.0**	**0.21**
BARIUM	7440-39-3	82	Soil to GW	27.0	20.0	0.097
BERYLLIUM	7440-41-7	3.2	Soil to GW	1.1	0.5	0.037
CADMIUM	**7440-43-9**	**0.36**	**Eco**	**0.12**	**0.5**	**0.023**
CALCIUM	7440-70-2	NC			500	4.3
CHROMIUM	7440-47-3	26	Eco	8.7	1.0	0.049
COBALT	**7440-48-4**	**0.49**	**Soil to GW**	**0.16**	**0.5**	**0.14**
COPPER	7440-50-8	28	Eco	9.3	0.5	0.15
IRON	7439-89-6	200	Eco	67.0	10.0	1.3
LEAD	7439-92-1	11	Eco	3.7	0.3	0.12
MERCURY	**7439-97-6**	**0.1**	**Eco**	**0.033**	**0.1**	**0.011**
MAGNESIUM	7439-95-4	NC			500	0.61
MANGANESE	7439-96-5	57	Soil to GW	19.0	1.0	0.043
NICKEL	7440-02-0	38	Eco	13.0	0.5	0.062
POTASSIUM	7440-09-7	NC			500	0.097
SELENIUM	***7782-49-2***	***0.26***	***Soil to GW***	***0.087***	***0.5***	***0.3***
SILVER	7440-22-4	1.6	Soil to GW	0.53	0.5	0.053
SODIUM	7440-23-5	NC			500	17.9
THALLIUM	***7440-28-0***	***0.14***	***Soil to GW***	***0.047***	***1.0***	***0.77***
VANADIUM	7440-62-2	7.8	Eco	2.6	2.0	0.04

ZINC	7440-66-6	46	Eco	15.0	2.0	0.73

Matrix: Soil
Analytical Group: Miscellaneous

Analyte	CAS Number	Project Action Limit[(1)]	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal[(2)]	Compuchem	
					Quantitation Limit	Method Detection
Gasoline Range Organics[(3)] (mg/kg)	---	NA	NA	NA	0.5	0.01
Diesel Range Organics[(3)] (mg/kg)	---	NA	NA	NA	10	2.9
Total Organic Carbon (mg/kg)	TtNUS003	NA	NA	NA	100	29.1
pH	---	NA	NA	NA	NA	NA

Footnotes

1) Project Action Limits (PALs) were compiled from the following sources:
   - U. S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (USEPA, December 2009). ORNL Tap Adjusted – Regional Screening Level for Tap Water adjusted by dividing by 10 for noncarcinogens; FEDMCL – Federal MCL; Soil to GW – Regional Screening Level for protection of Groundwater (based on Federal MCL or risk-based groundwater concentration). Residential – Regional Screening Level for Residential Exposure to Soil (divided by 10 for noncarcinogens).
   - OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), (USEPA, November 2002). VIGW – Target Groundwater Concentrations Corresponding to Target Indoor Air Concentration.
   - USEPA Ecological Soil Screening Levels available at http://www.epa.gov/ecotox/ecossl (USEPA, 2009) or Ecological Screening Values established by USEPA Region 4 (USEPA, 2001) .

2) Bolded rows indicate the PAL is between the laboratory quantitation limit (QL) and method detection limit (MDL). Bolded and italicized rows indicate the PAL is less then the MDL. All results for which the QL or MDL exceed the PAL will receive extra scrutiny to evaluate the effect on decision making of not being able to quantify concentrations as low as the PAL. Additional detail on data usability assessment is provided in Worksheet #37.

3) Reported as individual alkanes (C_6 to C_{10} for GRO and C_{10} to C_{36} for DRO).

NA = Not applicable
NC = No criteria available
ug/L = microgram per liter
mg/L = milligram per liter
mg/kg = milligram per kilogram
ug/g = microgram per gram

SAP Worksheet #16 -- Project Schedule/Timeline Table (optional format)

(UFP-QAPP Manual Section 2.8.2)

SAP Worksheet #17 -- Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

The sampling activities to be conducted in support of the Site 27 LNAPL delineation for the FOV Area in preparation for a NTCRA are described below, including the proposed sample locations, sampling methods, and a rationale for the sampling activities. The proposed sample locations are presented on Figure 17-1. The analytical program recommended for each proposed sample is presented in Worksheet No. 18. The field QC samples required are specified in Worksheet No. 20.

A source zone or widespread contamination from a known operation or process has not been fully identified or delineated during previous investigations, however, it is assumed that the source zone is approximately 50 ft wide by 50 ft long by 10 ft deep. This is based on the current known extent of contamination and the CSM. It is possible that waste pesticides that had been combined with diesel, which can be used as a carrier liquid, were disposed of in the FOV Area. The combination of diesel and pesticide contaminated soil allows the diesel to act as a solvent, dissolving and transporting the pesticide waste as it migrates through surface and subsurface soil and eventually reaches the water table. While much of the known FOV contamination is located in subsurface soil just above the water table, this area and other contaminated areas may be further impacting downgradient soil and groundwater throughout the FOV Area. The extent of contamination in soil and groundwater will be defined during this investigation. Data collected during this investigation will also be used to evaluate risk to human receptors exposed to the pesticides/diesel contamination.

Soil Sampling

Surface and subsurface soil samples that are representative of the source zone and the area of the site receptors would visit will be collected from soil borings installed in a grid pattern across the FOV Area, as shown on Figure 17-1. In addition, soil samples will be collected adjacent to monitoring well PAI-27-MW64S since odors were detected in that well in 2008. Soil samples will be collected from the 0-1 foot bgs interval, the mid-depth (4-5 feet bgs) interval, and from the interval that is just above the water table (7-8 feet bgs).

Soil samples from the 24 sample locations will be analyzed for DDT in the field using the SDI QuickChek® or equivalent remediation testing kit (EPA Method 4042), which has a detection limit range of 0.2 to 10 mg/kg. Soil samples from the 24 sample locations will also be field screened for TRPH (as a possible indicator of the presence of LNAPL) in the field using the PetroFLAG® or equivalent test kit, which has detection and quantitation limits of 15 mg/kg and 45 mg/kg, respectively.

In order to delineate the extent of contamination, step-out soil samples will be collected from additional soil borings in the event that concentrations of DDT or TRPH in perimeter soil samples exceed screening values (as measured by the field test kits). The additional soil borings will be located equidistant from the previously collected sample and in a direction that is toward anticipated lower contaminant concentrations. Soil samples from the 3 intervals of interest will be screened for the presence of DDT and TRPH. Once concentrations of DDT and TRPH are below the screening values, delineation efforts will be discontinued. If more than two additional samples are required in any one direction, the need for additional sample borings would be based on the FOL's discretion and in consultation with the MCRD Parris Island Partnering Team.

Based on the results of the field testing, 10 surface soil, 10 mid-depth soil, and 10 water table soil samples will be submitted to a fixed-base analytical lab for analysis of TCL pesticides and for TPH as DRO and GRO following industry standard protocols for sampling handling and shipment. To provide a more thorough characterization of the soil in the FOV area the samples sent to the fixed-base analytical laboratory will also be analyzed for TCL VOCs, TCL SVOCs, PAHs, TCL PCBs, TAL Metals, pH, and TOC. It is preferred that all three samples from individual borings be submitted to the fixed-base laboratory for analysis.

Samples of any IDW generated during this investigation will be collected and analyzed prior to disposal.

SAP Worksheet #18 -- Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Sampling Location/ID Number[(1)]	Matrix	Depth/ Location	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference
SOIL SAMPLES – LNAPL DELINEATION (10 SURFACE, 10 MID-DEPTH, and 10 WATER TABLE SOIL SAMPLES TO BE SENT TO FIXED BASE LABORATORY FOR CONFIRMATION)					
PAI-27-S0-48-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-49-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-50-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-51-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-52-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-53-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-54-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology

Sampling Location/ID Number[(1)]	Matrix	Depth/ Location	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference
PAI-27-S0-55-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-56-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-57-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-58-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-59-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-60-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-61-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-62-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology

Sampling Location/ID Number[(1)]	Matrix	Depth/ Location	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference
PAI-27-S0-63-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-64-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-65-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-66-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-67-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-68-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-69-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
PAI-27-S0-70-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology

Sampling Location/ID Number[(1)]	Matrix	Depth/ Location	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference
PAI-27-S0-71-xx	Soil	0 – 1 ft bgs Mid-depth Water table	Field Screen – DDT and TPH Select Samples – fixed base laboratory - TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	3	SA-2.5 Direct Push Technology
FIELD DUPLICATES – SOIL (3)					
PAI-27-SO-MMDDYY-01	Soil	---	TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	1	SA-2.5 Direct Push Technology
PAI-27-SO-MMDDYY-02	Soil	---	TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	1	SA-2.5 Direct Push Technology
PAI-27-SO-MMDDYY-03	Soil	---	TCL VOCS, SVOCS, PAHs, pesticides, PCBs, TAL metals, GRO/DRO, pH, and TOC	1	SA-2.5 Direct Push Technology

1. XX – Sample Depth – Bottom of sample interval in feet
   MMDDYY – date of sample – month, day, year

   VOCs - volatile organic compounds
   SVOCs - semivolatile organic compounds
   PAHs - polynuclear aromatic hydrocarbons
   PCBs - polychlorinated biphenyls
   TPH - total petroleum hydrocarbons
   GRO - gasoline range organics
   DRO - diesel range organics
   TOC - total organic carbon

SAP Worksheet #19 -- Analytical SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	**Analytical Group**	**Analytical and Preparation Method / SOP Reference**	**Containers** (number, size, and type)	**Sample volume**[2] (units)	**Preservation Requirements** (chemical, temperature, light protected)	**Maximum Holding Time**[3] (preparation / analysis)
Aqueous QC	VOCs	SW-846 5035/8260B CompuChem 1.3.2.2	3 40-mL vials	25 mL	Hydrochloric acid (HCl to pH<2; Cool to 4°C±2°C; no headspace	14 days to analysis
	SVOCs	SW-846 3510C/8270C, CompuChem 2.5.2.1/2.5.2.7	2 1-liter glass amber bottles	1,000 mL	Cool to 4°C±2°C	7 days to preparation; 40 days to analysis
	Pesticides	SW-846 3510C/8081A/ CompuChem 2.2.4.1/2.2.4.10	2 1-liter glass amber bottles	1,000 mL	Cool to 4°C±2°C	7 days to preparation; 40 days to analysis
	PCBs	SW-846 3510C/8082/ CompuChem 2.2.4.1, 2.2.5.3	2 1-liter glass amber bottles	1,000 mL	Cool to 4°C±2°C	7 days to preparation; 40 days to analysis
	Metals	SW-846 3010A/6010B/ 7470ACompuChem 3.2.1.4; 3.2.1.6, 3.3.1, 3.3.4	1 500-mL high density polyethene (HDPE)	150 mL	Nitric Acid (HNO_3) to pH<2	180 days to analysis; mercury 28 days to analysis

Matrix	**Analytical Group**	**Analytical and Preparation Method / SOP Reference**	**Containers** (number, size, and type)	**Sample volume**[2] (units)	**Preservation Requirements** (chemical, temperature, light protected)	**Maximum Holding Time**[3] (preparation / analysis)
Soil	VOCs	SW-846 5035/8260B/ CompuChem 1.3.2.4	3 40-mL VOA vial		2 Sodium Bisulfate, 1 MeOH or 3-5 encores + 1- 4 oz jar for Dry Wt.Cool to 4°C±2°C	14 days to analysis
	SVOCs	SW-846 3550B/8270C/ CompuChem 2.5.2.3/2.5.2.7	1 8-oz glass jar	30 g	Cool to 4°C±2°C	14 days until extraction/40 days to analysis
	PAHs	SW-846 3550B/8270C Modified for SIM/ CompuChem 2.5.2.3/2.4.4.5	1 8-oz glass jar	30 g	Cool to 4°C±2°C	14 days until extraction/40 days to analysis
	Pesticides	SW-846 3550B/8081A/ CompuChem 2.2.4.2/2.2.4.10	1 8-oz glass jar	30 g	Cool to 4°C±2°C	14 days until extraction/40 days to analysis
	PCBs	SW-846 3550B/8082/ CompuChem 2.2.4.2/2.2.5.3	1 8-oz glass jar	30 g	Cool to 4°C±2°C	14 days until extraction/40 days to analysis
	Metals	SW-846 3050A/6010B/7471A/ CompuChem 3.2.1.5; 3.2.1.6; 3.3.2; 3.3.4	1 2-oz glass jar	125 g	Cool to 4°C±2°C	Hg 28 days; metals 180 days to analysis
	DRO	SW-846 3550B/8015B; Compuchem 2.2.3.7/2.2.3.8	1 4-oz jar	30 g	Cool to 4°C±2°C	14 days to preparation; 40 days to analysis
	GRO	SW-846 5035/8015B; Compuchem 1.1.3.2	3 40-mL VOA vial	5 g	3-5 encores + 1- 4 oz jar for Dry Wt.Cool to 4°C±2°C	14 days to analysis

	pH	Sw-846 9045C/9045D/ CompuChem 3.5.14.3	1 4-oz wide-mouth amber glass jar (shared with TOC)	20 g	Cool to $4^{o}C \pm 2^{o}C$	ASAP
	TOC	SW-846 9060M/ CompuChem 3.6.2.2	1 4-oz wide-mouth amber glass jar	10 g	Cool to $4^{o}C \pm 2^{o}C$	28 days to analysis
IDW	TCLP Organics	SW-846 1311/3510C/5035/8260B/8270C/8081A/8151B; CompuChem 2.7.2/2.7.3/1.3.2.2/2.5.2.3/ 2.5.2.72.2.4.2/2.2.4.10/2.2.7.1/2.2.7.4	4 8-oz jars	400 g	Cool to 4°C±2°C	14 days leach/14 days analysis
	TCLP Inorganics	SW-846 1311/3010/6010B/ 7470A; CompuChem 3.2.1.4; 3.2.1.6; 3.3.1; 3.3.4	1 8-oz jar	100 g	Cool to 4°C±2°C	180 days leach/28 days Hg leach & analysis
	Flashpoint (ignitability)	SW-846 1010; CompuChem 3.5.9.1	1 8-oz(shared with Reactive Cyanide & Reactive Sulfide)	50 g	Cool to 4°C±2°C	7 days to analysis
	pH	9045C/9045D; CompuChem 3.5.14.3	1 4-oz jar (shared with Total metals & TOC)	20 g	Cool to 4°C±2°C	ASAP
	Reactive Cyanide	SW-846 9014; CompuChem 3.4.4	1 8-oz(shared with Flashpoint & Reactive Sulfide)	10 g	Cool to 4°C±2°C	7 days to analysis
	Reactive Sulfide	SW-846 9034; CompuChem 3.5.18.1	1 8-oz(shared with Reactive Cyanide & Flashpoint)	10 g	Cool to 4°C±2°C	7 days to analysis

SAP Worksheet #20 -- Field Quality Control Sample Summary Table

(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Number of Sampling Locations	Number of Field Duplicates	Number of MS/MSDs	Number of Field Blanks	Number of Equip. Blanks	Number of VOC Trip Blanks	Number of PT Samples	Total Number of Samples to Lab
Soil	TCL VOCs	30	3	2	1	2	4	0	42
	TCL SVOCs	30	3	2	1	2	NA	0	38
	PAHs	30	3	2	1	2	NA	0	38
	TCL Pesticides	30	3	2	1	2	NA	0	38
	TCL PCBs	30	3	2	1	2	NA	0	38
	TAL Metals	30	3	2	1	2	NA	0	38
	GRO	30	3	NA	1	2	NA	0	36
	DRO	30	3	NA	1	2	NA	0	36
	pH	30	3	NA	NA	NA	NA	0	33
	TOC	30	3	NA	NA	NA	NA	0	33

MS/MSD - Matrix Spike/Matrix Spike Duplicate
VOC - Volatile Organic Compound
PT - Proficiency Testing
GRO - Gasoline Range Organics
DRO - Diesel Range Organics
NA - Not Applicable
SVOC - Semivaolte Organic compound
TOC - Total Organic Carbon
TDS - Ttoal Dissolved Solids
PAHs - Polynuclear Aromatic Hydrocarbons
PCBs - Polychlorinated Biphenyls

SAP Worksheet #21 -- Project Sampling SOP References Table

(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date and/or Number	Organization of Sampling SOP	Equipment Type	Modified for Project Work?	Comments
CT-04	Sample Nomenclature, 09/2003 Rev. 1	TtNUS	None	N	Refer to Appendix C for Field SOPs
CT-05	Database Records and Quality Assurance, 01/01 Rev. 2	TtNUS	None	N	
SA-1.3	Soil Sampling	TtNUS	Encore™ sampling kit, safety glasses, nitrile surgeon's gloves, paper towels, packaging material, shipping material, decontamination equipment and supplies, sample bottleware, disposable trowel	Y	
SA-2.5	Direct Push Technology (Geoprobe/Hydropunch)	TtNUS	Geoprobe® sampling kit, PID, cut-resistant gloves, macrocore sampler, disposable sampler liners, probe sampler adaptors, Roto-hammer, Geoprobe® large bore soil sampler, decontamination equipment and supplies, cast aluminum or steel drive point, bentonite chips or equivalent	Y	
SA-6.1	Non-Radiological Sample Handling, 02/04 Rev. 3	TtNUS	Sample bottleware, packaging material, shipping materials	N	
SA-6.3	Field Documentation, 09/2003 Rev. 2	TtNUS	Field logbook, field sample forms, boring logs	Y	
SA-7.1	Decontamination of Field Equipment, 04/2008 Rev. 5	TtNUS	Decontamination equipment, scrub brushes, phosphate-free detergent, DI water	Y	
SDI QuickChek® or equivalent remediation testing kit	EnviroGard DDT in Soil Test Kit	SDI	EnviroGard DDT Soil Kit (7310000), Sample Extraction Kit (Soil) (73100EB or 73100EA), Field Lab System Rental (6997020)	N	Appendix C

Reference Number	Title, Revision Date and/or Number	Organization of Sampling SOP	Equipment Type	Modified for Project Work?	Comments
PetroFLAG® or equivalent test kit	Field Test Kit for Hydrocarbons in Soil	PetroFLAG®	PetroFLAG® Hydrocarbon Analysis System	N	Appendix C

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SAP Worksheet #22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference	Comments
PID	Prepared Standard Analysis	Daily	Manufacturer's guidance	Retry or replace	FOL	GH-1.2	
SDI QuickCheck® Field Test Kit	Prepared Standards Analysis	Daily	Manufacturer's Guidance	Retry ro replace	FOL	Manufacturer's Guidance	
PetroFLAG® or equivalent test kit	Prepared Standards Analysis	Daily	Manufacturer's Guidance	Retry ro replace	FOL	Manufacturer's Guidance	

FOL - Field Operations Leader
PID - Photoionization detector

SAP Worksheet #23 -- Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?[1] (Y/N)
1.1.3.2	Preparation and Analysis of Gasoline Range Organics (GRO) in Soil/Sediment Samples by Purge and Trap Following SW-846, CA LUFT, and TN GRO, Revision 10, 8/20/2007	Definitive	Soil/GRO	Gas Chromatography (GC)-Flame Ionization Detector (FID)	CompuChem	N
1.3.2.2	Analysis of Volatile Organic Compounds in Aqueous and Medium/High Concentration Soil Samples by SW-846, Revision 13, 3/24/09	Definitive	Aqueous QC/VOC	Gas Chromatography/ Mass Spectrometry (GC/MS)	CompuChem	N
1.3.2.4	GC/MS Analysis of Low Concentration Volatiles in Soil/Sediment/Sludge Samples by SW-846 Method 8260B, Revision11, 8/11/09	Definitive	Soil/VOC	GC/MS	CompuChem	N
2.2.3.7	Analysis of Diesel Range Organics (DRO), Oil Range Organics (ORO), JP4, JP8, and Total Jet Fuel in Aqueous and Solid Samples by SW846 and Extractable Petroleum Hydrocarbons by TN DEC, Revision 11, 1/27/09	Definitive	Soil/DRO	GC-FID	CompuChem	N
2.2.3.8	Preparation of Soil/Sediment/Sludge Samples for Diesel Range Organics (DRO) by SW-846,Oil Range Organics , and TN DEC, Revision 3, 2/5/09	Definitive	Soil/DRO preparation	NA	CompuChem	N
2.2.4.1	Sample Preparation for Pesticides/PCBs in Water SW-846 and NYSASP, Revision 11, 10/18/07	Definitive	Aqueous QC/ Pesticides/PCBs preparation	NA	CompuChem	N
2.2.4.2	Low Level Preparation for Analysis of Pesticides/PCBs Soil/Sediment/Sludge by SW-846 and NYSASP, Revision 11, 3/4/09	Definitive	Soil/ Pesticides/PCBs preparation	NA	CompuChem	N

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?[1] (Y/N)
2.2.4.10	GC/ECD Analysis of Organochlorine Pesticides in Water and Soil Extracts by SW-846 Method 8081A and Method 8081B, Revision 7, 3/6/09	Definitive	Aqueous QC/Pesticides	Gas Chromatography/Electron Capture Detector (GC/ECD)	CompuChem	N
2.2.5.1	PCBs in Water Preparation Procedure (SW-846 and NYSASP), Revision 9, 2/18/09	Definitive	Aqueous QC/PCBs preparation	NA	CompuChem	N
2.2.5.3	GC/ECD Analysis of Polychlorinated Biphenyls (PCBs) as Aroclors in Water and Soil by SW-846 and NYSASP, Revision 8, 3/02/09	Definitive	Aqueous QC/PCBs	GC/ECD	CompuChem	N
2.4.4.5	GC/MS Selected Ion Monitoring (SIM) Semivolatile Analyses of Aqueous and Soil Samples using SW-846 and EPA CLP Methodologies (OLC03.2 and OLM04.3), Revision 1, 6/20/06	Definitive	Aqueous QC and Soil/ Semivolatiles PAH SIM	NA	CompuChem	N
2.5.2.1	Preparation of Water Samples for the Analysis of Semivolatiles by SW-846 Method 3510C and EPA 625, Revision 13, 6/14/08	Definitive	Aqueous QC/ Semivolatiles preparation	NA	CompuChem	N
2.5.2.3	Preparation of Soil/Sediment/Sludge Samples by SW-846 Method 3550B and Method 3550C for the Analysis of Low-Level Semivolatiles, Revision 13, 10/13/09	Definitive	Soil/ Semivolatiles preparation	NA	CompuChem	N
2.5.2.7	GC/MS Analysis of Extractable Semivolatiles in Aqueous and Solid Samples by SW-846 , Revision 13, 11/4/08	Definitive	Aqueous QC/ Semivolatiles	GC/MS	CompuChem	N
3.2.1.4	Digestion Block Preparation of Aqueous Samples for ICP Analysis of Total or Dissolved Metals by SW-846, MCAWW, and Standard Methods, Revision 4, 5/27/08	Definitive	Aqueous QC/Metals digestion	NA	CompuChem	N

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?[1] (Y/N)
3.2.1.5	Digestion Block Preparation of Soil Samples for ICP Determination of Total Metals by SW-846 Method 3050B, Revision 7, 6/5/08	Definitive	Soil/Metals digestion	NA	CompuChem	N
3.2.1.6	Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES) by SW-846 Method 6010B, Revision 17, 8/31/09	Definitive	Aqueous QC/Metals	ICP-AES	CompuChem	N
3.3.1	Mercury in Water, Manual Digestion Procedure for EPA CLP, NYSASP, SW-846, and MCAWW, Revision 20, 9/03/09	Definitive	Aqueous QC/Mercury digestion	NA	CompuChem	N
3.3.2	Solid Sample Mercury Digestion by SW-846 Methods 7471A and 7471B, Revision 17, 9/2/09	Definitive	Soil/Mercury digestion	NA	CompuChem	N
3.3.4	Automated Cold Vapor Determination for Mercury by CLP, SW-846, MCAWW, and NYSASP, Revision 21, 7/23/07	Definitive	Aqueous QC/Soil Mercury	Cold Vapor Atomic Absorption (CVAA)	CompuChem	N
3.5.14.3	Soil and Waste pH by SW-846 Methods 9045C and 9045D, Revision 4, 9/2/09	Definitive	Solid pH	pH meter	CompuChem	N
3.6.2.2	Analysis of Soil Samples for Total Organic Carbon (TOC) by SW-846 Method 9060A, modified for Soils, and Lloyd Kahn (Revision 15, 10/6/09)	Definitive	Soil TOC	TOC Analyzer - Non-dispersive infrared detector (NDIRD)	CompuChem	N
4.1	Receiving Samples, Revision 35, 2/4/2009	NA	NA	NA	CompuChem	N
4.7	Organizing and Designating Raw Samples for Disposal, Revision 10, 2/18/09	NA	NA	NA	CompuChem	N
4.17	Glassware Shipping Procedures, Revision 2, 2/18/2009	NA	NA	NA	CompuChem	N
12.1	Hazardous Waste Disposal, Revision 7, 1/28/04	NA	NA	NA	CompuChem	N

Laboratory SOPs are found in Appendix D.

1 If yes, then specify the modification that has been made. Note that any analytical SOP modification made relative to project specific needs must be reviewed and approved by the Navy QAO.

SAP Worksheet #24 -- Analytical Instrument Calibration Table

(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/MS - VOC and SVOC/PAH	Tune Verification - Bromofluorobenzene (BFB) for VOCs and decafluorotriphenylphosphine (DFTPP) for SVOCs.	The tune is verified at the beginning of each 12-hour analytical sequence.	The tune verification must meet the ion abundance criteria required by the method. Selected Ion Monitoring (SIM) must meet the mass drift and peak width criteria required by the SOP. No samples may be accepted without a valid tune.	Manually tune the instrument and/or replace the ion source or filament.	Analyst/ Laboratory Area Supervisor	1.3.2.2; 1.3.2.4; 2.4.4.5, 2.5.2.7
	Initial Calibration – minimum of a five point calibration curve is prepared.	Perform after major instrument maintenance and upon failure of second consecutive continuing calibration verification.	The average response factor (RF) for VOC System Performance Check Compound (SPCCs) must be ≥0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. The average RF for SVOC SPCCs must be ≥ 0.05 (≥0.010 for SIM). The RSD for calibration check compounds (CCCs) for VOCs and SVOCs ≤ must be ≤ 30%; relative standard deviation (RSD) for each analyte must be ≤ 15% or the linear least squares regression (r) must be ≥ 0.995.	Recalibrate.	Analyst/ Laboratory Area Supervisor	
	Initial Calibration Verification	Perform after each initial calibration.	The percent recovery of all analytes must be 75-125%.	Recalibrate.	Analyst/ Laboratory Area Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Continuing Calibration Verification	Perform one per 12-hour analysis period.	The RF for VOC SPCCs must ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. The RF for SVOC SPCC must be ≥ 0.05. The percent difference/drift for CCCs for VOCs and SVOCs ≤ must be ≤ 20%.	Recalibrate	Analyst/ Laboratory Area Supervisor	
GC/ECD - Pesticides and PCBs	Breakdown Check (pesticides only)	Perform daily prior to sample analysis.	The degradation must be ≤ 15% for both Endrin and DDT.	Column maintenance; injection port maintenance	Analyst/ Laboratory Area Supervisor	2.2.4.10; 2.2.5.3
	Initial Calibration - minimum of five point calibrat8ion curve is prepared	Perform after major instrument maintenance and upon failure of second consecutive continuing calibration verification.	The RSD for each analyte must be ≤ 20% or linear least squares regression r ≥ 0.995.	Recalibrate.	Analyst/ Laboratory Area Supervisor	
	Initial Calibration Verification	Perform after initial calibration.	The percent recovery of all analytes must be 80-120%.	Recalibrate.	Analyst/ Laboratory Area Supervisor	
	Continuing Calibration Verification	Perform one per 10 field samples analyzed	The percent recovery of all analytes must be 80-120%.	Recalibrate.	Analyst/ Laboratory Area Supervisor	
GC/FID - GRO/DRO	Initial Calibration	Perform after major instrument maintenance and upon failure of second consecutive continuing calibration verification.	The RSD for each analyte must be ≤ 20% or linear least squares regression r ≥ 0.995.	Recalibrate.	Analyst/ Laboratory Area Supervisor	1.1.3.2/2.2.3.7
	Initial Calibration Verification	Perform after initial calibration.	The percent recovery of all analytes must be 80-120%.	Recalibrate.	Analyst/ Laboratory Area Supervisor	
	Continuing Calibration Verification	Perform one per 12-hour analysis period.	The percent recovery of all analytes must be 85-115%.	Recalibrate.	Analyst/ Laboratory Area Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
CVAA - Mercury	Initial Calibration – five point calibration curve is prepared.	Perform daily prior to sample analysis.	The correlation coefficient must be ≥ 0.995	Recalibrate.	Analyst/ Laboratory Area Supervisor	3.3.4
	Initial Calibration Verification	Each analytical sequence.	Analytes must agree within 10% of the expected value	Recalibrate	Analyst/ Laboratory Area Supervisor	
	Calibration Blank	One is performed at the beginning of analytical sequence, after every 10 samples, at the end of the sequence	All target analyte concentrations must be < 2x MDL.	Re-prepare and analyze all associated samples.	Analyst/ Laboratory Area Supervisor	
	Continuing Calibration	Perform every 10 samples and at the end of the analytical sequence.	The percent recovery must be 80-120%.	Recalibrate.	Analyst/ Laboratory Area Supervisor	
ICP-AES – Metals	Initial Calibration - the instrument is calibrated by a one point calibration per manufacturer's guidelines.	At the beginning of each day, or if the QC is out of criteria.	None; only one high standard and a calibration blank must be analyzed. If more than one calibration standard is used, correlation coefficient ≥ 0.995.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	3.2.1.6
	Initial Calibration Verification – from a source different than that used for calibration curve.	Following initial calibration prior to the analysis of samples.	90-110 %R of the true value.	Investigate reasons for failure, reanalyze once. If still unacceptable, repeat calibration.	Analyst/ Supervisor	
	Initial Calibration Blank (ICB)	Before beginning a sample sequence.	No analytes detected > 2x MDL.	Correct the problem, then re-prepare and reanalyze.	Analyst/ Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Continuing Calibration Verification	Analyze a standard at the beginning and end of the sequence and after every 10 samples.	90-110% R of true value.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/ Supervisor	
	Continuing Calibration Blank (CCB)	After the initial continuing calibration verification, after every 10 samples, and at the end of the sequence.	No analytes detected > 2x MDL.	Correct the problem, then re-prepare and reanalyze calibration blank and previous 10 samples.	Analyst/ Supervisor	
	Low-Level Check Standard	Daily after initial calibration and before samples.	80-120 %R of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze all affected samples.	Analyst/ Supervisor	
	Interference Check Standards (ICS – ICS A and ICS B)	At the beginning and end of an analytical run and after each batch of 20 samples.	ICS A recoveries must be within the absolute value of the QL and ICS B recoveries must be within 80-120 %R of the true value.	Investigate and perform necessary equipment maintenance. Recalibrate and reanalyze all affected samples.	Analyst/ Supervisor	
pH meter	Calibration	Daily; before use	The value for each of the certified buffer solutions must be within ± 0.05 pH units	Recalibrate	Lab Area Supervisor	3.5.14.3

TOC Analyzer	Initial Calibrations	Each analytical sequence.	Correlation coefficient of curve must be ≥ 0.995.	Recalibrate	Analyst/ Laboratory Area Supervisor	3.6.2.2
	Initial Calibration Verification	Each analytical sequence.	Analyte must agree within 10% of analyte true value.	Recalibrate	Analyst/ Laboratory Area Supervisor	
	Continuing Calibration Verification	Every 10 samples and at the end of the analytical sequence.	Analyte must agree within 10% of analyte true value.	Recalibrate	Analyst/ Laboratory Area Supervisor	

SAP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

(UFP-QAPP Manual Section 3.2.3)

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
GC/MS	Replace or clean ion source; clean injector, replace injector liner, replace or clip capillary column, flush or replace tubing on purge and trap; replace trap.	Volatiles	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	Perform as needed.	Initial and/or continuing calibration criteria must be met.	Repeat maintenance activity or remove from service.	Analyst/ Laboratory Area Supervisor	1.3.2.2;1.3.2.4
GC/MS	Replace or clean ion source; clean injector, replace injector liner, replace or clip capillary column, flush or replace tubing on purge and trap; replace trap.	Semivolatiles and PAHs	Ion source, injector liner, column, column flow, septum	Perform as needed.	Initial and/or continuing calibration criteria must be met.	Repeat maintenance activity or remove from service.	Analyst/ Laboratory Area Supervisor	2.4.4.5; 2.5.2.7
GC/ECD	Perform ECD maintenance; replace or clip capillary column.	Pesticides/ PCBs	ECD, injector, injector liner, column, adjust column flow	Perform as needed.	Initial and/or continuing calibration criteria must be met.	Repeat maintenance activity or remove from service.	Analyst/ Laboratory Area Supervisor	2.2.4.10; 2.2.5.3

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
GC/FID	Clean injector, replace injector liner, replace or clip capillary column, replace septum, flush or replace tubing on purge and trap; replace trap.	GRO/DRO	injector, injector liner, septum, column, column flow	Perform as needed.	Initial and/or continuing calibration criteria must be met.	Repeat maintenance activity or remove from service.	Analyst/ Laboratory Area Supervisor	1.1.3.2/2.2.3.7
ICP-AES	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing.	Metals	Torch, filters, nebulizer chamber, pump, pump tubing	Perform as needed.	Initial and/or continuing calibration criteria must be met.	Repeat maintenance activity or remove from service.	Analyst/ Laboratory Area Supervisor	3.2.1.6
CVAA	Clean or replace dehydrator tubing and sample mixing coil tubing; replace sample probe; replace pump tubing; clean optical cell.	Mercury	Tubing, sample probe, optical cell	Perform as needed.	Initial and/or continuing calibration criteria must be met.	Repeat maintenance activity or remove from service.	Analyst/ Laboratory Area Supervisor	3.3.4
pH meter	Clean probe	QC standards	probe	As needed	Value for each certified buffer solution must be within ± 0.05 pH units of the expected value	Repeat maintenance activity of remove from service	Lab Area Supervisor	3.5.14.3

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person[2]	SOP Reference[1]
TOC Analyzer	Replace sample tubing, clean sample boat, replace syringe.	TOC	Tubing, sample boat, syringe	As needed	Must meet initial and/or continuing calibration criteria.	Repeat maintenance activity of remove from service.	Analyst/ Laboratory Area Supervisor	3.6.2.2

SAP Worksheet #26 -- Sample Handling System

(UFP-QAPP Manual Appendix A)

SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): FOL or designee/TtNUS
Sample Packaging (Personnel/Organization): FOL or designee/ TtNUS
Coordination of Shipment (Personnel/Organization): FOL or designee/ TtNUS
Type of Shipment/Carrier: Express mail courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodians/CompuChem
Sample Custody and Storage (Personnel/Organization): Sample Custodians/CompuChem
Sample Preparation (Personnel/Organization): Extraction and Preparation Technicians/CompuChem
Sample Determinative Analysis (Personnel/Organization): Analysts /CompuChem
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 60 days from receipt
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 3 months
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodians/CompuChem

SAP Worksheet #27 --= Sample Custody Requirements Table

(UFP-QAPP Manual Section 3.3.3)

Field Chain of Custody

To ensure the integrity of a sample from collection through analysis, an accurate written record that traces the possession and handling of the sample is necessary. This documentation is referred to as the chain-of-custody form. Chain-of-custody begins at the time of sample collection. A sample is under custody if any of the following conditions apply:

- It is in the owner's actual possession,
- It is in the owner's view, after being in his/her physical possession,
- It was in the owner's possession and then was locked up or sealed it up to prevent tampering,
- It is in a secure area.

Custody documentation is designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. A multi-part chain-of-custody form is used with each page of the form signed and dated by the recipient of a sample or portion of sample. The person releasing the sample and the person receiving the sample will retain copies of the chain-of-custody form each time a sample transfer occurs.

Preservation of the integrity of the samples collected during the SI will be the responsibility of identified persons from the time the samples are collected until the samples, or their derived data, are incorporated into the final report.

The Tetra Tech FOL is responsible for the care and custody of the samples collected until they are delivered to the laboratory or are entrusted to a carrier. When transferring samples, the individuals relinquishing and receiving them will sign, date, and note the time on the chain-of-custody form. This form documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common carrier). Field chain-of-custody requirements are provided in SA-6.3 (Appendix C). Upon arrival at the laboratory, internal sample custody procedures will be followed as defined in the Laboratory SOPs included in Appendix D.

Laboratory Chain of Custody – CompuChem

Laboratory sample custody procedures (receipt of samples, archiving, and disposal) will be used according to CompuChem SOPs. Coolers are received and checked for proper temperature. The chain-of-custody form will be checked against the sample containers for correctness. Samples will be logged

into the laboratory information management system (LIMS) and given a unique log number that can be tracked through processing. The client will be notified of any problems.

SAP Worksheet #28 -- Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4)

Matrix	Aqueous QC/Soil
Analytical Group	VOCs
Analytical Method/SOP Reference	SW-846 8260B 1.3.2.2/ 1.3.2.4

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	Contaminants in the method blank must be < ½ QLs, except common lab contaminants, which must be <QL.	Re-prepare and analyze all associated samples.	Analyst/Laboratory Area Supervisor	Contamination/Bias	Contaminants in the method blank must be < ½ QLs, except common lab contaminants, which must be <QL.
Laboratory Control Sample (LCS)	One is performed for each batch of up to 20 samples.	Percent recoveries must meet the control limits listed in Appendix ?A.	Re-prepare and analyze all associated samples.	Analyst/Laboratory Area Supervisor	Accuracy	Percent recoveries must meet the control limits listed in Appendix A.
Matrix Spike (MS)	One is performed for each batch of up to 20 samples.	Percent recoveries must meet the control limits listed in Appendix A.	If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC.	Analyst/Laboratory Area Supervisor	Accuracy	Percent recoveries must meet the control limits listed in Appendix A.

Matrix	Aqueous QC/Soil
Analytical Group	VOCs
Analytical Method/SOP Reference	SW-846 8260B 1.3.2.2/ 1.3.2.4

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix Spike Duplicate (MSD)	One is performed for each batch of up to 20 samples.	Percent recoveries should meet the control limits listed in Appendix A and the relative percent difference (RPD) between MS and MSD should be ≤ 30%.	If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC.	Analyst/Laboratory Area Supervisor	Accuracy & Precision	Percent recoveries should meet the control limits listed in Appendix A and the RPD between MS and MSD should be ≤ 30%.
Surrogates	3 per sample	Percent recoveries: **Soil** Dibromofluoromethane 71-141 1,2-dichloroethane-d4 70-120 Toluene-d8 85-115 4-Bromofluorobenzene 85-102 **Water** Dibromofluoromethane 85-115 1,2-dichloroethane-d4 70-120 Toluene-d8 85-120 4-Bromofluorobenzene 75-120	(1) Re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	Percent recoveries: **Soil** Dibromofluoromethane 71-141 1,2-dichloroethane-d4 70-120 Toluene-d8 85-115 4-Bromofluorobenzene 85-102 **Water** Dibromofluoromethane 85-115 1,2-dichloroethane-d4 70-120 Toluene-d8 85-120 4-Bromofluorobenzene 75-120

Matrix	Aqueous QC/Soil
Analytical Group	VOCs
Analytical Method/SOP Reference	SW-846 8260B 1.3.2.2/ 1.3.2.4

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards	3 per sample- Fluorobenzene Chlorobenzene-d5 1,4-dichlorobezene-d4	Retention times for internal standards must be + 30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.	Inspect mass spectrometer or gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning	Analyst, Laboratory Supervisor and Data Validator	Precision/Accuracy/ Bias	Retention times for internal standards must be + 30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.

Matrix	Aqueous QC/Soil
Analytical Group	SVOCs/PAH SIM
Analytical Method/SOP Reference	SW-846 8270C/2.5.2.7/2.4.4.5

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	Contaminants in the method blank must be < ½ QLs, except common lab contamints, which must be < QL.	Re-prepare and analyze associated samples.	Analyst/Laboratory Director	Contamination/ Cias	Contaminants in the method blank must be < ½ QLs, except common lab contaminants, which must be < QL.
LCS	One is performed for each batch of up to 20 samples.	The percent recoveries should meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOPs.	Re-prepare and analyze associated samples.	Analyst/Laboratory Director	Accuracy	The percent recoveries should meet control limits listed in Appendix D with allowances for marginal exceedance failures as noted in the associated SOPs.
MS	One is performed for each batch of up to 20 samples.	The percent recoveries should meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOPs.	If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC.	Analyst/Laboratory Director	Accuracy	The percent recoveries should meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOPs.

Matrix	Aqueous QC/Soil
Analytical Group	SVOCs/PAH SIM
Analytical Method/SOP Reference	SW-846 8270C/2.5.2.7/2.4.4.5

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MSD	One is performed for each batch of up to 20 samples.	The percent recoveries should meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOP and the RPD should be ≤ 30%.	If both the LCS and MS/MSD are unacceptable, re-prepare and analyze the associated samples and QC.	Analyst/Laboratory Director	Precision/ Accurcay	The percent recoveries should meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOP and the RPD should be ≤ 30%.
Surrogates	6 per sample Full Scan 3 per sample SIM	Percent recoveries: **Soil** 2-Fluorobiphenyl 45-105 Terphenyl-d14 30-125 2,4,6-Tribromophenol (Full Scan Only)35-125 2-Fluorophenol Full Scan Only) 35-105 Phenol-dd5 Full Scan Only) 40-100 Nitrobenzene-d5 35-100 **Water** 2-Fluorobiphenyl 50-110 Terphenyl-d14 50-135 2,4,6-Tribromophenol (Full Scan Only) 40-125 2-Fluorophenol Full Scan Only) 20-110 Phenol-dd5 Full Scan Only) 10-110 Nitrobenzene-d5 40-110	(1) Re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy / Bias	Percent recoveries: **Soil** 2-Fluorobiphenyl 45-105 Terphenyl-d14 30-125 2,4,6-Tribromophenol (Full Scan Only)35-125 2-Fluorophenol Full Scan Only) 35-105 Phenol-dd5 Full Scan Only) 40-100 Nitrobenzene-d5 35-100 **Water** 2-Fluorobiphenyl 50-110 Terphenyl-d14 50-135 2,4,6-Tribromophenol (Full Scan Only) 40-125 2-Fluorophenol Full Scan Only) 20-110 Phenol-dd5 Full Scan Only) 10-110 Nitrobenzene-d5 40-110

Matrix	Aqueous QC/Soil
Analytical Group	SVOCs/PAH SIM
Analytical Method/SOP Reference	SW-846 8270C/2.5.2.7/2.4.4.5

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards	6 per sample - 1,4-Dichlorobenzene, Naphthalene-d8, Acenapthene-d10 Phenanthrene-d10, chrysene-d12 Perylene-d12	Retention times for internal standards must be + 30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.	Inspect mass spectrometer or gas chromatograph for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning	Analyst, Laboratory Supervisor and Data Validator	Precision/ Accuracy/ Bias	Retention times for internal standards must be + 30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.

Matrix	Aqueous QC/Soil
Analytical Group	PCBs
Analytical Method/SOP Reference	SW-846 8082/2.2.5.3

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	All target analyte concentrations must be <½ QL.	Re-prepare and analyze associated samples.	Analyst/Laboratory Director	Contamination/ Bias	No analytes > ½ QL.
LCS	One is performed for each batch of up to 20 samples.	The percent recovery must be between 25-145 for Aroclor 1016 and between 30-145 for Aroclor 1260 (soil).	Re-prepare and analyze associated samples.	Analyst/Laboratory Director	Accuracy	The percent recovery must be between 25-145 for Aroclor 1016 and between 30-145 for Aroclor 1260.
MS	One is performed for each batch of up to 20 samples.	The percent recovery must be between 25-145 for Aroclor 1016 and between 30-145 for Aroclor 1260 (soil).	Contact client for guidance.	Analyst/Laboratory Director	Accuracy	The percent recovery must be between 25-145 for Aroclor 1016 and between 30-145 for Aroclor 1260.
MSD	One is performed for each batch of up to 20 samples.	The percent recovery should be between 25-145 for Aroclor 1016 and between 30-145 for Aroclor 1260 (soil). The RPD should be ≤ 30%.	Contact client for guidance.	Analyst/Laboratory Director	Accuracy/ Precision	The percent recovery should be between 25-145 for Aroclor 1016 and between 30-145 for Aroclor 1260. The RPD should be ≤ 30%.
Surrogates	1 per sample	Percent recoveries: **Soil** Decachlorobiphenyl 60-125 **Water** Decachlorobiphenyl 40-135	(1) Re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy/Bias	Percent recoveries: **Soil** Decachlorobiphenyl 60-125 **Water** Decachlorobiphenyl 40-135

Matrix	Aqueous QC/Soil
Analytical Group	Pesticides
Analytical Method/SOP Reference	SW-846 8081A/2.2.4.10

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	All target analyte concentrations must be <½ QL.	Re-prepare and analyze associated samples.	Analyst/ Laboratory Director	Contamination/ Bias	All target analyte concentrations must be <½ QL.
LCS	One is performed for each batch of up to 20 samples.	Percent recoveries must meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOP.	Re-prepare and analyze associated samples.	Analyst/ Laboratory Director	Accuracy	Percent recoveries must meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOP.
MS	One is performed for each batch of up to 20 samples.	Percent recoveries must meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOP.	Contact client for guidance.	Analyst/ Laboratory Director	Accuracy	Percent recoveries must meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOP.
MSD	One is performed for each batch of up to 20 samples.	The percent recoveries should meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOP and the RPD should be ≤ 30%.	Contact client for guidance.	Analyst/ Laboratory Director	Accuracy/ Precision	The percent recoveries should meet control limits listed in Appendix A with allowances for marginal exceedance failures as noted in the associated SOP and the RPD should be ≤ 30%.

Matrix	Aqueous QC/Soil
Analytical Group	Pesticides
Analytical Method/SOP Reference	SW-846 8081A/2.2.4.10

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogates	2 per sample	Percent recoveries: **Soil** Tetrachloro-m-xylenes 70-125 Decachlorobiphenyl 55-130 **Water** Tetrachloro-m-xylenes 25-140 Decachlorobiphenyl 30-135	(1) Re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy/ Bias	Percent recoveries: **Soil** Tetrachloro-m-xylenes 70-125 Decachlorobiphenyl 55-130 **Water** Tetrachloro-m-xylenes 25-140 Decachlorobiphenyl 30-135

Matrix	Aqueous QC/Soil
Analytical Group	Metals
Analytical Method/SOP Reference	SW-846 6010B/7470A/7471A/3.2.1.6; 3.3.4

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	All target analyte concentrations must be <½ QL.	Re-prepare and analyze all associated samples.	Analyst/Laboratory Area Supervisor	Contamination/ Bias	All target analyte concentrations must be <½ QL.
LCS	One is performed for each batch of up to 20 samples.	The percent recovery must be 80-120%.	Re-prepare and analyze all associated samples.	Analyst/Laboratory Area Supervisor	Accuracy	The percent recovery must be 80-120%.
MS	One is performed for each batch of up to 20 samples.	The percent recovery should be 80-120%.	Contact client for guidance.	Analyst/Laboratory Area Supervisor	Accuracy	The percent recovery should be 80-120%.
Laboratory Duplicate	One is performed for each batch of up to 20 samples.	The percent recovery should be 80-120% and the RPD ≤ 20%.	Contact client for guidance.	Analyst/Laboratory Area Supervisor	Accuracy/ Precision	The percent recovery should be 80-120% and the RPD≤ 20%.
Serial Dilution	One is performed for each preparation batch with sample concentration(s) > 50x MDL.	The result must agree within ± 10% of the original sample result.	Perform Post Digestion Spike	Analyst/Laboratory Area Supervisor	Accuracy/ Precision	The result must agree within ± 10% of the original sample result.
Post Digestion Spike (does not apply to Cold Vapor)	One is performed when serial dilution fails or analyte concentration(s) in all samples < 50x MDL.	The result must agree within ± 25% of expected result.	Flag results of samples of same matrix as estimates in SDG narrative.	Analyst/Laboratory Area Supervisor	Accuracy/ Precision	The result must agree within ± 25% of expected result.

SAP Worksheet #29 -- Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
Sample Collection Documents and Records Field logbook (and sampling notes) Field sample forms (e.g., boring logs, sample log sheets, drilling logs, etc.) Chain-of-custody records Sample shipment airbills Equipment calibration logs Photographs Field Task Modification Forms Sampling and Analysis Plan Field Sampling SOPs	TtNUS Project File, results will be discussed in subject document.
Laboratory Documents and Records Sample receipt/login forms Sample storage records Sample preparation logs Standard traceability logs Equipment calibration logs Sample analysis run logs Equipment maintenance, testing, and inspection logs Corrective action forms Reported field sample results Reported results for standards, quality control checks, and quality control samples Data completeness checklists Sample storage and disposal records Telephone logs Extraction/clean-up records Raw data	TtNUS Project File, long-term data package storage at third-party professional document storage firm, results will be discussed in subject document.
Data Assessment Documents and Records Field Sampling Audit Checklist (if an audit is conducted) Analytical Audit Checklist (if an audit is conducted) Data Validation Memoranda	TtNUS Project File, results will be discussed in subject document.

SAP Worksheet #30 -- Analytical Services Table

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical Method	Data Package Turnaround Time	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Soil	VOCs	See Worksheet 18	SW-846 8260B	21 calendar days	Cathy Dover Compuchem 501 Madison Avenue Cary, North Carolina 27513 (919) 379-4089 cdover@compuchemlabs.com	NA
	SVOCs and PAHs		SW-846 8270C and 8270C SIM			
	Pesticides		SW-846 8081A			
	PCBs		SW-846 8082			
	Metals		SW-846 6010B/7470A /7471A			
	GRO/DRO		SW-846 8015B			
	pH		SW-846 9045C			
	TOC		SW-846 9060M			

SAP Worksheet #31 -- Planned Project Assessments Table

(UFP-QAPP Manual Section 4.1.1)

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment** (title and organizational affiliation)	**Person(s) Responsible for Responding to Assessment Findings** (title and organizational affiliation)	**Person(s) Responsible for Identifying and Implementing Corrective Actions (CA)** (title and organizational affiliation)	**Person(s) Responsible for Monitoring Effectiveness of CA** (title and organizational affiliation)
Field Supervision	Daily during sampling events	Internal	TtNUS	TtNUS FOL	TtNUS FOL	TtNUS FOL and Field Crew	TtNUS FOL, TOM, and CLEAN QAM
Project Supervision	Every sampling event	Internal	TtNUS	TtNUS TOM	TtNUS FOL	TtNUS PM/TOM and FOL	TtNUS TOM and FOL
Field Systems Audit	1 per contract year	Internal	TtNUS	Person assigned by TtNUS QAM	TtNUS TOM and FOL	TtNUS Auditor and TOM	TtNUS CLEAN QAM
Laboratory System Audit[1]	18 months	External	Naval Facilities Engineering Service Center (NFESC)	NFESC or designee	Laboratory QA Manager or Laboatory Manager	Laboratory QAM or Laboratory Manager	Laboratory QAM or Laboratory Manager

1 CompuChem has successfully completed the laboratory evaluation process required as part of the Department of Defense (DoD) QSM. The NFESC approval letter (expires April 2010) is included in Appendix E.

SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses

(UFP-QAPP Manual Section 4.1.2)

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings** (name, title, organization)	**Timeframe of Notification**	**Nature of Corrective Action Response Documentation**	**Individual(s) Receiving Corrective Action Response** (name, title, organization)	**Timeframe for Response**
Field Supervision	Site log book and sample collection logs	Mark Sladic, TOM, Tetra TtNUS; TBD, FOL, TtNUS	Immediately	Entry in site log book	Mark Sladic, TOM, Tetra TtNUS; TBD, FOL, TtNUS	24 hours
Project Supervision	Written report	Debra Humbert Program Manager; Mark Perry, Deputy Program Manager, TtNUS	Monthly	Written memo	Debra Humbert Program Manager; Mark Perry, Deputy Program Manager, TtNUS	Within a week of notification
Field Sampling System Audit (1)	Audit checklist (as per Navy Installation Restoration Chemical Data Quality Manuel [IRCDQM]) and written audit report	Mark Sladic, TOM, Tetra TtNUS; TBD, FOL, TtNUS; Debra Humbert Program Manager; Mark Perry, Deputy Program Manager, TtNUS	Dependent on the finding; if major a stop work may be issued immediately; however, if minor within 1 week of audit	Written memo	Mark Sladic, TOM, TtNUS; TBD, FOL,TtNUS; Debra Humbert Program Manager; Mark Perry, Deputy Program Manager, TtNUS	Within 48 hours of notification
Laboratory System Audit	Written audit report	Jennifer Rebman CompuChem QAM	Not specified by DOD	Letter	NFESC	Specified by DOD

1 Audits are scheduled at the TtNUS program level and may or may not include this project.

SAP Worksheet #33 -- QA Management Reports Table

(UFP QAPP Manual Section 4.2)

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Data validation report	Per sample delivery group (SDG)	Within 3 weeks of receipt of laboratory data	TtNUS DVM or designee	TtNUS TOM, project file
Major analysis problem identification (Internal Memorandum)	When persistent analysis problems are detected	Immediately upon detection of problem	TtNUS CLEAN QAM	TtNUS TOM, CLEAN QAM, Program Manager, and project file
Project monthly progress report	Monthly for duration of the project	Monthly	TtNUS TOM	DON, project file
Field progress reports	Daily, oral, during the course of sampling	Every day that field sampling is occurring	TtNUS FOL	TtNUS TOM
Laboratory QA Report	When significant plan deviations result from unanticipated circumstances	Immediately upon detection of problem	Laboratory PM	TtNUS TOM, project file

SAP Worksheet #34 -- Verification (Step I) Process Table

(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Chain-of-custody forms	The TtNUS FOL or designee will review and sign the chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and the sample information is accurate. The forms will be signed by the sampler and a copy will be retained for the project file, the TOM, and the data validators. See SOP SA-6.3	Internal	TtNUS sampler and FOL
SAP Sample tables	Verify that all proposed samples listed in the SAP tables have been collected.	Internal	TtNUS, FOL or designee
Sample log sheets	Verify that information recorded in the log sheets is accurate and complete.	Internal	TtNUS, FOL or designee
Sample coordinates	Verify that sample locations are correct and in accordance with the SAP proposed locations.	Internal	TtNUS, FOL or designee
Field QC samples	Check that field QC samples listed in Worksheet 20 were collected as required.	Internal	TtNUS, FOL or designee
Chain-of-custody forms	The laboratory sample custodian will review the sample shipment for completeness, integrity, and sign accepting the shipment. The data validators will check that the chain-of-custody form was signed/dated by the TtNUS FOL or designee relinquishing the samples and also by the laboratory sample custodian receiving the samples for analyses.	Internal/ External	1 CompuChem sample custodian 2 TtNUS, data validators
Analytical data package	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The laboratory QA Manager will sign the case narrative for each data package.	Internal	CompuChem QAM
Analytical data package	The data package will be verified for completeness by TtNUS data validators. Missing information will be requested from the laboratory and validation will be suspended until missing data are received.	External	TtNUS, data validators
Electronic data deliverables	The electronic data will be verified against the chain-of-custody and hard copy data package for accuracy and completeness.	External	TtNUS, data validators

Verification includes field data verification and laboratory data verification. Verification inputs as per SAP Worksheet 34 will be checked.

SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37, page 110 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Field SOPs/Field Logs/Sample Collection	Ensure that all sampling SOPs were followed. Verify that deviations have been documented and MPCs have been achieved. Particular attention should be given to verify that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken chain of custody from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented.	TtNUS TOM, FOL, or designee
IIa	Analytical SOPs	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Laboratory QAM (CompuChem)
IIa	Documentation of Method QC Results	Verify that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the laboratory will contact TtNUS for guidance prior to report preparation.	Laboratory QAM (CompuChem)
IIa	Chain-of-custody	Ensure that the custody and integrity of the samples were maintained from collection to analysis and the custody records are complete and any deviations are recorded.	TtNUS project chemist or data validators
IIa	Holding times	Verify that the samples were shipped and store at the required temperature and sample pH for chemically-preserved samples meet the requirements listed in Worksheet 19. Ensure that the analyses were performed within the holding times listed in Worksheet 19.	TtNUS project chemist or data validators
IIa/IIb	Laboratory data results for accuracy	Ensure that the laboratory QC samples listed in Worksheet 28 were analyzed and that the measurement performance criteria listed in Worksheet 12 were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical quality control criteria set up for this project were met.	TtNUS project chemist or data validators

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa/IIb	Field and laboratory duplicate analyses for precision	Check the field sampling precision by calculating the relative percent difference (RPD) for field duplicate samples. Check the laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; matrix spike/matrix spike duplicates; and laboratory control sample/laboratory control sample duplicate. Ensure compliance with the methods and project MPC accuracy goals listed in Worksheets 12.	TtNUS project chemist or data validators
IIa/IIb	Sample results for representativeness	Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis.	TtNUS project chemist or data validators
IIa/IIb	Project action limits	Discuss the impact on matrix interferences or sample dilutions performed because of the high concentration of one or more contaminant on the other target compounds reported as non-detected. Document this usability issue and inform the PM.	TtNUS project chemist or data validators
IIa/IIb	Data validation report	Summarize deviations from methods, procedures, or contracts. Qualify data results based on method or QC deviation and explain all the data qualifications. Print a copy of the project data base with data depicting data qualifiers and data qualifiers codes that summarize the reason for data qualifications Determine if the data met the MPC and determine the impact of any deviations on the technical usability of the data.	TtNUS project chemist or data validators
IIa, IIb	SAP QC Sample Documentation	Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within prescribed SAP acceptance limits. Ensure that QC samples and standards prescribed in analytical SOPs were analyzed and within the prescribed control limits. If any significant QC deviations occur, the laboratory shall have contacted the TtNUS TOM.	TtNUS TOM or designee

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa, IIb	Documentation of Analytical Reports for Completeness	Review the chain-of-custody form generated in the field to ensure that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. Validator will verify that elements of the data package required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed as per Worksheet #36. Check that all data have been transferred correctly and completely to the final Structured Query Language (SQL) database.	TtNUS project chemist or data validators
IIa/IIb	Project Action Limits	Review and add project action limits to the laboratory electronic data deliverable. Flag samples and notify PM of samples that exceed project action limits as listed on Worksheet #15.	TtNUS TOM or designee
IIb	Project Quantitation Limits for sensitivity	Ensure that the project quantitation limits listed in Worksheet #15 were achieved.	TtNUS project chemist or data validators
IIb	Analytical data Deviations	Determine the impact of any deviation from sampling or analytical methods and SOP requirements and matrix interference on the analytical results.	TtNUS project chemist or data validators

SAP Worksheet #36 -- Analytical Data Validation (Steps IIa and IIb) Summary Table

(UFP-QAPP Manual Section 5.2.2.1) (Figure 37, page 110 UFP-QAPP Manual)

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Soil	VOCs, SVOCs, PAHs, Pesticide, and PCBs	SW-846 8260B , 8270C, 8081A, 8151A, 8082, method specific criteria, DOD QSM, and those criteria listed in Worksheets #12, #15, #24, and #28. If not included in Worksheet #12, #15, #24 or #28, the logic outlined in USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review EPA-540/R-99-008, October 1999 will be used to apply qualifiers to data.	TtNUS Data Validation Specialist
IIa and IIb	Soil	Metals	SW-846 6010B, 7470A/7471A, and 9012A method specific criteria, DOD QSM, and those listed in Worksheets #12, #15, #24, and #28. If not included in Worksheet #12, #15, #24, and #28 and the logic outlined in USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review EPA 540-R-04-004, October 2004 will be used to apply qualifiers to data.	TtNUS Data Validation Specialist
IIa and IIb	Soil	pH and TOC	Method specific criteria listed in worksheets #12, #15, #25, and #28	

SAP Worksheet #37 -- Usability Assessment

(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment

Usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum and the results of the evaluations of these characteristics will be included in the project report. The characteristics will be evaluated for multiple concentration levels if the evaluator determines that this is necessary. To the extent required by the type of data being reviewed, the assessors will consult with experienced individuals to render sound technical assessments of these data characteristics:

Completeness

For each matrix that was scheduled to be sampled, the FOL acting on behalf of the Project Team will prepare a table comparing planned samples and analyses to samples actually collected and analyses actually performed. If deviations are identified, the TtNUS TOM and risk assessor will determine whether the deviations compromise the ability to meet project objectives. If they do, the TtNUS TOM will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions.

Precision

The Project Chemist acting on behalf of the Project Team will determine whether precision goals for field duplicates and laboratory duplicates were met. This will be accomplished by comparing duplicate results to precision goals identified in Worksheets #s 12 and 28. This will also include a comparison of field and laboratory precision with the expectation that field duplicate results will be no less precise than laboratory duplicate results. If the goals are not met, or data have been flagged as estimated (J qualifier), limitations on the use of the data will be discussed in the project report.

Accuracy

The Project Chemist acting on behalf of the Project Team will determine whether the accuracy/bias goals were met for project data. This will be accomplished by comparing percent recoveries of LCS, LCSD, MS, MSD, and surrogate compounds to accuracy goals identified in Worksheet # 28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, matrix spike, and laboratory control samples. If the goals are not met, limitations on the use of the data will be described in the project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the project report.

Representativeness

A Project Scientist identified by the TtNUS TOM and acting on behalf of the Project Team will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and processed for analysis in accordance with the SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The usability report will describe the representativeness of the data for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the project scientist indicates that a quantitative analysis is required.

Comparability

The Project Chemist acting on behalf of the Project Team will determine whether the data generated under this project are sufficiently comparable to historical site data generated by different methods and for samples collected using different procedures and under different site conditions. This will be accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction. This will not require quantitative comparisons unless professional judgment of the Project Chemist indicates that such quantitative analysis is required.

Sensitivity

The Project Chemist acting on behalf of the Project Team will determine whether project sensitivity goals listed in Worksheet #15 are achieved. If sensitivity goals are not achieved, the limitations on the data will be described. The Project Chemist will enlist the help of the project risk assessor to evaluate deviations from planned sensitivity goals. Special attention will be paid to the effect on attainment of project objectives in cases where quantitation or detection limits are less than PALs.

Project Assumptions and Data Outliers

The TtNUS TOM and designated team members will evaluate whether project assumptions were valid. This will typically be a qualitative evaluation but may be supported by quantitative evaluations. The type of evaluation depends on the assumption being tested. Quantitative assumptions include assumptions related to data distributions (e.g., normal or log-normal) and estimates of data variability. Potential outliers will be removed if a review of the associated documentation indicates that the results have an assignable cause that renders them inconsistent with the remainder of the data. During this evaluation, the team will consider whether outliers could be indications of unanticipated site conditions.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

After completion of data validation, the data and data quality will be reviewed to determine whether sufficient data of acceptable quality are available for decision making. In addition to the evaluations described earlier, a series of inspections and statistical analyses will be performed to estimate these characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples with non-detected results, number of samples with detected results, and the proportion of samples with detected and non-detected results. The Project Team members identified by the TtNUS TOM will assess whether the data collectively support the attainment of project objectives. They will consider whether any missing or rejected data have compromised the ability to make decisions or to make the decisions with the desired level of confidence. The data will be evaluated to determine whether missing or rejected data can be compensated for with other data. Although rejected data will generally not be used, there may be reason to use them in a weight-of-evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales.

For statistical comparisons and mathematical manipulations, non-detected values will be represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate samples will be used to represent the concentration at a particular sampled location.

Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate samples will be used to represent the concentration at a particular sampled location.

Identify the personnel responsible for performing the usability assessment:

The TtNUS TOM, TtNUS Project Chemist, TtNUS FOL, and TtNUS Project Scientist will be responsible for conducting the data usability assessments. The data usability assessment will be reviewed with the Navy, USEPA, and SCDHEC RPMs. The review will take place either in a face-to-face meeting or a teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The data will be presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). Written documentation will support use of non-compliant estimated or rejected data results. Results flagged as rejected during data validation will only be used qualitatively or semi-quantitatively at the discretion of the risk assessor. The project report will identify and describe the data usability limitations and suggest resampling or other corrective actions, if necessary.

REFERENCES

B&R Environmental (Brown and Root Environmental), 1998. Master Work Plan for MCRD Parris Island, South Carolina, Volumes I, II and III.

SCDHEC (South Carolina Department of Health and Environmental Control), May 2001. South Carolina Risk-Based Corrective Action for Petroleum Releases. Columbia, South Carolina.

TtNUS (Tetra Tech NUS), July 2002. Draft Site Inspection/Confirmatory Sampling Report for Site/SWMU 4, Site/SWMU 5, Site/SWMU 7, Site 9/SWMU 8, Site 13C/SWMU 13, Site/SWMU 16, SWMU 27, and SWMU 35, for Marine Corps Recruit Depot, Parris Island, South Carolina.

TtNUS, August 2004. Preliminary Assessment/Site Investigation and Confirmatory Sampling Report for Site/SWMU 55 Fiber Optic Vault, Marine Corps Recruit Depot, Parris Island, South Carolina.

TtNUS, June 2009. Conceptual Site Model, Site 27, Equipment Parade Deck, MCRD Parris Island, South Carolina.

USEPA (United States Environmental Protection Agency), 2001. Supplemental Guidance to RAGs: Region 4 Bulletin, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001 at http://www.epa.gov/region4/wasteots/ecolbul.htm

USEPA, November 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), EPA-530-D-02-004.

USEPA, December 2002. Guidance for Quality Assurance Project Plans, EPA QA/G-5, Office of Environmental Information, EPA/240/R-02/009, Washington, D.C.

U.S. Environmental Protection Agency; U.S. Department Of Defense; and U.S. Department of Energy (March 2005). Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP). EPA-505-B-04-900A; DTIC ADA 427785. Washington, D.C.

USEPA, 2009. USEPA Ecological Soil Screening Levels available at http://www.epa.gov./ecotox/ecossl.

USEPA, December 2009. Regional Screening Levels for Chemicals at Superfund Sites. http://epa-prgs.ornl.gov/chemicals/index.shtml.

SAP Worksheet #1 -- Title and Approval Page

(UFP-QAPP Manual Section 2.1)

Draft
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
29 May 2009

REMEDIAL INVESTIGATION OF SITE 5, FORMER PAINT SHOP DISPOSAL AREA
MARINE CORPS RECRUITING DEPOT (MCRD)
PARRIS ISLAND, SOUTH CAROLINA

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EXECUTIVE SUMMARY

This Uniform Federal Policy-Sampling and Analysis Plan (UFP-SAP) describes the study designed to complete a Remedial Investigation (RI) at Site 5, Former Paint Shop Disposal Area located at the Marine Corps Recruiting Depot (MCRD) on Parris Island, South Carolina. This UFP-SAP was prepared by Tetra Tech NUS, Inc. (TtNUS) on behalf of Naval Facilities Engineering Command (NAVFAC) Southeast under Contract Number N62467-04-0055, Contract Task Order (CTO) 0110. The field investigation described herein will be conducted to collect additional soil, groundwater, and sediment data so that risk assessments may be completed and risk mitigation can be addressed in a Feasibility Study (FS), if necessary.

Site 5 includes the area surrounding a former paint shop (Structure 177) and the bank of the Beaufort River where approximately 17 tons of paint wastes were disposed from the 1930s to the 1960s. Previous investigations consisted of an Interim Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) in 1990 and a Site Investigation/Confirmation Study (SI/CS) performed in 1999. During these investigations surface soil and sediment samples were collected and low level contamination was detected from the riverbank and shoreline of the Beaufort River. The nature and extent of this contamination have not been defined. This RI plan has been designed to answer two primary environmental questions:

- What is the nature and extent of contamination in soil, groundwater, and sediment at Site 5?
- Are the human health and ecological risks associated with exposure to potentially contaminated soil, groundwater, and sediment at Site 5 unacceptable?

SAP Worksheets

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ACRONYMS

AET	Apparent Effects Threshold
amu	Atomic mass unit
ASE	Accelerated Solvent Extraction
BFB	Bromofluorobenzene
bgs	Below ground surface
°C	Degree Celsius
CCB	Continuing Calibration Blank
CCC	Continuing Check Compounds
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLLE	Continuous Liquid-Liquid Extractor
CLP	Contract Laboratory Program
COC	Chain-of-Custody
COPC	Constituent of Potential Concern
CS	Confirmation Study
CSM	Conceptual Site Model
CTO	Contract Task Order
CV	Calibration Verification
%D	Percent Difference
DI	Deionized
DFTPP	Decafluorotriphenylphosphine
DoD	Department of Defense
DOT	Department of Transportation
DPT	Direct-push Technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
DVM	Data Validation Manager
EDD	Electronic Data Deliverables
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
ESV	Ecological Screening Value
FOL	Field Operations Leader
FS	Feasibility Study
FTMR	Field Task Modification Request

GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas chromatography/mass spectrophotometer
GFAA	Graphite Furnace Atomic Absorption
GPR	Ground Penetrating Radar
GPS	Global Positioning System
HASP	Health and Safety Plan
HQ	Hazard Quotient
HHRA	Human Health Risk Assessment
HSM	Health and Safety Manager
IAS	Initial Assessment Study
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma
ICV	Initial Calibration Verification
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
IDL	Instrument Detection Limit
IDW	Investigation-derived waste
ILCR	Incremental lifetime cancer risk
IS	Internal Standard
IV	Intervention Value
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
LUC	Land use control
MCL	Maximum Contaminant Level
MCRD	Marine Corps Recruiting Depot
MDL	Method detection limit
MPC	Measurement Performance Criteria
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NACIP	Naval Assessment and Control of Installation Pollutants
NAVFAC	Naval Facilities Engineering Command
NEESA	Naval Energy and Environmental Support Activity
NFA	No Further Action
NFESC	Naval Facilities Engineering Service Center

NIRIS	Naval Installation Restoration Information Solutions
OPNAV	Office of the Chief of Naval Operations
ORNL	Oak Ridge National Laboratory
ORP	Oxygen-Reduction Potential
OSHA	Occupational Safety and Health Administration
%R	Percent Recovery
%D	Percent Difference
PA	Preliminary Assessment
PAL	Project Action Limit
PAH	Polynuclear aromatic hydrocarbons
PCB	Polychlorinated biphenyl
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
PQL	Project Quantitation Limit
PT	Proficiency Testing (previously known as performance evaluation [PE] sample)
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QC	Quality Control
QL	Quantitation limit
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RF	Response factor
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RME	Reasonable maximum exposure
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
RT	Retention Time
SAP	Sampling and Analysis Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SCV	Secondary Chronic Value
SDG	Sample Delivery Group
SI	Site Investigation

SIM	Selected Ion Monitoring
SOP	Standard Operating Procedure
SPCC	System performance check compound
SQL	Structured Query Language
SRCR	Sample Receipt Condition Report
SRM	Standard Reference Material
SSL	Soil Screening Level
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
TV	Threshold Value
TtNUS	Tetra Tech NUS, Inc.
UCL	Upper confidence limit
UFP-SAP	Uniform Federal Policy-Sampling and Analysis Plan
USEPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile organic compound
VSP	Visual Sample Plan

SAP Worksheet #2 -- SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number:	**Site 5, Former Paint Shop Disposal Area**
Operable Unit:	**Not Applicable**
Contractor Name:	**Tetra Tech NUS, Inc. (TtNUS)**
Contract Number:	**N62467-04-0055**
Contract Title:	**Comprehensive Long-term Environmental Action Navy (CLEAN)**
Work Assignment Number:	**Contract Task Order (CTO) 0110**

1. This Uniform Federal Policy-Sampling and Analysis Plan (UFP-SAP or SAP) was prepared in accordance with the requirements of the United States Environmental Protection Agency (USEPA) *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (2005c) and *USEPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, (*2002d*)*.

2. Identify regulatory program:

   Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

3. This document is a project-specific SAP.

4. List dates of scoping sessions that were held:

   Data Quality Objective (DQO) Scoping Session, August 1, 2008

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	*Date*
Initial Assessment Study (IAS)	1986
Site Investigation (SI)/Confirmation Study (CS)	1995
Solid Waste Management Unit 3 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI)	1999

6. List organizational partners (stakeholders) and connection with lead organization:

   South Carolina Department of Health and Environmental Control (SCDHEC) – regulatory oversight, Marine Corps Recruiting Depot (MCRD) – property owner/manager

7. Lead organization

   Department of the Navy, NAVFAC Southeast

8. If any required UFP-SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

   All required elements are included in this SAP.

UFP-SAP Worksheet #	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
1	Title and Approval Page	Not Applicable
2	Table of Contents SAP Identifying Information	Not Applicable
3	Distribution List	Not Applicable
4	Project Personnel Sign-Off Sheet	Not Applicable
Project Organization		
5	Project Organizational Chart	Not Applicable
6	Communication Pathways	Not Applicable
7	Personnel Responsibilities and Qualifications Table	Not Applicable
8	Special Personnel Training Requirements Table	Not Applicable
Project Planning/ Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	Not Applicable
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	Not Applicable
11	Site-Specific Project Quality Objectives	Not Applicable
12	Measurement Performance Criteria Table	Not Applicable
13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	Not Applicable
14	Summary of Project Tasks	Not Applicable
15	Reference Limits and Evaluation Table	Not Applicable
16	Project Schedule/Timeline Table	Not Applicable
B. Measurement Data Acquisition		
Sampling Tasks		
17	Sampling Design and Rationale	Not Applicable
18	Sampling Locations and Methods/ Standard Operating Procedure (SOP) Requirements Table/Sample Location Map(s)	Not Applicable
19	Analytical Methods/SOP Requirements Table	Not Applicable
20	Field Quality Control Sample Summary Table	Not Applicable
21	Project Sampling SOP References Table Sampling SOPs	Not Applicable
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	Not Applicable
Analytical Tasks		
23	Analytical SOPs Analytical SOP References Table	Not Applicable
24	Analytical Instrument Calibration Table	Not Applicable
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Not Applicable
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	Not Applicable
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	Not Applicable

UFP-SAP Worksheet #	Required Information	Crosswalk to Related Information
Quality Control Samples		
28	Quality Control Samples Table Screening/Confirmatory Analysis Decision Tree	Not Applicable
Data Management Tasks		
29	Project Documents and Records Table	Not Applicable
30	Analytical Services Table Analytical and Data Management SOPs	Not Applicable
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	Not Applicable
32	Assessment Findings and Corrective Action Responses Table	Not Applicable
33	Quality Assurance Management Reports Table	Not Applicable
D. Data Review		
34	Verification (Step I) Process Table	Not Applicable
35	Validation (Steps IIa and IIb) Process Table	Not Applicable
36	Validation (Steps IIa and IIb) Summary Table	Not Applicable
37	Usability Assessment	Not Applicable

SAP Worksheet #3 -- Distribution List
(UFP-QAPP Manual Section 2.3.1)

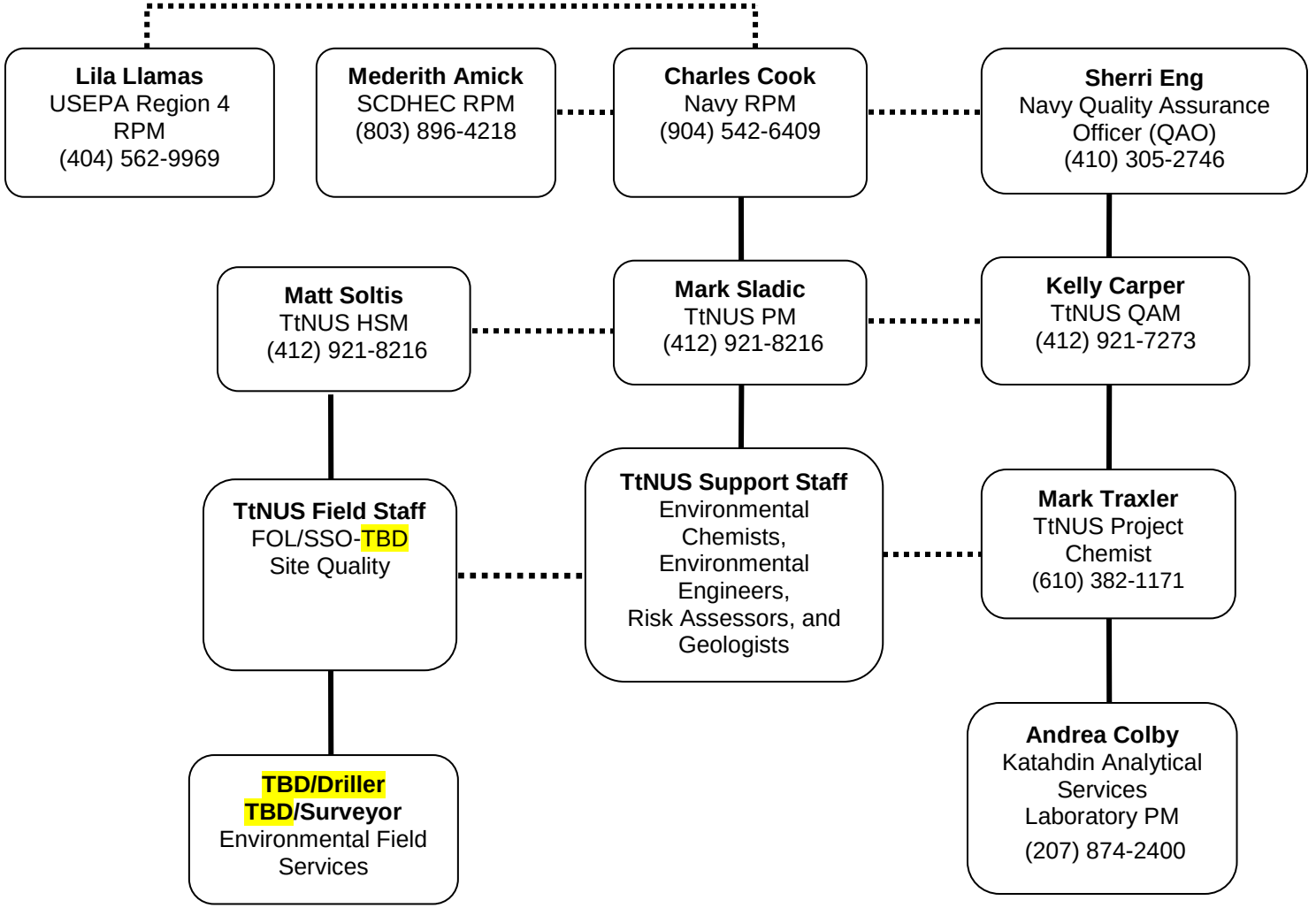
Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-Mail Address or Mailing Address
Lila Llamas	Federal Remedial Project Manager (RPM)	USEPA Region 4	(404) 562-9969	Koroma-Llamas.Lila@epa.gov
Meredith Amick	State RPM	SCDHEC	(803) 896-4218	AmickMS@dhec.sc.gov
Charles Cook	Navy RPM	NAVFAC Southeast	(904) 542-6409	charles.cook2@navy.mil
Andrea Colby	Laboratory Project Manager (PM)	Katahdin Analytical Services	(207) 874-2400	acolby@katahdinlab.com
Mark Sladic	PM	TtNUS	(412) 921-8216	mark.sladic@tetratech.com
Kelly Carper	Quality Assurance Manager (QAM)	TtNUS	(412) 921-7273	kelly.carper@tetratech.com
Mark Traxler	Project Chemist	TtNUS	(610) 382-1171	mark.traxler@tetratech.com
Joseph Samchuck	Data Validation Manager (DVM)	TtNUS	(412) 921-8510	joseph.samchuck@tetratech.com
Matt Soltis	Health and Safety Manager (HSM)	TtNUS	(412) 921-8912	matt.soltis@tetratech.com
To Be Determined (TBD) by TtNUS Project Manager	Field Operations Leader (FOL)/Site Safety Officer (SSO)	TBD	---	---

SAP Worksheet #4 -- Project Personnel Sign-Off Sheet
(UFP-QAPP Manual Section 2.3.2)

Name	Organization/Title/Role	Telephone Number	Signature/E-Mail receipt	SAP Section Reviewed	Date SAP Read
Lila Llamas	USEPA Region 4, Federal RPM	(404) 562-9969	Koroma-Llamas.Lila@epa.gov	All	
Mederith Amick	SCDHEC, State RPM	(803) 896-4218	AmickMS@dhec.sc.gov	All	
Charles Cook	Navy RPM	(904) 542-6409	charles.cook2@navy.mil	All	
Mark Sladic	TtNUS PM	(412) 921-8216	mark.sladic@tetratech.com	All	
TBD by TtNUS Project Manager	FOL/SSO	---	---	All	
Joseph Samchuck	DVM	(412) 921-8510	joseph.samchuck@ttnus.com	All	
Mark Traxler	TtNUS Project Chemist	(610) 382-1171	mark.traxler@tetratech.com	All	
Matt Soltis	TtNUS HSM	(412) 921-8912	matt.soltis@ttnus.com	Health and Safety Plan (HASP)	
Andrea Colby	Katahdin Analytical Services/Laboratory PM	(207) 874-2400	acolby@katahdinlab.com	Project Objectives and Laboratory SOPs	
TBD by TtNUS Project Manager	TBD/Driller	TBD	TBD	Project Objectives	
TBD by TtNUS Project Manager	TBD/Surveyor	TBD	TBD	Project Objectives	

SAP Worksheet #5 -- Project Organizational Chart
(UFP-QAPP Manual Section 2.4.1)

Lines of Authority ——— Lines of Communication ·····



SAP Worksheet #6 -- Communication Pathways
(UFP-QAPP Manual Section 2.4.2)

Communication Driver	Responsible Affiliation	Name	Phone Number and/or E-Mail	Procedure
The need for a change in schedule	TtNUS PM	Mark Sladic	(412) 921-8216	Inform Navy via schedule impact letter within 1 business day
Issues in the field that result in changes in scope of field work	TtNUS FOL TtNUS PM Navy RPM	TBD Mark Sladic Charles Cook	--- (412) 921-8216 (904) 542-6409	FOL inform PM immediately; PM inform Navy RPM by close of next working day. Document the changes on a Field Task Modification Request (FTMR) form and obtain required approvals within 5 days of initiating the form.
Recommendation to stop work and initiate work upon corrective action	TtNUS FOL TtNUS PM TtNUS QAM TtNUS HSM Navy RPM	TBD Mark Sladic Kelly Carper Matt Soltis Charles Cook	--- (412) 921-8216 (412)-921-7273 (412) 921-8912 (904) 542-6409	Responsible party immediately inform subcontractors, the Navy, and Project Team
Analytical data quality issues	Analytical Laboratory TtNUS Project Chemist	Andrea Colby Mark Traxler	(207) 874-2400 (610)-382-1171	Immediately notify TtNUS Project Chemist Notify Data Validation Staff and TtNUS PM immediately.

SAP Worksheet #7 – Personnel Responsibilities and Qualification's Table
(UFP-QAPP Manual Section 2.4.3)

Name	Title, Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications
Mark Sladic	PM, TtNUS	Oversees financial, schedule, and technical day-to-day management of the project. • Ensures timely resolution of technical, quality, and safety questions associated with TtNUS project-related operations. • Functions as the primary TtNUS interface with the Navy RPM, MCRD, TtNUS field and office personnel, and laboratory points of contact. • Ensures that TtNUS health and safety issues related to this project are communicated effectively to all personnel and off-site laboratory. • Monitors and evaluates all TtNUS subcontractor performance. • Coordinates and oversees work performed by TtNUS field and office technical staff (including data validation, data interpretation, and report preparation). • Coordinates and oversees maintenance of all TtNUS project records. • Coordinates and oversees review of TtNUS project deliverables. • Prepares and issues final TtNUS deliverables to the Navy.	B.S. Mechanical Engineering, 18 years environmental experience
Kelly Carper	NAVFAC SE CLEAN Program QAM and QA Advisor, TtNUS	As QAM is responsible for: • Reviewing the SAP, overseeing preparation of the laboratory scope of work, coordinating with laboratory, and performing data quality reviews. Ensures quality requirements of the TtNUS NAVFAC Southeast CLEAN program are satisfied. • Develops, maintains, and monitors QA policies and procedures. • Provides training to TtNUS staff in QA/Quality Control (QC) policies and procedures. • Conducts systems and performance audits to monitor compliance with environmental regulations, contractual requirements, SAP requirements, and corporate policies and procedures. • Audits project records. • Monitors subcontractor quality controls and records. • Assists in the development of corrective action plans and ensuring correction of non-conformances reported in internal or external audits. • Ensures that this SAP meets TtNUS, Navy, USEPA, and SCDHEC requirements. • Prepares QA reports for management. As Site QA Advisor, is responsible for ensuring that all QA/QC requirements as defined in this SAP are met. Strict adherence to these procedures is critical to the collection of acceptable and representative data. The following is a summary of the Site QA Advisor's responsibilities: • Ensuring that field QC samples are collected at the proper frequencies.	B.S. Biology, 17 years environmental experience

Name	Title, Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications
		• Ensuring that additional volumes of sample are supplied to the analytical laboratory with the proper frequency to accommodate laboratory QA/QC analyses. • Ensuring that measuring and test equipment are calibrated, used, and maintained in accordance with applicable procedures and technical standards. • Acting as liaison between site personnel, laboratory personnel, and the QAM. • Managing bottleware shipments and overseeing field preservation. • Preparing a daily log of all work being performed.	
Mark Traxler	Project Chemist, TtNUS	Coordinates analyses with chemists, ensures the scope is followed, reviews data packages, and communicates with TtNUS staff. • Ensures that the project meets objectives from the standpoint of laboratory performance. • Provides technical advice to the TtNUS team on matters of project chemistry. • Monitors and evaluates subcontractor laboratory performance. • Ensures timely resolution of laboratory-related technical, quality, or other issues affecting project goals. • Functions as the primary interface with the subcontracted laboratory and the TtNUS PM. • Coordinates and oversees work performed by the subcontracted laboratory. • Oversees the completion of TtNUS data validation. • Coordinates and oversees review of laboratory deliverables. • Recommends appropriate laboratory corrective actions.	B.S., Biochemistry, 28 years of environmental experience.
Mike Whitten	Ecological Risk Assessor, TtNUS	Develops the Ecological Risk Assessment (ERA)	M.S. Environmental Science, 18 years of environmental experience
Robert Jupin	Human Health Risk Assessor, TtNUS	Develops the Human Health Risk Assessment (HHRA).	M.S. Environmental Engineering, 28 years environmental experience
Joseph Samchuck	DVM, TtNUS	Manages data validation activities.	B.S. Chemistry, M.S. Finance, 24 years of environmental experience

Name	Title, Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications
TBD by TtNUS Project Manager	SSO, TtNUS	The SSO will be responsible for training and monitoring site conditions. • Controls specific health and safety-related field operations such as personnel decontamination, monitoring of worker heat or cold stress, and distribution of safety equipment. • Conducts and documents a daily health and safety briefing each day while on site. • Ensures that field personnel comply with all procedures established in the HASP. • Identifies assistant SSOs in his/her absence. • Terminates work if an imminent safety hazard, emergency situation, or other potentially dangerous situation is encountered. • Ensures the availability and condition of health and safety monitoring equipment. • Coordinates with FOL and PM to institute and document any necessary HASP modifications. • Ensures that facility personnel and subcontractors are adequately advised and kept clear of potentially contaminated materials.	TBD
TBD by TtNUS Project Manager	FOL, TtNUS	Supervises, coordinates, and performs field sampling activities. • Ensures that all health and safety requirements unique to this project are implemented. • Alerts off-site analytical laboratory of any special health and safety hazards associated with environmental samples. • Functions as the on-site communications link between field staff members, the SSO, MCRD, and TtNUS PM. • Oversees the mobilization and demobilization of all field equipment and subcontractors. • Coordinates and manages the field technical staff. • Adheres to the work schedules provided by the TtNUS PM. • Ensures the proper maintenance of site logbooks, field logbooks, and field recordkeeping. • Initiates FTMRs when necessary. • Identifies and resolves problems in the field via consultation with MCRD, implements and documents corrective action procedures, and provides communication between the field team and project management. For this UFP-SAP, the FOL will also be responsible for SSO duties and Site QA Advisor responsibilities	TBD

Name	Title, Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications
Andrea Colby	Laboratory PM, Katahdin Analytical Services	Coordinates analyses with laboratory chemist, ensures that scope is followed, reviews data packages, communicates with TtNUS staff. • Ensures that methods and project-specific requirements are properly communicated and understood by laboratory personnel. • Ensures that all laboratory resources are available on an as-required basis. • Ensures compliance with analytical and project QA requirements. • Reviews data packages for completeness, clarity, and compliance with project requirements. • Informs the TtNUS PM of project status and any sample receipt or analytical problems. • Oversees the preparation of and approves final analytical reports before submittal to TtNUS.	Available upon request.
Leslie Diamond	Katahdin Analytical QAM	The Katahdin Analytical QAM will reports directly to the Laboratory Operations Manager and will be independent of laboratory production management to ensure that laboratory quality performance is assessed without schedule and cost considerations. Responsibilities of the Laboratory QAO include the following: • Defining appropriate laboratory QA procedures and monitoring overall laboratory QA. • Stopping work if a condition adverse to the quality of work is encountered, if QA/QC procedures are not followed, or if analytical out-of-control events are encountered that have not been corrected. • Approving and maintaining document control of all QA documents and SOPs. • Performing and/or implementing internal system and performance audits and verifying completion of corrective actions cited in audits. • Directing laboratory participation in laboratory accreditation and certification programs. • Reviewing overall data packages and case narratives for completeness according to project requirements and analytical methods.	Available upon request.

SAP Worksheet #8 -- Special Personnel Training Requirements Table
(UFP-QAPP Manual Section 2.4.4)

There are no specialized/non-routine project-specific training requirements or certifications needed by personnel in order to successfully complete the project or tasks associated with the Site RI. Office of the Chief of Naval Operations (OPNAV) Instructions 5090.1 are not considered specialized training; the OPNAV training requirements represent routine minimum requirements that are mandatory for all Navy projects.

All field personnel will have appropriate training to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed a 40-hour course (and 8-hour refresher, if applicable) in health and safety training as described under Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(b)(4). Safety requirements are addressed in greater detail in the TtNUS site-specific HASP.

SAP Worksheet #9 -- Project Scoping Session Participants Sheet
(UFP-QAPP Manual Section 2.5.1)

Project Name: Site 5 RI Projected Date(s) of Sampling: Spring 2009 Project Manager: Mark Sladic	Site Name: Site 5 Site Location: MCRD, Parris Island, South Carolina
Date of Session: August 1, 2008 **Scoping Session Purpose:** DQO Development	

Name	Title, Affiliation	Phone #	E-Mail Address	Project Role
Mark Sladic	PM, TtNUS	(412) 921-8216	mark.sladic@tetratech.com	PM
Tom Johnston	Senior Chemist, TtNUS	(412) 921-8615	tom.johnston@tetratech.com	DQO Facilitator
Kelly Carper	Environmental Scientist, TtNUS	(412) 921-7273	kelly.carper@tetratech.com	QAM
Lauren Gorgol	Engineer I, TtNUS	(412) 921-8268	lauren.gorgol@tetratech.com	Engineering Support
Anna-Marie Christian	Statistician, TtNUS	(412) 921-8351	annamarie.christian@tetratech.com	Development of Worksheet # 11

Comments/Decisions: Team met to discuss list of probable contaminants of concern and sampling boundaries for Site 5. There is not enough information from previous studies to characterize the nature and extent contamination or the ecological and human health risks; therefore further sampling is required.

Action Items: The number of soil and sediment samples will be determined using Visual Sample Plan (VSP) Software.

Consensus Decisions:

- Further sampling for volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and metals will be conducted at Site 5 surface soil, subsurface soil, sediment, and groundwater media because these contaminants were detected at Site 5 during previous investigations.

- The sampling area will consist of the river shoreline where sediments are located, and approximately one acre of land surrounding the former paint shop building where soil and groundwater samples will be collected. Statistical modeling will be used to determine the number of soil and sediment samples required to fully characterize the site according to the risk-based Project Action Limits (PALs).

- For this RI, an unacceptable human health risk is defined as an incremental lifetime cancer risk (ILCR) that is greater than 10^{-4} or a Hazard Quotient (HI) for individual target organs greater than 1.0. An unacceptable ecological risk is defined as a HQ greater than 1.0.

- Possible outcomes of the risk assessment include No Further Action (NFA), Land Use Controls (LUCs), or an FS.

SAP Worksheet #10 – Problem Definition
(UFP-QAPP Manual Section 2.5.2)

10.1 Site Background

Parris Island is located near South Carolina's Atlantic Coast, between the Broad and Beaufort Rivers. The MCRD is located on Parris Island and consists of developed regions containing buildings surrounded by salt marshes. Site 5 is located in the northeastern portion of the MCRD, adjacent to the Beaufort River (Figure 10-1). The closest residential area is approximately 800 feet southwest of Site 5.

Site 5 is a location where dried paint wastes from Structure 177 and nearby structures were reportedly disposed at the edge of the Beaufort River from the 1930s to 1960s (see Figure 10-2). Figures 10-3 through 10-6 are photographs taken on May 6, 2009 to show Site 5 from various angles. Figures 10-3 and 10-4 show the paved areas and a small amount of grass southwest and southeast of Structure 177. A grassy area can also be seen on the right side of Figure 10- 4 (northeast of Structure 177) but most of the area to the north and northeast of Structure 177 is bare. Figures 10-5 and 10-6 show two opposite views of the shoreline along Site 5. In these two figures the gray, rough-surfaced masses on the beach are oyster shells. Figure 10-6 shows a crane in the distance and construction debris along the shoreline. Collectively, the photographs illustrate the industrial nature of Site 5.

While Site 5 was active, the disposal area consisted of bare riverbank adjacent to a dock or wharf. After 1972, marsh land along the river bank at the original Site 5 was filled in with soil, and later with construction debris, extending the shoreline further northeast. This process continues today but it is unclear how much the shoreline has been extended from the original shoreline. Areal photographs showing the progression of the shoreline expansion are not available. Between 1949 and 1960, the MCRD Parris Island Paint Shop was located in Structure 177, which was a prefabricated metal structure situated approximately 150 feet from the bank of the Beaufort River in the northeastern corner of the Depot. Prior to 1949, the Paint Shop was located in several other prefabricated metal structures, all of which were reportedly near Structure 177. Most paints used at the Depot during this time were mixed in tanks at the Paint Shop. The mixtures consisted of white lead (lead hydroxides and carbonates), zinc, and linseed oil. A paint remover consisting of diesel fuel oil or kerosene was used to remove the hardened paint waste from the mixing tanks. The hardened paint scraped from the tanks was reportedly carried to the edge of the Beaufort River and poured down the riverbank. The disposal site, whose exact location is unknown, was located within a small area, approximately 30 feet long and 5 feet wide, located along the riverbank adjacent to a small pump house (see Figure 10-2).

In 1986, the Naval Energy and Environmental Support Activity (NEESA) conducted an IAS under the Naval Assessment and Control of Installation Pollutants (NACIP) Program (NEESA, 1986). The purpose of the IAS (Phase I of the NACIP Program) was to identify potentially contaminated sites at MCRD Parris

Island that may pose a threat to human health or the environment. The IAS concluded that, because of the age and location of the site and the method of disposal, the wastes would likely have been washed from this site into the river and carried away. Much of the soil was also eroded by river currents and storms before the area was filled with construction debris in 1972. Therefore, the study concluded that no wastes were likely to remain at the site and that further migration of contaminants from this site was very unlikely. No investigation of Site 5 was recommended.

In accordance with the requirements of MCRD's application for a RCRA permit, an Interim RCRA Facility Assessment (RFA) was performed from January 1990 to March 1990 (Kearney, 1990). The RFA concluded that, although there was no evidence of a release, RFA Phase II sampling should be performed to confirm that hazardous constituents were not present at the former disposal area.

A Site Investigation/Confirmatory Sampling (SI/CS) investigation was conducted at Site 5 in October, 1999. Sampling locations were selected based on their proximity to the rear door of Structure 177 and because of the observed visual signs of dried paint at the sampled locations. The samples were analyzed for Target Compound List (TCL) VOCs, semivolatile organic compounds (SVOCs), PCBs, pesticides, and Target Analyte List (TAL) metals, and cyanide. The results showed the presence of low levels of VOCs, PAHs, pesticides, and a PCB. Chloroform, benzo(a)pyrene, carbazole, fluoranthene, pyrene, 4,4'-DDT, 4,4'-DDE, and Aroclor 1260 were detected at concentrations greater than USEPA Region 9 Residential-Use and Industrial-Use Soil Preliminary Remediation Goals (2000) and/or USEPA Region 4 Ecological Screening Values (ESVs). Fifteen inorganic chemicals were detected, and 13 of these inorganic chemicals (aluminum, arsenic, barium, chromium, nickel, copper, cadmium, iron, lead, mercury, selenium, vanadium, and zinc) exceeded background concentrations, and/or human health criteria, and/or ecological screening criteria.

During the SI/CS, one sediment sample (PAI-05-SD-03-01) was collected from the Beaufort River 20 feet from the edge of the bank during low tide. The sediment sample was analyzed for TCL VOCs, SVOCs, and TAL metals (total). Low levels of VOCs and PAHs were detected. The indeno(1,2,3-cd)pyrene (a PAH) concentration exceeded the USEPA Region 4 soil ESV and USEPA Region 9 Residential-Use Soil Preliminary Remediation Goal. Twelve inorganic chemicals were detected, and arsenic and iron concentrations exceeded background levels and human health and/or ecological screening criteria.

10.2 Conceptual Site Model

For purposes of developing a Conceptual Site Model (CSM) and completing the RI, the site has been separated into two distinct areas based on the types of impacted media in each area, and on site conditions and current and historical activities (see Figure 10-2).

Area 1 spans approximately 0.7 acres of land from southwest of Structure 177extending northeast up to and including the top of the riverbank, but excludes the soils under the footprint of Structure 177. The topography of this area is relatively flat except for the river bank which has steep grades up to 10 percent. The portion of Area 1 southwest and southeast of Structure 177 is mostly paved.

There is little vegetation in the Area 1. Paint wastes were transported to the riverbank and disposed over the edge of the bank in Area 1. Low levels of contamination that may be associated with paint disposal were found in soil near the top of the riverbank in Area 1 (see Figure 10-2). Based on the knowledge that paint wastes were transported from the Paint Ship to the river bank and that the historical record may be incomplete, paint contamination may also have been released in surface soil surrounding Structure 177. The study area therefore extends southwest of Structure 177. This portion of Site 5 relatively flat and is mostly paved. The pavement was installed after operations in this area had ceased. Most contamination would be expected close to Structure 177, between this structure and the river bank, and on the river bank. Workers are assumed to have taken the shortest path to the river bank when transferring paint wastes for disposal. The shortest path evident in Figure 10-2 may not have been the shortest path 30 or 40 years ago.

Environmental media in Area 1 that are potentially impacted by historical paint waste disposal practices include surface soil, subsurface soil, and groundwater. Groundwater would not have been contaminated directly by paint wastes but contaminants, if present in surface soil, may have flowed into deeper soils through cracks in the surface and may have leached into the groundwater as a result of precipitation infiltration.

Area 2 consists of 150 feet of the river shoreline northeast of Structure 177. Paint wastes were disposed over the riverbank and may have directly contaminated the shoreline sediments in this area. Overland runoff is likely to have washed contaminants down the riverbank into the sediments. Groundwater contaminant migration from Area 1, if present, may also affect groundwater and sediment in Area 2. Little habitat exists for wildlife because the marsh that existed along the riverbank was filled with soil and construction debris after 1972. The presence of construction debris is likely to complicate the determination of source for select contaminants such as metals and some SVOCs. The river shoreline contains depositional sediments at the river's edge. These fine grained sediments are expected to be adsorbers of inorganic and organic contaminants because of the relatively high surface to volume ratio of the sediment particles and also because of potentially high organic content. Low levels of contamination have been found in sediments near the shoreline. Environmental media in Area 2 potentially impacted by historical disposal practices may include groundwater and sediment. The groundwater impacts would be a result of precipitation leaching contaminants into the groundwater from the soils or sediments, or from migration of contaminated groundwater from Area 1.

10.2.1 Soil Composition

There is no subsurface soil information for Site 5. Subsurface soil samples were collected Site 55 in 2002 from DPT/MIP borings for lithologic classification, and also for a Phase II RI for Site 27. Site 55 and 27 are approximately 1.5 miles west of Site 5. Based on the soil borings and MIP information, the soil consists of light brown to tan, fine to very fine sand to a depth of approximately 6 feet bgs. A greenish-gray silty clay was encountered at a depth of approximately 6 to 8 feet bgs. The uppermost clay varies in thickness. Below the uppermost clay is a tan to greenish-gray fine sand with thin discontinuous layers of clay that extends to approximately 24 feet bgs where another greenish-gray clay approximately 2 feet thick was encountered. Below this clay layer was a medium gray, medium to fine sand that extends to approximately 29 feet bgs and was underlain by greenish-gray to blue-gray clay approximately 1.5 - 2 feet thick. This clay was underlain by medium gray fine sand with clayey intervals to approximately 36 feet bgs where another clay layer was encountered. The soil at Site 5 is expected to be similar to the Site 55 and Site 27 soils because of the proximity of Site 5 to those sites.

10.2.2 Hydrogeology

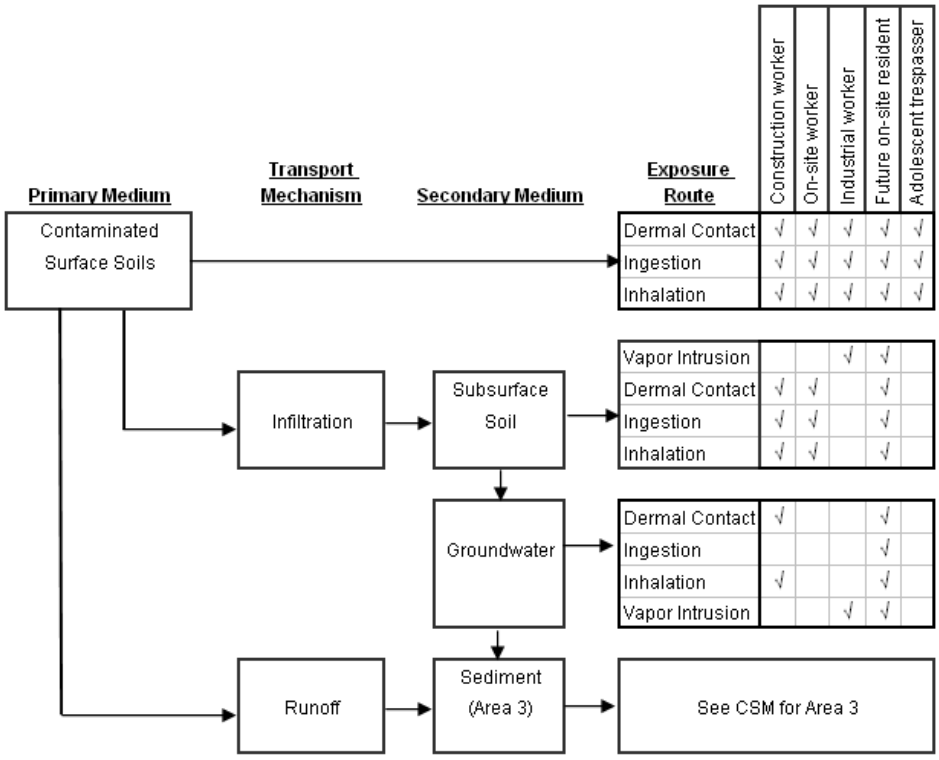
There is no hydrogeologic information for Site 5. However, hydrogeology studies performed at Site 27 are applicable to Site 5. The aquifer of interest at Site 27 and the surrounding area is the surficial aquifer, which is separated from the underlying regional Tertiary Floridan aquifer by the Hawthorn Formation, a confining unit that extends beneath Parris Island. The surfical aquifer discharges to on-site streams and tidal areas within the base. Therefore, contaminants within this unit would discharge to these site streams and tidal areas, which ultimately discharge to the Beaufort and Broad Rivers (see Figure 10-1), which form Port Royal Sound (not shown on figures). The surficial aquifer consists of medium to fine sand with interbeds of silty clay and clay. This aquifer has been investigated to depths of approximately 42 feet bgs in the Site 27 area.

In August 2008, monitoring wells were installed for a Phase II investigation of Site 27. Shallow water levels at the two on-site wells were 0.36 to 0.42 feet higher than the intermediate wells and 4.06 to 5.01 feet higher than the deep wells at these respective locations, indicating a downward hydraulic gradient. These water-level differences suggest that the clay-rich beds between the screened intervals of these wells act to retard vertical groundwater flow. Also, the downward gradients and the site's location on a topographic high suggest that the area is a local recharge area and that the overall groundwater flow pattern at the site may include a downward component of flow. Based on knowledge of typical groundwater flow patterns and the site topography, general groundwater flow at Site 5 is expected to be northeasterly toward the Beaufort River.

10.2.3 Migration Pathways

Area 1

Paint disposed at the riverbank or potentially spilled near Structure 177 could have resulted in surface soil contamination. Chemicals of environmental interest that may be associated with paint waste contamination are VOCs, PAHs, PCBs, and metals. Potentially contaminated surface soil in Area 1 could impact sediment in Area 2 through runoff and erosion during precipitation. Potentially contaminated surface soil in Area 1 could also affect subsurface soil and groundwater by infiltration. Migrating groundwater impacted by subsurface soil near Structure 177 could further impact downgradient subsurface soil. Because it is likely that groundwater from Area 1 discharges to the river, groundwater and sediment in Area 2 may also be impacted by contaminated groundwater migrating from Area 1. The contaminant migration routes and exposure scenarios in Area 1 are depicted on the figure and in the text below:



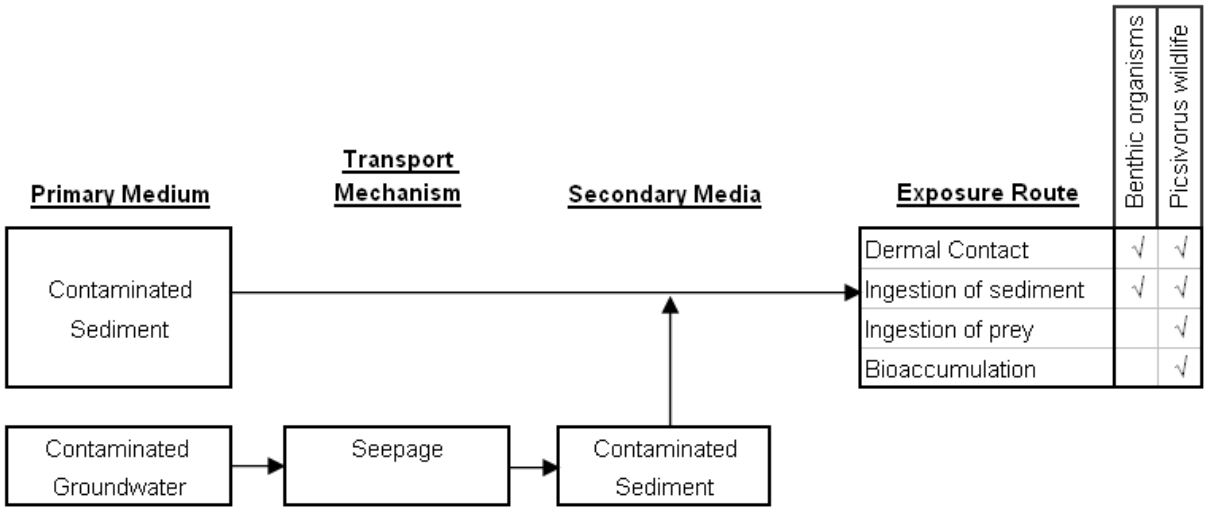
The exposure scenarios for Area 1 are that of a typical commercial site. Potential current human receptors include construction workers exposed during development activities such as excavation at the site, on-site workers such as maintenance or utility workers, and industrial workers such as those employed at the businesses at the MRCD. Although future residential development is not planned at Area 1, a hypothetical future resident will be evaluated to determine whether LUCs are necessary to prohibit this future use. These receptors could be exposed to surface soil (via dermal contact, ingestion,

or inhalation), subsurface soil (via vapor intrusion into buildings, dermal contact, ingestion, inhalation), and groundwater (dermal contact, ingestion, inhalation, vapor intrusion). Area 1 consists largely of buildings, structures, and parking lots, and has very little vegetation; therefore, the exposure pathway for terrestrial receptors is incomplete because the site provides essentially no habitat for terrestrial receptors. For this reason, an assessment of ecological risk will not be conducted for Area 1. A further description of potential human receptors and exposure routes is provided in the HHRA methodology in Appendix A.

Because the soil in the strip of land southwest of Structure 177 is covered by pavement, infiltration and potential contamination of subsurface soil and groundwater in this strip is limited. If paint was historically spilled on surface soil prior to paving, contaminants could have migrated to subsurface soils and groundwater through infiltration, and eventually impacted downgradient groundwater and subsurface soil in this strip, as well as groundwater and sediment in Area 2. .If releases of paint related wastes occurred west and northwest of Structure 177 the locations closest to the building are the most likely to have been contaminated because the wastes. All records of paint waste disposal indicate that the releases occurred northeast of Structure 17 at the river bank.

Area 2

Sediment contamination in Area 2 could have resulted from paint disposal at the riverbank. Sediment and groundwater in Area 2 could be impacted from contaminant migration from Area 1, as described above. Chemicals of environmental interest that may be associated with paint waste contamination are VOCs, PAHs, PCBs, and metals. Due to the high volume flow of the Beaufort River and low contaminant concentrations detected in sediment during previous investigations, surface water contamination from site-related sediment contamination is expected to be negligible. The exposure scenarios of potential receptors at Area 2 are described below.



Human receptors are not expected to come in contact with sediment at Area 2 due to the steep grade of the riverbank and use of the site being limited to commercial activities. Due to these factors, the exposure pathway for human contact to contaminated sediments at Area 2 is not complete and human health risk swill not be evaluated. The primary ecological receptors at Site 5 are benthic organisms, which are defined as invertebrates that live in or on sediment. These organisms would be exposed to contaminated sediments through dermal contact and ingestion of sediment. Area 2 does not provide a suitable habitat for most wildlife due to the proximity of MCRD buildings and lack of marshes and vegetation. However, piscivorous wildlife that forages along the shoreline at Site 5 could be exposed to contaminants from Site 5. The term "piscivorous" includes birds and mammals that prey on fish and also a variety of crustaceans and mollusks. Piscivorous wildlife would be exposed to contaminated sediment through ingestion of sediment, dermal contact with sediment, and ingestion of contaminated prey (benthic organisms) and subsequent bioaccumulation through the food chain. Benthic organisms and piscivorous wildlife are not expected to come in direct contact with groundwater in Area 2 but could be affected by groundwater seepage to sediment. A further description of potential ecological receptors and exposure routes is provided in the ERA methodology in Appendix B.

10.2.4 Cultural Resources

There are no known cultural resources affected by Site 5.

10.3 Problem Definition

Previous investigations determined that low levels of contaminated soil and sediment were present at Site 5 near the riverbank and shoreline. The contaminants are reportedly associated with releases of paint related wastes. The releases reportedly occurred at the river bank northeast of Structure 177, but may also have occurred in other areas around Structure 177. The number and locations of previously collected samples were not enough to fully characterize the nature and extent of contamination at Site 5. An RI must be conducted to determine the nature and extent of contamination in soil and groundwater surrounding Structure 177 (Area 1), the top of the riverbank (Area 1), and shoreline sediments (Area 2). An HHRA for Area 1, and an ERA for Area 2 must be conducted as part of this RI to determine whether unacceptable risks to human and ecological receptors exist at Site 5

Figure 10-1

Figure 10-2

Figure 10-3. View along southwest edge of Structure 177 looking northwest.

Figure 10-4. View along southeast edge of Structure 177 looking north.

Figure 10-5. View along Site 5 shoreline looking northwest.

Figure 10-6. View along Site 5 shoreline looking northwest.

SAP Worksheet #11 -- Project Quality Objectives/Systematic Planning Process Statements

(UFP-QAPP Manual Section 2.6.1)

The section below describe the data quality objectives developed for this project after the problem definition was established.

11.1 Identification of Study Goals

Decision Statement #1 (Areas 1 and 2): Determine whether the extent of Site 5 contamination has been adequately delineated within Area 1 and Area 2 at Site 5. If the extent of contamination is adequately bounded, then discontinue delineation. If the extent of contamination is not fully delineated, identify risk-driving chemicals for the risk assessment and continue data collection to delineate them.

Decision Statement #2 (Area 1): Determine whether human health risk in Area 1 is unacceptable in accordance with the protocol described in Appendix A. An unacceptable human health risk is defined as an ILCR greater than $1x10^{-4}$, or a HI for individual target organs that is greater than 1.0. If there are unacceptable human health risks in Area 1, then conduct an FS to select the most effective remediation approach. If there are no unacceptable human health risks in Areas 1, then NFA for those areas will be recommended based on human health risk.

Decision Statement #3 (Area 2): Determine whether ecological risk in Area 2 is unacceptable in accordance with the protocol described in Appendix B. Ecological HQs greater than 1.0 indicate that ecological receptors are potentially at risk. If there are no ecological risks, recommend NFA in Area 2 based on ecological risk. If there are unacceptable ecological risks at Area 2, then the project team will convene to determine whether remedial action is appropriate based on an evaluation of the entire site.

11.2 Information Inputs

To meet the study goals of the RI, the following physical and chemical data was or will be collected at Site 5:

- Site documents and historical information were used to determine the Site and area boundaries, and the possible sources of contamination within Areas 1 and 2 (see Worksheet #13).

- Based on the history of Site 5 and results of previous studies, soil, groundwater, and sediment will be analyzed for TCL VOCs, PAHs, PCBs, and TAL metals. The sampling methods are presented in Worksheet #18, and the analytical methods are presented in Worksheet #19 and Appendix D.

- Basewide background data for inorganic chemicals, organic chemicals, and pesticides were collected in 1999 by TtNUS for the Site 3 Parris Island RFI. This background data set will be used to determine whether elevated chemical concentrations are due to natural conditions at Parris Island MCRD, or are related to paint disposal or other activities at Site 5.

- Groundwater field parameters including dissolved oxygen, conductivity, pH, temperature, turbidity, and oxidation-reduction potential will be collected. This information will assist with site characterization, and when combined with chemical soil and groundwater data, will assist in understanding the nature and extent of site contamination. These groundwater measurements will be used to determine when groundwater samples are representative of the groundwater being investigated. Standard field screening SOP (see SA-1.1 in Appendix C) will be used for collecting these data.

- Photoionization detector (PID) data from screening of subsurface soil samples will be used to determine soil intervals with the highest concentrations of organic chemicals. Visual screening of DPT cores will also be used to determine whether signs of paint contamination exists. Standard field screening SOP (SA-1.3 in Appendix C) will be used.

- Physical measurements for groundwater migration analysis will include groundwater levels, hydraulic conductivity by aquifer testing (rising and falling head slug tests), and grain size and porosity from select samples in the water-bearing zone (ASTM D422). See Worksheet #14.

Project Action Limits

PALs for risk assessment are the limits are te ILCR, HI, and HQ values identified in Section 11.1.. The RI soil, groundwater, and sediment analytical data will be compared to site-specific screening values (SVs) (see Worksheet #15) when determining the extent of contamination and when selecting chemicals of potential concern for the risk assessments.. The soil and groundwater SVs were set at the lowest matrix-specific, risk-based, or regulatory screening criteria appropriate for the site. USEPA Region 4 ESVs are the ecological screening criteria for sediment. For chemicals that do not have an ESV, other applicable criteria were used. For chemicals that do not have applicable soil or sediment screening criteria, background concentrations from the basewide background dataset developed during the Site 3 RFI were used as SVs. The complete list of applicable screening values and derivation of SVs is provided in Appendix E. The SVs for this investigation are as follows:

Soil

- USEPA, 2008a. Regional Soil Screening Levels for Chemical Contaminants at Superfund Sites developed by Oak Ridge National Laboratory (ORNL) - Residential Use.
- USEPA, 1996. Soil Screening Guidance: User's Guide.

Groundwater

- USEPA. 2006 Edition of the Drinking Water Standards and Health Advisories, Maximum Contaminant Levels (MCLs) for Inorganics and Organics.

- USEPA, 2008a. Regional Screening Values for Chemical Contaminants at Superfund Sites- Tap Water (developed by ORNL).

Sediment

- USEPA, 2001a. Region 4 Ecological Risk Assessment Bulletins – Supplement to RAGS.
- USEPA, 2006b. Region 3 Freshwater Sediment Screening Benchmarks.
- USEPA, 2006c. Region 3 Marine Sediment Screening Benchmarks.

Background Values

- TtNUS, 1999. Parris Island Site 3 Causeway Landfill Background Study. These values will be used to delineate metal, PAH, ad pesticide contamination and to select COPCs for risk assessment by comparing individual results from Site 5 samples to the tabulated background value.

To conduct comparisons of site data to screening values for soil, sediment, and groundwater, the selected laboratory must be able to achieve quantitation limits that are low enough to measure constituent concentrations less than the SVs. In cases where the where the SV is between the method detection limit (MDL) and project quantitation limit (PQL), the project team will accept these analytical results for risk assessment and/or delineation purposes as long as the results are "J" qualified. When the SV is less than the MDL for a particular analyte or analytes, an evaluation of detection limits will be included in the uncertainty section of the risk assessment. In some cases, there are no applicable screening criteria for a specific chemical. In these instances, the background value will be used as a screening value, or if there is no background value, the chemicals will be addressed in the uncertainty section of the risk assessment.

11.3 Study Boundaries

Area 1 is approximately 0.7 acre and consists of the land in between Structure 177 and the top of the riverbank. This area includes 170 feet along the southwestern wall of Structure 177, up to and including the top of the riverbank. Area 1 does not include areas beneath buildings because it is unlikely that contamination is present under building foundations because reported disposal practices were to dispose of wastes at the riverbank. The media of interest in Area 1 are soil and groundwater. Surface and subsurface soil data will be collected from depths of 0 to 2 feet bgs and 2 feet bgs to the water table, respectively. Groundwater data will be collected across the water table, which is approximately 5 to 6 feet bgs based on hydrogeology investigations at Site 55, which is 1.5 miles west of Site 5. The targeted groundwater population is the depth interval representing the top of the water table and associated smear zone. This is the depth at which light non-aqueous liquids such as paint thinners would tend to accumulate.

Area 2 consists of the 150 feet of the river shoreline northeast of Structure 177. Low levels of contamination were found at the top of the riverbank above the center of Area 2. Area 2 boundaries have been extended along the shoreline northwest and southeast from the location where contamination was found at the top of the riverbank in Area 1. Area 2 only includes the shoreline sediments closest to the riverbank, where the river is shallow and any contamination that may be present is most likely from historical paint disposal. The medium of interest in Area 2 is sediment. The vertical boundary is defined as 0 to 4 inches bgs. This is the depth where ecological receptors are at risk and contaminants were detected in previous investigations.

11.4 Analytic Approach

Specific decision rules were developed from Decision Statements #1 through #3. These rules, which clarify how the data will be used to render decisions, are presented below.

Decision Rule #1: Nature and Extent of Contamination (Applies to Areas 1 and 2)

The extent of contamination in Area 1 will be determined through comparison of concentrations on the outer edges of the sampling patterns to SVs and also by reviewing concentration patterns to assess whether areas of contamination can be enclosed with a concentration boundary separating the contamination area on the inside of a closed polygon from uncontaminated area(s) outside the polygon. For Area 2, the extent of contamination will be defined only along the shoreline closest to the riverbank and will not extend away from the shoreline into the deep river sediments where off-site contamination may exist. The extent of contamination will be determined through comparison of concentrations along the northwestern and southeastern edges of Area 2 to screening values (SVs) and reviewing concentrations patterns to assess whether area of contaminated shoreline can be enclosed with a concentration boundary separating the contaminated shoreline on the inside of a closed polygon from the

uncontaminated shoreline outside the polygon. This judgment will be based on experience of the TtNUS Project Manager and will be reviewed by the project team. If elevated levels of contaminants are not fully delineated in Areas 1 and 2 shoreline, risk-driving chemicals will be identified in accordance with Decision Rules 2 and 3, and will be delineated as part of appropriate remedial actions. This will prevent multiple mobilizations during this project.

Decision Rule #2: Human Health Risk Assessment **(Applies to Area 1)**

In accordance with the protocol presented in Appendix A, a chemical detected in soil will be selected as a human health constituent of potential concern (COPC) if any detected concentration exceeds the screening level for soil and the concentration is greater than two times the arithmetic average background concentration from the Site 3 Background Study (TtNUS 1999). If a chemical does not have a screening level but was detected at a concentration exceeding two times the arithmetic average background level, the chemical will be selected as a COPC. There are no studies available that establish groundwater background levels for Site 5. Therefore, a chemical detected in groundwater will be selected as a constituent of potential concern (COPC) if any detected concentration exceeds the screening level and upgradient concentration for groundwater.

The 95-percent upper confidence limit (UCL) of the mean of the data for soil in Area 1 will be used as an estimate of the exposure point concentration (EPC) for each COPC. UCLs will be calculated using USEPA's ProUCL Version 4.00.02 software (2007b). If the UCL is greater than the maximum detected concentration for soil, the maximum detected concentration will represent the exposure point concentration (EPC). EPCs for groundwater will be the arithmetic average of the concentrations detected in permanent wells at the site.

Non-carcinogenic risk estimates will be presented in the form of HIs, and lifetime cancer risks will be expressed as ILCRs. If the cumulative ILCR for the reasonable maximum exposure (RME) residential scenario is less than or equal to 1×10^{-4} and the HI for individual target organs is less than or equal to 1.0 for residential receptors, NFA will be recommended. However, if the cumulative ILCR is greater than $1 X 10^{-4}$ or the HI for individual target organ effects is greater than 1.0, the risk assessment exposure scenarios will be refined based on site-specific conditions. If the cumulative ILCR and HI for individual target organ effects for the revised risk assessment are both less than 1×10^{-4} and 1.0, respectively, LUCs will be recommended. If the ILCR and the HI for individual target organs is greater than 1×10^{-4} or 1.0, respectively for the revised risk assessment, then an FS will be required to determine the appropriate remedial action for Site 5. Figure 11-1 shows this logic in a flow diagram.

Decision Rule #3: Ecological Risk Assessment **(Applies to Area 2)**

The maximum detected concentrations of contaminants in sediment will be compared to screening concentrations to determine COPCs. Ecological risk estimates will be presented in the form of HQs. An

HQ greater than 1.0 indicates that ecological receptors are potentially at risk. Due to the conservative nature of USEPA Region 4 ESVs, sediment concentrations of one or more chemicals will probably exceed their respective ESVs, indicating a potential for adverse ecological effects. Therefore, it is anticipated that the ERA will involve a refinement of the conservative exposure assumptions to more realistically estimate potential risks to ecological receptors. This refinement will include toxicological evaluation of COPCs, spatial distribution of contaminants, frequency of detection, and habitat quality. Sediment background concentrations from the Site 3 RFI Background Study will also be considered during the refinement process.

If there are no unacceptable ecological risks after the refinement process, NFA will be recommended. However, if there are unacceptable ecological risks after the refinement process, then the project team will evaluate whether remedial action is appropriate for Site 5. The project team will consider the extent of contamination and the magnitude of contaminant concentrations when making this determination. The tendency will be to remediate for large areas of contamination or very high levels of contamination but not to remediate for low levels of contamination limited to small areas. The general cost benefit of potential disruption to site operations, destruction of ecological habitat, and other such factors will also be considered with emphasis on taking remedial action only if there is a significant perceived benefit at reasonable costs.

11.5 Performance or Acceptance Criteria

The delineation of contaminants will be considered complete if concentration trends within a particular environmental medium decrease with distance from apparent source areas, contaminated areas can be enclosed within a concentration boundary separating the contamination area on the inside of a closed polygon from uncontaminated area(s) outside the polygon, and no anomalous spatial concentration patterns are present that suggest incomplete delineation of a significant contaminant source. For this type of determination, visual inspection of data patterns is required and statistical analysis will be of limited value, especially for soils because contamination at one soil location may be unrelated to contamination in another location. Therefore, the project team decided to use the approach described below for the risk assessment to determine the required number of samples with an expectation that use of a spatial grid would ensure that samples could be spatially distributed in a way that would support the delineation of contamination.

For the risk assessment portion of this plan, a statistical approach was used to determine an appropriate number of samples to collect. The sample size was calculated using Visual Sampling Plan (VSP) software (Version 5.1) to determine whether site conditions are greater than or less than PALs. This software, developed by EPA, relies on:

- Alpha and Beta decision error limits developed by the project team,
- a related level called the gray region boundary, which was also established by the team
- the selected action levels
- an estimate of the variability to be expected in the data,

The first step was to agree that each area to be sampled would be assumed to exceed the PAL unless a sufficient data set demonstrated otherwise. This posture helps to ensures that the human health is protected against accidentally overlooking an environmentally hazardous site. With this assumption in place, a false rejection decision error (Alpha) corresponds to the chance that a site with existing concentrations equal to or greater than the PAL will be released as clean to the public. A false acceptance decision error (Beta) corresponds to the chance that a site with existing concentrations equal to or less than the lower bound of the gray region will be condemned as dirty. The former decision error was considered to be more egregious than the latter because it represents a failure to identify an actual unacceptable environmental condition. Upon consideration of the consequences of making the two types of decision errors, the project team decided that the ideal false rejection decision error limit would be 0.25 (25%) and the ideal false acceptance decision error limit would be 0.30 (30%).. The requisite gray region boundary (see Appendix G for details) was set to be 80 percent of the PAL. This value is a commonly used gray region boundary value. Data variability was estimated as described in appendix G.2.6. The derivation of these decision performance specifications and the actual samples size calculations are provided in more detail in Appendix G

11.6 Plan Development for Obtaining Data

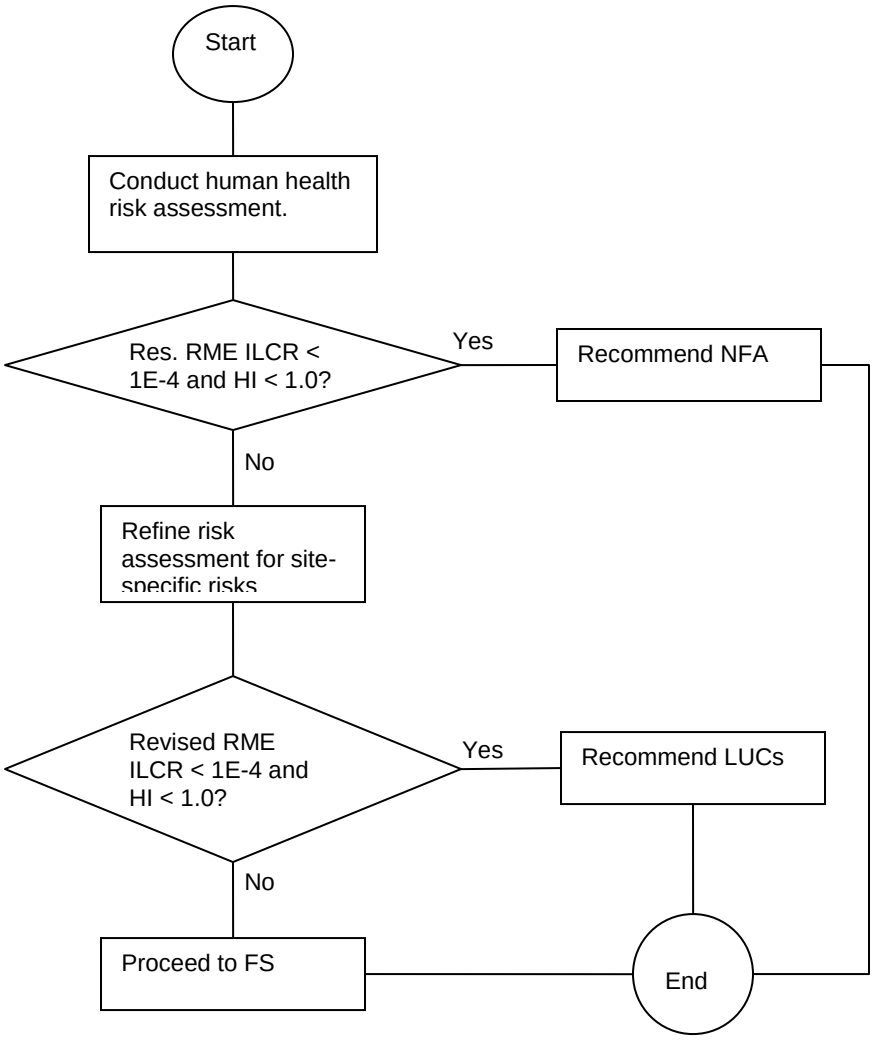
Area 1 — Allocation of sampling locations for Area 1 was based on a triangular grid with random starting point (See Worksheet #17). This type of grid design ensures that samples are spaced uniformly across the sampled area thus obtaining comprehensive spatial coverage of the area without biasing the orientation of the grid.. This design is well suited to delineation of contamination and for supporting risk assessments because it allows concentration gradients to be established with a relatively few number of samples ad it mimics the exposure potential of typical receptors exposed to soils. The primary limitation is on how finely the areas of contamination must be delineated. The greater the spatial resolution required, the greater the number of samples required. The computed number of samples ranged from five to eight, so eight was the minimum number of samples required to be collected in Area 1 and Area 2.

To help delineate contamination in Area 1, two additional sampling locations were selected near where paint wastes were previously identified along the shore. These additional locations will help bound the extent of previously identified contamination. Surface and subsurface soil samples will be sampled at each of the 10 sampling locations.

The project team felt that the relatively small size of Area 1 would not require a large number of groundwater wells to determine whether an impact from the site is significant. Three permanent groundwater wells will be drilled and sampled in Area 1; one placed in between Structure 177 and the riverbank, one adjacent to the riverbank, and one near the western corner of Area 1. The placement of these wells was chosen to provide the greatest likelihood of detecting groundwater contamination if it is present and to provide a triangular configuration suited to establishing groundwater flow direction. This type of biased sampling design limits the number of wells necessary to determine whether groundwater contamination exists. It supports a conservative estimate of risks and, given the relatively small size and limited potential for detecting groundwater contamination, was considered sufficient to support all project objectives. Groundwater quality parameters will be measured to ensure groundwater conditions are stable and samples are representative of the aquifer before samples are collected. Hydraulic testing will be performed to establish groundwater seepage velocity and flow direction. Well screens will be installed across the water table. In addition, a minimum of three wells is necessary to calculate groundwater flow direction.

Area 2 — To obtain adequate coverage across all of Area 2, sediment samples will be collected from eight sampling locations based on a randomized sampling strategy. Sample locations were determined using VSP software to find the minimum samples to determine whether the site will require cleanup based the exposure risk to human receptors. Maximum sample depth will be 4 inches below sediment surface.

FIGURE 11-1. LOGIC DIAGRAM FOR HUMAN HEALTH RISK ASSESSMENT



FS = Feasibility Study
HI = Hazard index
ILCR = incremental lifetime cancer risk
NFA = No further action
Res. = Residential
RME = Reasonable maximum exposure scenario

SAP Worksheet #12 -- Measurement Performance Criteria Table Field Quality Control Sample – All Fractions
(UFP-QAPP Manual Section 2.6.2)

Quality Control Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	Quality Control Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Blank	All Fractions	One per source water.	Bias/Contamination	No target analytes greater than the quantitation limit (QL) with the exception of common laboratory contaminants.	S&A
Trip Blank	VOCs	One per cooler containing VOC samples.	Bias/Contamination	No target analytes greater than the QL with the exception of common laboratory contaminants.	S&A
Field Duplicate	All Fractions	One per 10 field samples collected.	Precision	Aqueous samples Relative Percent Difference (RPD) of 30; Solid samples RPD of 50(1).	S
Cooler Temperature Blank	All Fractions	One per cooler.	Accuracy/ Representativeness	Between 2 and 6 degrees Celsius (°C).	S&A

1 If duplicate values are greater than 5 times the QL, the absolute difference of the duplicate values must be greater than the QL.

SAP Worksheet #13 -- Secondary Data Criteria and Limitations Table
(UFP-QAPP Manual Section 2.7)

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
Site historical information	NEESA, IAS report, 1986	NEESA, backgrond information, prior to 1985	Background information was included in the planning of the RI.	No chemical data were collected in the IAS. Site history useful without change,
Characterization data for inorganic and organic chemicals in soil and sediment	Brown & Root Environmental, 1995	Characterization data for soil and sediment.	Characterization data (fully validated) used to determine the number of soil and sediment samples.	Data will not be pooled with new data.
Characterization data for inorganic and organic chemicals in soil and sediment	TtNUS, Site inspection Ci/CS Report for mulitple sites 4, 5, 7, 9, 13C, 16, and SWMUs 27, and 35, Feb., 2001	TtNUS, characterization data for soil and sediment.,Oct 1999, Dec. 1999, and Aug. 2000.	Characterization data (fully validated) used to determine the number of soil and sediment samples.	Data will not be pooled with new data.
Background values for soil and sediment representing all of MCRD Parris Island	TtNUS, RFI for Site/SMWU 3, Nov., 1999	TtNUS, characterization datafor soil and sediment	Soil and sediment concentrations will be compared to background levels to help determine if detected contaminants are due to background conditions or site-specific contamination.	None, the data were fully validated.

SAP Worksheet #14 -- Summary of Project Tasks
(UFP-QAPP Manual Section 2.8.1)

The field tasks are summarized below. A short description of these tasks is also provided. All data recording and management procedures are described in Worksheet #29.

- Mobilization/demobilization
- Site-specific health and safety training
- Utility clearance/digging permit acquisition
- Monitoring equipment calibration
- DPT boring
- Sediment sampling
- Drilling and installation of groundwater wells
- Groundwater well development
- Synoptic water-level measurements
- Collection of groundwater samples
- Hydraulic groundwater testing
- Investigation derived waste (IDW) management
- Land surveying
- Field decontamination procedures
- Field documentation procedures
- Sample custody and shipment tasks
- Restoration of disturbed areas.

Mobilization/demobilization

Mobilization shall consist of the delivery of all equipment, materials, and supplies to the site, the complete assembly in satisfactory working order of all such equipment at the site, and the satisfactory storage at the site of all such materials and supplies. TtNUS will coordinate with the base to identify locations for the storage of equipment and supplies.

Demobilization will consist of the prompt and timely removal of all equipment, materials, and supplies from the site following completion of the work. Demobilization will also includes the cleanup and removal of waste generated during the conduct of the investigation.

Site-specific Health and Safety Training

There are no specialized/non-routine project-specific training requirements or certifications needed by personnel to successfully complete the project. All field personnel will have appropriate training to

conduct the field activities to which they are assigned. Each site worker will be required to have completed the OSHA 40-hour course (and 8-hour refresher, if applicable) in health and safety training. Safety requirements are addressed in greater detail in the site-specific TtNUS Health and Safety Plan (HASP).

Utility Clearance/digging permit acquisition

Potential underground utilities will be located and marked after a review of property maps and surface indications of utilities. See SOP HS-1.0 in Appendix C for conducting subsurface soil investigations for further information. Digging permits will be obtained prior to conducting intrusive activities.

Monitoring Equipment Calibration

These procedures are described in Worksheet #22.

DPT Boring

A total of 10 surface and 10 subsurface soil samples will be collected using a DPT rig. The soil will be described by the site geologist and will be screened for evidence of contamination with a PID. Any visual signs of potential paint contamination will be noted. The methodology for sample collection is described in SOP SA-2.5 in Appendix C. All borings will be logged in accordance with SOP GH-1.5. The sample numbering scheme will be in accordance with SOP CT-04. Methods for recording data are included in SOP SA-6.3.

Sediment Sampling

A total of eight sediment samples will be collected using a scoop and trowel. The methods for sediment sampling are described in SOP SA-1.2.

Drilling and Installation of Groundwater Wells

Selected soil borings will be converted into permanent wells in accordance with SOP GH-2.8 in Appendix C.

Groundwater Well Development

Prior to sampling, the new wells will be developed to remove fine-grained materials. Well development procedures are described in SOP GH-2.8 in Appendix C.

Synoptic Water-Level Measurements

Water level measurements will be collected according to SOP GH-1.2 is Appendix C.

Groundwater Sampling

A total of three groundwater samples will be collected from permanent wells. Wells will only be installed in Area 1 where a flat stable surface exists. Groundwater samples will be collected in accordance with

SOP SA-1.1. The sample numbering scheme will be in accordance with SOP CT-04. Methods for recording data are included in SOP SA-6.3.

Hydraulic Testing

Rising-and falling-slug tests will be used to determine the hydraulic conductivity of the aquifer. SOP GH-2.4 describes the procedures for hydraulic conductivity testing.

Investigation-Derived Waste Management

IDW will be containerized by TtNUS in Department of Transportation (DOT)-approved (DOT specification 17C) 55-gallon drums and stored in a centralized location.

Under oversight by TtNUS, the drilling subcontractor(s) will be responsible for providing, filling, sealing, and moving the drums to a centralized area specified by the base point of contact during mobilization. The drums must be generally clean prior to moving to the centralized storage area, and will be labeled by TtNUS as soon as possible after they are filled. The drums shall be arranged into rows by the drilling subcontractor(s) (no more than two drums deep) by liquids, solids, and contaminated personal protective equipment (PPE) for easy access.

Land surveying

A Global Positioning System (GPS) survey will be used to locate all sampling points.

Field Decontamination Procedure

Sample containers will be provided certified clean from the analytical laboratory. Decontamination of sampling equipment will be conducted prior to and between sampling at each location. At each site, an abbreviated decontamination procedure consisting of a soapy water (laboratory-grade detergent) rinse followed by a deionized water rinse will be performed. However, if free product is encountered, a more elaborate decontamination of equipment will be conducted in accordance with TtNUS SOP SA-7.1.

Field Documentation Procedures

Field documentation will be performed in accordance with SOP SA-6.3 presented in Appendix C.

A summary of all field activities will be properly recorded in a bound logbook with consecutively number pages that cannot be removed. Logbooks will be assigned to field personnel and will be stored in a secured area on base when not in use.

At a minimum, the following information will be recorded in the site logbook:

- Name of the person to whom the logbook is assigned.
- Project name.
- Project start date.
- Names and responsibilities of on-site project personnel including subcontractor personnel.
- Names, affiliations, and arrival/departure times of site visitors.
- Descriptions and arrival/departure times of on-site equipment.
- Sampling activity information and sample log sheet references.
- Descriptions of subcontractor activities.
- Sample pick-up information including Chain-of-Custody form numbers and air bill numbers, carrier, time, and date.
- Description of borehole and monitoring well installation activities and operations.
- Health and safety issues.
- Description of photographs including date, time, photographer, picture number, location, and compass direction of photograph.

All entries will be written in ink, and no erasures will be made. If an incorrect entry is made, striking a single line through the incorrect information will make the correction; the person making the correction will initial and date the change.

Sample custody and shipment tasks

Data management and sample tracking procedures are included in SOP CT-05 in Appendix C.

Restoration of disturbed areas.

During well installation and other field activities soil, pavement, and other site features may be disturbed or damaged. It will b necessary to restore these features to their original condition as near to their original condition as feasible. Grass may need to be planted in disturbed soil after it is regarded and pavement may need to be patched.

SAP Worksheet #15 -- Reference Limits and Evaluation Table
(UFP-QAPP Manual Section 2.8.1)

Matrix: Soil
Analytical Group: TAL Metals

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal[2] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
Aluminum	7429-90-5	77000	Residential SSL	30	30	2.2
Antimony	7440-36-0	31	Residential SSL	0.80	0.80	0.056
Arsenic	7440-38-2	0.39	Residential SSL	0.39	8.0	0.27
Barium	7440-39-3	15000	Residential SSL	0.50	0.50	0.031
Beryllium	7440-41-7	160	Residential SSL	0.50	0.50	0.012
Cadmium	7440-43-9	70	Residential SSL	1.0	1.0	0.0080
Calcium	7440-70-2	766	PI Background Value	5.0	5.0	3.0
Chromium	7440-47-3	6.2	PI Background Value	1.5	1.5	0.046
Cobalt	7440-48-4	0.36	PI Background Value	3.0	3.0	0.027
Copper	7440-50-8	3100	Residential SSL	2.5	2.5	0.13
Iron	7439-89-6	55000	Residential SSL	10	10	0.60
Lead	7439-92-1	400	Residential SSL	0.5	0.5	0.12
Magnesium	7439-95-4	515	PI Background Value	5.0	5.0	1.1
Manganese	7439-96-5	1800	Residential SSL	0.5	0.5	0.2
Mercury	7439-97-6	6.7	Residential SSL	0.040	0.040	0.0024
Nickel	7440-02-0	1600	Residential SSL	4.0	4.0	0.013
Potassium	7440-09-7	313	PI Background Value	100	100	3.7
Selenium	7782-49-2	390	Residential SSL	1.0	1.0	0.38
Silver	7440-22-4	390	Residential SSL	1.5	1.5	0.068
Sodium	7440-23-5	241	PI Background Value	100	100	2.2
Thallium	7440-28-0	5.1	Residential SSL	1.5	1.5	0.064

Vanadium	7440-62-2	550	Residential SSL	2.5	2.5	0.032
Zinc	7440-66-6	23000	Residential SSL	2.5	2.5	0.17

Matrix: Soil
Analytical Group: PAHs

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
Acenaphthene	83-32-9	3400	Residential SSL	0.020	0.020	0.0015
Acenaphthylene	208-96-8	NV	NA	0.020	0.020	0.0012
Anthracene	120-12-7	17000	Residential SSL	0.020	0.020	0.0012
Benzo(a)anthracene	56-55-3	0.15	Residential SSL	0.020	0.020	0.0019
Benzo(a)pyrene	50-32-8	0.015	Residential SSL	0.015	0.020	0.0033
Benzo(b)fluoranthene	205-99-2	0.15	Residential SSL	0.020	0.020	0.0024
Benzo(g,h,i)perylene	191-24-2	NV	NA	0.020	0.020	0.0020
Benzo(k)fluoranthene	207-08-9	1.5	Residential SSL	0.020	0.020	0.0031
Chrysene	218-01-9	15	Residential SSL	0.020	0.020	0.0017
Dibenzo(a,h)anthracene	53-70-3	0.015	Residential SSL	0.015	0.020	0.0018
Fluoranthene	206-44-0	2300	Residential SSL	0.020	0.020	0.0018
Fluorene	86-73-7	2300	Residential SSL	0.020	0.020	0.0032
Indeno(1,2,3-cd)pyrene	193-39-5	0.15	Residential SSL	0.020	0.020	0.0019
2-Methylnaphthalene	91-57-6	310	Residential SSL	0.020	0.020	0.0022
Naphthalene	91-20-3	3.9	Residential SSL	0.020	0.020	0.0026
Phenanthrene	85-01-8	NV	NA	0.020	0.020	0.0018
Pyrene	129-00-0	1700	Residential SSL	0.020	0.020	0.0021

Matrix: Soil
Analytical Group: TCL Volatiles

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
Acetone	67-64-1	61000	Residential SSL	0.025	0.025	0.01097
Benzene	71-43-2	1.1	Residential SSL	0.005	0.005	0.00153
Bromodichloromethane	75-27-4	10	Residential SSL	0.005	0.005	0.00163
Bromoform	75-25-2	61	Residential SSL	0.005	0.005	0.00116
Bromomethane	74-83-9	7.9	Residential SSL	0.010	0.010	0.00227
2-Butanone	78-93-3	28000	Residential SSL	0.025	0.025	0.00948
Carbon disulfide	75-15-0	670	Residential SSL	0.005	0.005	0.00188
Carbon tetrachloride	56-23-5	0.25	Residential SSL	0.005	0.005	0.00144
Chlorobenzene	108-90-7	310	Residential SSL	0.005	0.005	0.00151
Chloroethane	75-00-3	15000	Residential SSL	0.010	0.010	0.00193
Chloroform	67-66-3	0.30	Residential SSL	0.005	0.005	0.00181
Chloromethane	74-87-3	1.7	Residential SSL	0.010	0.010	0.00192
Cyclohexane	110-82-7	7200	Residential SSL	0.005	0.005	0.00117
Dibromochloromethane	124-48-1	5.8	Residential SSL	0.005	0.005	0.00153
1,2-Dibromo-3-chloropropane	96-12-8	0.0056	Residential SSL	0.005	0.005	0.00206
1,2-Dibromoethane	106-93-4	0.034	Residential SSL	0.005	0.005	0.00174
1,2-Dichlorobenzene	95-50-1	2000	Residential SSL	0.005	0.005	0.00111
1,3-Dichlorobenzene	541-73-1	NV	NA	0.005	0.005	0.00129
1,4-Dichlorobenzene	106-46-7	2.6	Residential SSL	0.005	0.005	0.00142
Dichlorodifluoromethane	75-71-8	190	Residential SSL	0.010	0.010	0.00124
1,1-Dichloroethane	75-34-3	3.4	Residential SSL	0.005	0.005	0.00186

Analyte	CAS Number	Project Action Limit[1] (mg/kg)	Project Action Limit Reference[1]	Project Quantitation Limit Goal [2] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
1,2-Dichloroethane	107-06-2	0.45	Residential SSL	0.005	0.005	0.00137
1,1-Dichloroethene	75-35-4	250	Residential SSL	0.005	0.005	0.00152
cis-1,2-Dichloroethene	156-59-2	780	Residential SSL	0.005	0.005	0.0020
trans-1,2-Dichloroethene	156-60-5	110	Residential SSL	0.005	0.005	0.00211
1,2-Dichloropropane	78-87-5	0.93	Residential SSL	0.005	0.005	0.00164
cis-1,3-Dichloropropene	10061-01-5	1.7[3]	Residential SSL	0.005	0.005	0.00160
trans-1,3-Dichloropropene	10061-02-6	1.7[3]	Residential SSL	0.005	0.005	0.00219
Ethylbenzene	100-41-4	5.7	Residential SSL	0.005	0.005	0.00122
2-Hexanone	591-78-6	NV	NA	0.025	0.025	0.00798
Isopropylbenzene	98-82-8	2200	Residential SSL	0.005	0.005	0.00148
Methylacetate	79-20-9	78000	Residential SSL	0.005	0.005	0.00448
Methylcyclohexane	108-87-2	NV	NA	0.005	0.005	0.00152
Methylene chloride	75-09-2	11	Residential SSL	0.025	0.025	0.00271
4-Methyl-2-pentanone	108-10-1	5300	Residential SSL	0.025	0.025	0.00946
Methyl-tert-butyl-ether	1634-04-4	39	Residential SSL	0.005	0.005	0.00290
Styrene	100-42-5	6500	Residential SSL	0.005	0.005	0.00119
1,1,2,2-Tetrachloroethane	79-34-5	0.59	Residential SSL	0.005	0.005	0.00106
Tetrachloroethene	127-18-4	0.57	Residential SSL	0.005	0.005	0.00190
Toulene	108-88-3	5000	Residential SSL	0.005	0.005	0.00132
1,2,4-Trichorobenzene	120-82-1	87	Residential SSL	0.005	0.005	0.00138
1,1,1-Trichloroethane	71-55-6	9000	Residential SSL	0.005	0.005	0.00184
1,1,2-Trichloroethane	79-00-5	1.1	Residential SSL	0.005	0.005	0.00152
Trichloroethene	79-01-6	2.8	Residential SSL	0.005	0.005	0.00171
Trichlorofluoromethane	75-69-4	800	Residential SSL	0.010	0.010	0.00145

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	43000	Residential SSL	0.005	0.005	0.00176
Vinyl chloride	75-01-4	0.060	Residential SSL	0.010	0.010	0.00143
Xylenes (total)	1330-20-7	600	Residential SSL	0.015	0.015	0.00109

Matrix: Soil
Analytical Group: PCBs

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
Aroclor-1016	12674-11-2	3.9	Residential SSL	0.017	0.017	0.0052
Aroclor-1221	11104-28-2	0.17	Residential SSL	0.017	0.017	0.0099
Aroclor-1232	11141-16-5	0.17	Residential SSL	0.017	0.017	0.0066
Aroclor-1242	53469-21-9	0.22	Residential SSL	0.017	0.017	0.0038
Aroclor-1248	12672-29-6	0.22	Residential SSL	0.017	0.017	0.0095
Aroclor-1254	11097-69-1	0.22	Residential SSL	0.017	0.017	0.0069
Aroclor-1260	11096-82-5	0.22	Residential SSL	0.017	0.017	0.0033

Matrix: Sediment
Analytical Group: TAL Metals

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
Aluminum	7429-90-5	18000	NOAA AET	30	30	2.2
Antimony	7440-36-0	12	Region 4 ESV	0.080	0.80	0.056
Arsenic	7440-38-2	7.24	Region 4 ESV	7.24	8.0	0.27
Barium	7440-39-3	48	NOAA AET	0.50	0.50	0.031
Beryllium	7440-41-7	0.98	PI Background Value	0.50	0.50	0.012
Cadmium	7440-43-9	1	Region 4 ESV	1.0	1.0	0.0080
Calcium	7440-70-2	4000	PI Background Value	5.0	5.0	3.0
Chromium	7440-47-3	52.3	Region 4 ESV	1.5	1.5	0.046
Cobalt	7440-48-4	50	Region 3 FW	3.0	3.0	0.027
Copper	7440-50-8	18.7	Region 4 ESV	2.5	2.5	0.13
Iron	7439-89-6	20000	Region 3 FW	10	10	0.60
Lead	7439-92-1	30.2	Region 4 ESV	0.5	0.5	0.12
Magnesium	7439-95-4	0.13	Region 4 ESV	**0.13**	5.0	1.1
Manganese	7439-96-5	186	PI Background Value	0.5	0.5	0.2
Mercury	7439-97-6	0.13	Region 4 ESV	0.040	0.040	0.0024
Nickel	7440-02-0	15.9	Region 4 ESV	4.0	4.0	0.013
Potassium	7440-09-7	3200	PI Background Value	100	100	3.7
Selenium	7782-49-2	2	Region 3 FW	1.0	1.0	0.38
Silver	7440-22-4	2	Region 4 ESV	1.5	1.5	0.068
Sodium	7440-23-5	19000	PI Background Value	100	100	2.2
Thallium	7440-28-0	0.41	PI Background Value	1.5	1.5	0.064
Vanadium	7440-62-2	57	NOAA AET	2.5	2.5	0.032
Zinc	7440-66-6	124	Region 4 ESV	2.5	2.5	0.17

Matrix: Sediment
Analytical Group: PAHs

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
Acenaphthene	83-32-9	0.33	Region 4 ESV	0.020	0.020	0.0015
Acenaphthylene	208-96-8	0.33	Region 4 ESV	0.020	0.020	0.0012
Anthracene	120-12-7	0.33	Region 4 ESV	0.020	0.020	0.0012
Benzo(a)anthracene	56-55-3	0.33	Region 4 ESV	0.020	0.020	0.0019
Benzo(a)pyrene	50-32-8	0.33	Region 4 ESV	0.020	0.020	0.0033
Benzo(b)fluoranthene	205-99-2	0.33	Region 4 ESV	0.020	0.020	0.0024
Benzo(g,h,i)perylene	191-24-2	0.17	Region 3 FW	0.020	0.020	0.0020
Benzo(k)fluoranthene	207-08-9	0.24	Region 3 FW	0.020	0.020	0.0031
Chrysene	218-01-9	0.33	Region 4 ESV	0.020	0.020	0.0017
Dibenzo(a,h)anthracene	53-70-3	0.33	Region 4 ESV	0.020	0.020	0.0018
Fluoranthene	206-44-0	0.33	Region 4 ESV	0.020	0.020	0.0018
Fluorene	86-73-7	0.33	Region 4 ESV	0.020	0.020	0.0032
Indeno(1,2,3-cd)pyrene	193-39-5	0.017	Region 3 FW	**0.017**	0.020	0.0019
2-Methylnaphthalene	91-57-6	0.33	Region 4 ESV	0.020	0.020	0.0022
Naphthalene	91-20-3	0.33	Region 4 ESV	0.020	0.020	0.0026
Phenanthrene	85-01-8	0.33	Region 4 ESV	0.020	0.020	0.0018
Pyrene	129-00-0	0.33	Region 4 ESV	0.020	0.020	0.0021

Matrix: Sediment
Analytical Group: TCL VOCs

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
Acetone	67-64-1	0.0087	ORNL SCV	0.0087	0.025	0.01097
Benzene	71-43-2	0.137	Region 3 MA	0.005	0.005	0.00153
Bromodichloromethane	75-27-4	NV	NA	0.005	0.005	0.00163
Bromoform	75-25-2	0.654	Reg 3 FW	0.005	0.005	0.00116
Bromomethane	74-83-9	NV	NA	0.010	0.010	0.00227
2-Butanone	78-93-3	0.27	ORNL SCV	0.025	0.025	0.00948
Carbon disulfide	75-15-0	0.000851	Reg 3 FW	**0.000851**	0.005	0.00188
Carbon tetrachloride	56-23-5	0.0642	Reg 3 FW	0.005	0.005	0.00144
Chlorobenzene	108-90-7	0.82	Region 4 ESV	0.005	0.005	0.00151
Chloroethane	75-00-3	NV	NA	0.010	0.010	0.00193
Chloroform	67-66-3	0.022	ORNL SCV	0.005	0.005	0.00181
Chloromethane	74-87-3	NV	NA	0.010	0.010	0.00192
Cyclohexane	110-82-7	NV	NA	0.005	0.005	0.00117
Dibromochloromethane	124-48-1	NV	NA	0.005	0.005	0.00153
1,2-Dibromo-3-chloropropane	96-12-8	NV	NA	0.005	0.005	0.00206
1,2-Dibromoethane	106-93-4	NV	NA	0.005	0.005	0.00174
1,2-Dichlorobenzene	95-50-1	0.34	Region 4 ESV	0.005	0.005	0.00111
1,3-Dichlorobenzene	541-73-1	1.7	Region 4 ESV	0.005	0.005	0.00129
1,4-Dichlorobenzene	106-46-7	0.35	Region 4 ESV	0.005	0.005	0.00142
Dichlorodifluoromethane	75-71-8	NV	NA	0.010	0.010	0.00124
1,1-Dichloroethane	75-34-3	0.027	ORNL SCV	0.005	0.005	0.00186
1,2-Dichloroethane	107-06-2	0.25	ORNL SCV	0.005	0.005	0.00137

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
1,1-Dichloroethene	75-35-4	0.031	Region 3 FW	0.005	0.005	0.00152
cis-1,2-Dichloroethene	156-59-2	0.4	ORNL SCV	0.005	0.005	0.0020
trans-1,2-Dichloroethene	156-60-5	1.05	Region 3 FW	0.005	0.005	0.00211
1,2-Dichloropropane	78-87-5	0.002	NOAA TV	0.002	0.005	0.00164
cis-1,3-Dichloropropene	10061-01-5	0.000051	ORNL SCV	**0.000051**	0.005	0.00160
trans-1,3-Dichloropropene	10061-02-6	0.000051	ORNL SCV	**0.000051**	0.005	0.00219
Ethylbenzene	100-41-4	3.6	Region 4 ESV	0.005	0.005	0.00122
2-Hexanone	591-78-6	0.022	ORNL SCV	0.022	0.025	0.00798
Isopropylbenzene	98-82-8	0.086	Reg 3 FW	0.005	0.005	0.00148
Methylacetate	79-20-9	NV	NA	0.005	0.005	0.00448
Methylcyclohexane	108-87-2	NV	NA	0.005	0.005	0.00152
Methylene chloride	75-09-2	0.37	ORNL SCV	0.025	0.025	0.00271
4-Methyl-2-pentanone	108-10-1	0.033	ORNL SCV	0.025	0.025	0.00946
Methyl-tert-butyl-ether	1634-04-4	100	NOAA IV	0.005	0.005	0.00290
Styrene	100-42-5	0.559	Reg 3 FW	0.005	0.005	0.00119
1,1,2,2-Tetrachloroethane	79-34-5	0.94	Region 4 ESV	0.005	0.005	0.00106
Tetrachloroethene	127-18-4	0.53	Region 4 ESV	0.005	0.005	0.00190
Toulene	108-88-3	0.67	Region 4 ESV	0.005	0.005	0.00132
1,2,4-Trichorobenzene	120-82-1	9.2	Region 4 ESV	0.005	0.005	0.00138
1,1,1-Trichloroethane	71-55-6	0.17	Region 4 ESV	0.005	0.005	0.00184
1,1,2-Trichloroethane	79-00-5	0.57	Reg 3 MA	0.005	0.005	0.00152
Trichloroethene	79-01-6	1.6	Region 4 ESV	0.005	0.005	0.00171
Trichlorofluoromethane	75-69-4	NV	NA	0.010	0.010	0.00145

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	NV	NA	0.005	0.005	0.00176
Vinyl chloride	75-01-4	0.01	NOAA TV	0.010	0.010	0.00143
Xylenes (total)	1330-20-7	0.025	Region 4 ESV	0.015	0.015	0.00109

Matrix: Sediment
Analytical Group: PCBs

Analyte	CAS Number	Project Action Limit[(1)] (mg/kg)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (mg/kg)	Katahdin Analytical Services	
					Quantitation Limit (mg/kg)	Method Detection Limit (mg/kg)
Aroclor-1016	12674-11-2	0.033	Region 4 ESV	0.0017	0.0017	0.00052
Aroclor-1221	11104-28-2	0.067	Region 4 ESV	0.0017	0.0017	0.00099
Aroclor-1232	11141-16-5	0.033	Region 4 ESV	0.0017	0.0017	0.00066
Aroclor-1242	53469-21-9	0.033	Region 4 ESV	0.0017	0.0017	0.00038
Aroclor-1248	12672-29-6	0.033	Region 4 ESV	0.0017	0.0017	0.00095
Aroclor-1254	11097-69-1	0.033	Region 4 ESV	0.0017	0.0017	0.00069
Aroclor-1260	11096-82-5	0.033	Region 4 ESV	0.0017	0.0017	0.00033

Matrix: Groundwater
Analytical Group: TAL Metals

Analyte	CAS Number	Project Action Limit[(1)] (µg/L)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (µg/L)	Katahdin Analytical Services	
					Quantitation Limit (µg/L)	Method Detection Limit (µg/L)
Aluminum	7429-90-5	37000	USEPA Tap Water	300	300	15
Antimony	7440-36-0	6	MCL	6	8.0	0.78
Arsenic	7440-38-2	0.045	USEPA Tap Water	**0.045**	8.0	1.7
Barium	7440-39-3	7300	USEPA Tap Water	5.0	5.0	0.59
Beryllium	7440-41-7	4	MCL	4	5.0	0.13
Cadmium	7440-43-9	5	MCL	10	10	0.037
Calcium	7440-70-2	NV	NA	50	50	30
Chromium	7440-47-3	NV	NA	15	15	0.41
Cobalt	7440-48-4	11	USEPA Tap Water	30	30	0.24
Copper	7440-50-8	1300	MCL	25	25	0.75
Iron	7439-89-6	26000	USEPA Tap Water	100	100	9.0
Lead	7439-92-1	15	MCL	5.0	5.0	0.97
Magnesium	7439-95-4	NV	NA	50	50	4.3
Manganese	7439-96-5	880	USEPA Tap Water	5.0	5.0	1.1
Mercury	7439-97-6	0.63	USEPA Tap Water	0.20	0.20	0.031
Nickel	7440-02-0	730	USEPA Tap Water	40	40	0.42
Potassium	7440-09-7	NV	NA	1000	1000	41
Selenium	7782-49-2	50	MCL	10	10	0.96
Silver	7440-22-4	180	USEPA Tap Water	15	15	0.29
Sodium	7440-23-5	NV	NA	1000	1000	15
Thallium	7440-28-0	2.4	USEPA Tap Water	2.4	15	1.6
Vanadium	7440-62-2	260	USEPA Tap Water	25	25	0.38
Zinc	7440-66-6	11000	USEPA Tap Water	25	25	2.2

Matrix: Groundwater
Analytical Group: PAHs

Analyte	CAS Number	Project Action Limit[(1)] (µg/L)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (µg/L)	Katahdin Analytical Services	
					Quantitation Limit (µg/L)	Method Detection Limit (µg/L)
Acenaphthene	83-32-9	NV	NA	20	20	0.064
Acenaphthylene	208-96-8	2200	USEPA Tap Water	20	20	0.054
Anthracene	120-12-7	11000	USEPA Tap Water	20	20	0.044
Benzo(a)anthracene	56-55-3	0.029	USEPA Tap Water	**0.029**	20	0.046
Benzo(a)pyrene	50-32-8	0.0029	USEPA Tap Water	**0.0029**	20	0.066
Benzo(b)fluoranthene	205-99-2	0.029	USEPA Tap Water	**0.029**	20	0.089
Benzo(g,h,i)perylene	191-24-2	NV	NA	20	20	0.065
Benzo(k)fluoranthene	207-08-9	0.29	USEPA Tap Water	**0.29**	20	0.049
Chrysene	218-01-9	2.9	USEPA Tap Water	**2.9**	20	0.036
Dibenzo(a,h)anthracene	53-70-3	0.0029	USEPA Tap Water	**0.0029**	20	0.070
Fluoranthene	206-44-0	1500	USEPA Tap Water	20	20	0.073
Fluorene	86-73-7	1500	USEPA Tap Water	20	20	0.061
Indeno(1,2,3-cd)pyrene	193-39-5	0.029	USEPA Tap Water	**0.029**	20	0.052
2-Methylnaphthalene	91-57-6	150	USEPA Tap Water	20	20	0.077
Naphthalene	91-20-3	0.14	USEPA Tap Water	0.14	20	0.064
Phenanthrene	85-01-8	NV	NA	20	20	0.051
Pyrene	129-00-0	1100	USEPA Tap Water	20	20	0.059

Matrix: Groundwater
Analytical Group: TCL Volatiles

Analyte	CAS Number	Project Action Limit[(1)] (µg/L)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (µg/L)	Katahdin Analytical Services	
					Quantitation Limit (µg/L)	Method Detection Limit (µg/L)
Acetone	67-64-1	22000	USEPA Tap Water	5.0	5.0	2.10
Benzene	71-43-2	0.41	USEPA Tap Water	0.41	1.0	0.28
Bromodichloromethane	75-27-4	1.1	USEPA Tap Water	1.0	1.0	0.27
Bromoform	75-25-2	8.5	USEPA Tap Water	1.0	1.0	0.37
Bromomethane	74-83-9	8.7	USEPA Tap Water	2.0	2.0	0.33
2-Butanone	78-93-3	7100	USEPA Tap Water	5.0	5.0	1.33
Carbon disulfide	75-15-0	1000	USEPA Tap Water	1.0	1.0	0.25
Carbon tetrachloride	56-23-5	0.20	USEPA Tap Water	**0.20**	1.0	0.36
Chlorobenzene	108-90-7	91	USEPA Tap Water	1.0	1.0	0.25
Chloroethane	75-00-3	21000	USEPA Tap Water	2.0	2.0	0.34
Chloroform	67-66-3	0.19	USEPA Tap Water	**0.19**	1.0	0.22
Chloromethane	74-87-3	1.8	USEPA Tap Water	1.8	2.0	0.26
Cyclohexane	110-82-7	13000	USEPA Tap Water	1.0	1.0	0.39
Dibromochloromethane	124-48-1	0.80	USEPA Tap Water	0.80	1.0	0.26
1,2-Dibromo-3-chloropropane	96-12-8	0.00032	USEPA Tap Water	**0.00032**	1.0	0.64
1,2-Dibromoethane	106-93-4	0.0065	USEPA Tap Water	**0.0065**	1.0	0.28
1,2-Dichlorobenzene	95-50-1	370	USEPA Tap Water	1.0	1.0	0.29
1,3-Dichlorobenzene	541-73-1	NV	NA	1.0	1.0	0.34
1,4-Dichlorobenzene	106-46-7	0.43	USEPA Tap Water	0.43	1.0	0.28
Dichlorodifluoromethane	75-71-8	390	USEPA Tap Water	2.0	2.0	0.35
1,1-Dichloroethane	75-34-3	2.4	USEPA Tap Water	1.0	1.0	0.22
1,2-Dichloroethane	107-06-2	0.15	USEPA Tap Water	**0.15**	1.0	0.26
1,1-Dichloroethene	75-35-4	7	MCL	1.0	1.0	0.26

Analyte	CAS Number	Project Action Limit[(1)] (µg/L)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (µg/L)	Katahdin Analytical Services	
					Quantitation Limit (µg/L)	Method Detection Limit (µg/L)
cis-1,2-Dichloroethene	156-59-2	370	USEPA Tap Water	1.0	1.0	0.24
trans-1,2-Dichloroethene	156-60-5	100	MCL	1.0	1.0	0.35
1,2-Dichloropropane	78-87-5	0.39	USEPA Tap Water	0.39	1.0	0.30
cis-1,3-Dichloropropene	10061-01-5	0.43[(3)]	USEPA Tap Water	0.43	1.0	0.31
trans-1,3-Dichloropropene	10061-02-6	0.43[(3)]	USEPA Tap Water	0.43	1.0	0.25
Ethylbenzene	100-41-4	1.5	USEPA Tap Water	1.0	1.0	0.30
2-Hexanone	591-78-6	NV	NA	5.0	5.0	1.70
Isopropylbenzene	98-82-8	680	USEPA Tap Water	1.0	1.0	0.36
Methylacetate	79-20-9	37000	USEPA Tap Water	1.0	1.0	0.79
Methylcyclohexane	108-87-2	NV	NA	1.0	1.0	0.37
Methylene chloride	75-09-2	4.8	USEPA Tap Water	4.8	5.0	0.30
4-Methyl-2-pentanone	108-10-1	2000	USEPA Tap Water	5.0	5.0	1.90
Methyl-tert-butyl-ether	1634-04-4	12	USEPA Tap Water	1.0	1.0	0.50
Styrene	100-42-5	100	MCL	1.0	1.0	0.27
1,1,2,2-Tetrachloroethane	79-34-5	0.067	USEPA Tap Water	**0.067**	1.0	0.30
Tetrachloroethene	127-18-4	0.11	USEPA Tap Water	**0.11**	1.0	0.40
Toulene	108-88-3	2300	USEPA Tap Water	1.0	1.0	0.35
1,2,4-Trichorobenzene	120-82-1	8.2	USEPA Tap Water	1.0	1.0	0.34
1,1,1-Trichloroethane	71-55-6	200	MCL	1.0	1.0	0.31
1,1,2-Trichloroethane	79-00-5	0.24	USEPA Tap Water	**0.24**	1.0	0.28
Trichloroethene	79-01-6	1.7	USEPA Tap Water	1.0	1.0	0.37
Trichlorofluoromethane	75-69-4	1300	USEPA Tap Water	2.0	2.0	0.51
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	59000	USEPA Tap Water	1.0	1.0	0.73

Analyte	CAS Number	Project Action Limit[(1)] (µg/L)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (µg/L)	Katahdin Analytical Services	
					Quantitation Limit (µg/L)	Method Detection Limit (µg/L)
Vinyl chloride	75-01-4	0.016	USEPA Tap Water	**0.016**	2.0	0.26
Xylenes (total)	1330-20-7	200	USEPA Tap Water	3.0	3.0	0.26

Matrix: Groundwater
Analytical Group: PCBs

Analyte	CAS Number	Project Action Limit[(1)] (µg/L)	Project Action Limit Reference[(1)]	Project Quantitation Limit Goal [(2)] (µg/L)	Katahdin Analytical Services	
					Quantitation Limit (µg/L)	Method Detection Limit (µg/L)
Aroclor-1016	12674-11-2	0.96	USEPA Tap Water	0.050	0.050	0.016
Aroclor-1221	11104-28-2	0.0068	USEPA Tap Water	**0.0068**	0.050	0.040
Aroclor-1232	11141-16-5	0.0068	USEPA Tap Water	**0.0068**	0.050	0.012
Aroclor-1242	53469-21-9	0.034	USEPA Tap Water	0.034	0.050	0.012
Aroclor-1248	12672-29-6	0.034	USEPA Tap Water	0.034	0.050	0.008
Aroclor-1254	11097-69-1	0.034	USEPA Tap Water	0.034	0.050	0.0092
Aroclor-1260	11096-82-5	0.034	USEPA Tap Water	0.034	0.050	0.013

1 PALs were compiled from the following sources:

- Residential soil screening levels (SSLs) were obtained from the USEPA Regional Soil Screening Levels for Chemical Contaminants at Superfund Sites-Residential Use (ORNL, 2008a). These values include the USEPA soil-to-groundwater criteria.
- Sediment Ecological Screening Values were selected in the following order of preference:
  i. USEPA (2001a) Region 4 Ecological Risk Assessment Bulletins – Supplemental to Risk Assessment Guide for Superfund.
  ii. The lesser of the Region 3 Freshwater (FW) or Marine (MA) Screening Level – USEPA (2006b) Region 3 Freshwater Sediment Screening Benchmarks, USEPA (2006c) Region 3 Marine Sediment Screening Benchmarks.
  iii. ORNL Secondary Chronic Values (SCVs) – Jones, Hull, and Sulter (1997) Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment – Associated Biota.

iv. The National Oceanic and Atmospheric Administration (NOAA) Apparent Effects Threshold (AET), NOAA Dutch Intervention Value (IV), or NOAA Dutch Target Value (TV) – Buchman (2008) NOAA Screening Quick Reference Tables.

- Groundwater screening levels are the lesser of the federal Maximum Contaminant Level (MCL) from the Drinking Water Standard and Health Advisories (USEPA 2006a), or the USEPA Tap Water Screening Levels for Chemical Contaminants at Superfund Sites-Residential Use (ORNL, 2008a)
- Parris Island (PI) Background – TtNUS (1999) Site 3 Causeway Landfill Background Study for soil and sediment.

These PALs represent screening values which are the lowest concentrations to which data will be compared when delineating contamination or selecting COPCs. Human health and ecological risk decision limits are presented in Section 11.4.
NV = No value
NA = Not applicable

2 Highlighted PQL Goals indicate values which are less than the Laboratory QL or MDL Values in this concentration range will be flagged with a "J" qualifier to alert data users to the potentially high uncertainty associated with the values. Bolded and highlighted PQL Goals indicates values which are less than the Laboratory QL and MDL. The effects on decision making of non-detect values greater than the QL will be addressed in the uncertainty section of the risk assessment. The project decision levels equate to 100 times the PALs as presented above so the project team believes that it will be appropriate to evaluate these conditions after the data have been collected. The risk of overlooking an environmentally significant problem is perceived to be extremely low because most of the QLs and MDLs are less than their respective PALs and the contaminant being investigated are relatively old..

3 This screening value is for total 1,3-Dichloropropene.

SAP Worksheet #16 -- Project Schedule/Timeline Table
(UFP-QAPP Manual Section 2.8.2)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
Draft UFP-SAP	TtNUS	1/3/09	3/13/09	Draft UFP-SAP	3/13/09
Team Review	NAVFAC, USEPA Region 4, SCDHEC, TtNUS	3/16/09	4/16/09	Draft Final UFP-SAP	4/16/09
Government Chemist Review	Navy	4/16/09	5/29/09	NA	NA
Resolve Comments	TtNUS, NAVFAC	5/29/09	6/29/09	Response to Comments	6/29/09
Final UFP-SAP	TtNUS	6/29/09	7/29/09	Final UFP-SAP	7/29/09
Field Work and Chemical Analysis	TtNUS	7/30/09	10/30/09	NA	NA
Data Validation	TtNUS	11/2/09	12/2/09	Final Analytical Data Tables	12/2/09
Draft RI Report	TtNUS	12/2/09	2/2/10	Draft RI Report	2/2/10
Team Review	NAVFAC, USEPA Region 4, SCDHEC, TtNUS	2/2/10	3/2/10	NA	NA
Resolve Comments	TtNUS	3/2/10	4/2/10	Response to Comments	4/2/10
Final RI Report	TtNUS	4/2/10	5/2/10	Final RI Report	5/2/10

SAP Worksheet #17 -- Sampling Design and Rationale
(UFP-QAPP Manual Section 3.1.1)

Site 5 is the location of a former paint shop disposal area divided into two areas for sampling (see Figure 17-1). Sampling will be conducted surrounding the former paint shop, Structure 177, the riverbank, and the shoreline to support delineation of contamination (Areas 1 and 2) and human health (area 1) and ecological (Area 2) risk assessments. The soil and sediment sampling locations were allocated sing VSP software with two additional soil sampling locations added manually to better define contamination in a previously identified paint waste disposal location. Soil, groundwater, and sediment samples will be analyzed for TCL VOCs, PAHs, PCBs, and TAL metals., These contaminants were selected based on historical disposal of paint wastes and the findings of previous investigations. Soil, groundwater, and sediment sampling SOPs are provided in Appendix C, and will follow the methods outlined in Worksheet #18. Field QC samples, including field blanks, field duplicates, matrix spike (MS)/matrix spike duplicate (MSD) samples, temp blanks, and VOC trip blanks will be collected as outlined in Worksheet #20.

Surface/Subsurface Soil Samples (Area 1): Area 1 consists of approximately 0.7 acre of land surrounding Structure 177 and between this structure and the Beaufort River,, including the upper elevation half of the riverbank. The soils under the footprint of Structure 177 are excluded. Eight surface soil samples (0 to 2 feet bgs), and eight collocated subsurface soil samples (2 feet bgs to the water table in 2-feet intervals) will be collected on a rectangular grid. In addition, two surface and subsurface samples will be collected from near the top of the river bank in the area near where contamination was detected previously. These two additional sample locations were selected in a judgmental manner to help establish extent of contamination in the previously identified contaminant source area. The data from these two samples will not be used for risk assessment because they represent soils on the steep river bank and do not represent human health or ecological risks consistent with the goals of this project.

Groundwater Samples (Area 1): The purpose of groundwater sampling and analysis is to obtain current water quality data, identify the nature and extent of groundwater contamination in Area 1, and establish groundwater flow direction. Because there was no existing groundwater data set, statistics were not used to generate a sampling strategy. Groundwater well locations were selected using engineering judgment. Well locations were selected upgradient and downgradient of Structure 177 and near the riverbank in Area 1 where paint was historically disposed. It is assumed that groundwater flows northeast towards the Beaufort River. The well upgradient of Building 177 will be used as a point of reference for evaluating the downgradient data as the location of this well indicates that it should be unaffected by the paint operations.

Sediment Samples (Area 2): Area 3 consists of 150 feet of shoreline northeast of Structure 177. Eight sediment samples will be collected in the 0 to 4-inch interval where ecological receptors are exposed and where contamination was detected during previous investigations.

Figure 17-1

SAP Worksheet #18 -- Sampling Locations and Methods/SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Sampling Location/ ID Number	Matrix	Depth	Analytical Group	Number of Samples	Sampling Standard Operating Procedure Reference
Area 1 (See locations on Figure 17-1)					
01SS01 to 01SS10(01SB09 and 01SB10 are for contamination delineation only)	Surface Soil	First 0 to 2 feet of soil	TCL VOCs, PAHs, PCBs, TAL Metals	10 plus one duplicate	HS-1.0, CT-04, CT-05, SA-1.3, SA-2.5, SA-6.1, SA-6.3, SA-7.1, GH-1.5
01SB01 to 01SB10 (01SB09 and 01SB10 are for contamination delineation only)	Subsurface Soil	2 feet to the water table	TCL VOCs, PAHs, PCBs,TAL Metals	10 plus one duplicate	HS-1.0, CT-04, CT-05, SA-1.3, SA-2.5, SA-6.1, SA-6.3, SA-7.1, GH-1.5
01GW01 to 01GW03	Groundwater	Straddling water table	TCL VOCs, PAHs, PCBs, TAL Metals	3 plus one duplicate	HS-1.0, CT-04, CT-05, SA-1.1, SA-6.1, SA-6.3, SA-7.1, GH-1.2, GH-1.3, GH-1.5, GH-2.4, GH-2.8
Area 2 (See locations on Figure 17-1)					
01SD01 to 01SD08	Sediment	0 to 4 inches	TCL VOCs, PAHs, PCBs, TAL Metals	8 plus one duplicate	SA-1.2, CT-04, CT-05, SA-6.1, SA-6.3

SAP Worksheet #19 -- Analytical SOP Requirements Table
(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Analytical and Preparation Method/Standard Operating Procedure Reference	Containers	Sample Volume	Preservation Requirements	Maximum Holding Time
Soil/Sediment	TAL Metals	SW-846 6010B, 6020, 3050, 7471 / KAS(1) SOP CA608, CA627, CA605, CA611	(1) 2-oz. soil jar	1 g	Cool to (4 ± 2) °C	6 Months to analysis/ (Mercury 28 days to analysis)
Soil/Sediment	TCL VOCs	SW-846 8260B, 5035 / KAS(1) SOP CA202, CA214	(4) 5 g EnCore sampler	(1) volatile vial	Cool to (4 ± 2) °C	14 days to analysis
Soil/Sediment	PAHs	SW-846 8270C SIM, 3540, 3550 / KAS(1) SOP CA213,CA512, CA526	(1) 4 oz. soil jar	30 g	Cool to (4 ± 2) °C	14 days to extraction/40 days to analysis
Soil/Sediment	PCBs	SW-846 8082, 3540, 3545, 3550 / KAS(1) SOP CA329, CA500, CA524, CA537	(1) 4 oz. soil jar	30 g	Cool to (4 ± 2) °C	14 days to extraction/40 days to analysis
Aqueous	TAL Metals	SW-846 6010B, 6020, 7470, 3010 / KAS(1) SOP CA608, CA627, CA604, CA615	(1) 500 mL plastic bottles	250 mL	Nitric acid to a pH <2, Cool to (4 ± 2) °C	6 Months/28 days (Mercury to analysis)
Aqueous	TCL VOCs	SW-846 8260B, 5030 / KAS(1) SOP CA202	(3) 40 mL volatile vial	40 mL	Hydrochloric acid to a pH <2, Cool to (4 ± 2) ° C; no headspace	14 days to analysis
Aqueous	PAHs	SW-846 8270C SIM, 3510, 3520 / KAS(1) SOP CA213, CA502	(2)1000 mL amber glass bottles	1,000 mL	Cool to (4 ± 2) °C	7 days to extraction/40 days to analysis
Aqueous	PCBs	SW-846 8082, 3510, 3520 / KAS(1) SOP CA329, CA515	(2)1000 mL glass bottles	1,000 mL	Cool to (4 ± 2) °C	7 days to extraction/40 days to analysis

1 KAS = Katahdin Analytical Services

SAP Worksheet #20 -- Field Quality Control Sample Summary Table
(UFP-QAPP Manual Section 3.1.1)

Matrix	Analytical Group	Number of Sampling Locations	Number of Field Duplicates	Number of MS/MSDs	Number of Field Blanks	Number of Equip. Blanks	Number of VOC Trip Blanks	Number of PT Samples	Total Number of Samples to Lab
Soil	TCL VOCs	20	2	1	1	0	1 per day per shipment (two total)	0	26
	PAHs	20	2	1	1	0	NA	0	24
	PCBs	20	2	1	1	0	NA	0	24
	TAL Metals	20	2	1	1	0	NA	0	24
Sediment	TCL VOCs	8	1	1	0	0	1 per day per shipment (two total)	0	12
	PAHs	8	1	1	0	0	NA	0	10
	PCBs	8	1	1	0	0	NA	0	10
	TAL Metals	8	1	1	0	0	NA	0	10
Groundwater	TCL VOCs	3	1	1	0	0	1 per day per shipment (one total)	0	6
	PAHs	3	1	1	0	0	NA	0	5
	PCBs	3	1	1	0	0	NA	0	5
	TAL Metals	3	1	1	0	0	NA	0	5

SAP Worksheet #21 -- Project Sampling SOP References Table
(UFP-QAPP Manual Section 3.1.2)

Reference Number	Title, Revision Date, and Number	Organization of Sampling SOP	Equipment Type	Modified for Project Work?	Comments
CT-04	Sample Nomenclature, 09/2003 Rev. 1	TtNUS	None	Y	Refer to Appendix C for Field SOPs
CT-05	Data Base Records and Quality Assurance, 01/01 Rev. 2	TtNUS	None	N	
GH-1.2	Evaluation of Existing Monitoring Wells and Water Level Measurement, 09/03 Rev. 2	TtNUS	None	Y	
GH-1.3	Soil and Rock Drilling Methods, 06/99 Rev. 1	TtNUS	Drilling rig and accessories	Y	
GH-1.5	Borehole and Sample Logging, 06/99 Rev. 1	TtNUS	Drilling rig and accessories	N	
GH-2.4	In-Situ Hydraulic Conductivity Testing, 06/99 Rev 1	TtNUS	Slug, Water level indicator	N	
GH-2.8	Groundwater Monitoring Well Installation, 09/03 Rev. 3	TtNUS	Drill rig, accessories, and well supplies	Y	
HS-1.0	Utility Locating and Excavation Clearance, 12/03 Rev. 2	TtNUS	Remote subsurface sensing, magnetometer, ground-penetrating radar, etc.	Y	
SA-1.1	Groundwater Sample Acquisition and Onsite Water Quality Testing, 04/2008 Rev. 7	TtNUS	Pump, tubing, water quality meter, and accessories	Y	
SA-1.2	Surface Water and Sediment Sampling, 04/2008 Rev. 6	TtNUS	Sediment sampling device	Y	
SA-1.3	Soil Sampling, 04/2008 Rev. 9	TtNUS	DPT drill rig	Y	
SA-2.5	Direct Push Technology, 09/2003 Rev. 3	TtNUS	DPT drill rig	Y	
SA-6.1	Non-Radiological Sample Handling, 02/04 Rev. 3	TtNUS	Sample bottleware, packaging material, shipping materials	N	
SA-6.3	Field Documentation, 09/2003 Rev. 2	TtNUS	Field logbook, field sample forms, boring logs	Y	
SA-7.1	Decontamination of Field Equipment, 04/2008 Rev. 5	TtNUS	Decontamination equipment, scrub brushes, phosphate-free detergent, DI water	Y	

SAP Worksheet #22 -- Field Equipment Calibration, Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.1.2.4)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Standard Operating Procedure Reference	Comments
PID	Calibration Gas	Daily	Manufacturer's guidance	Operating correction or replacement	FOL	SA-1.1	None
Water Quality Meter	Prepared Standards	Daily	Manufacturer's guidance	Operating correction or replacement	FOL	SA-1.1	None
Turbidity Meter	Prepared Standards	Daily	Manufacturer's guidance	Operating correction or replacement	FOL	SA-1.1	None
Water Level Indicator	Field Checks per Manufacturer	Once upon receiving from vendor	0.01-foot accuracy	Operating correction or replacement	FOL	GH-1.2	None

SAP Worksheet #23 -- Analytical SOP References Table
(UFP-QAPP Manual Section 3.2.1)

Lab SOP Number	Title, Revision Date, and Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
CA-101	Equipment Maintenance, 07/08, Revision 7.	Definitive	Various	Various	Katahdin Analytical Services	N
CA-202	Analysis of VOAs by Purge and Trap Gas Chromatograph/Mass Spectrometer (GC/MS): SW-846 Method 8260, 03/08, Revision 9.	Definitive	Soil, Sediment, Aqueous VOCs	GC/MS	Katahdin Analytical Services	N
CA-213	Analysis of Semivolatile Organic Compounds By: SW 846 Method 8270 – Modified For Selected Ion Monitoring (SIM), 02/08, Revision 5.	Definitive	Soil, Sediment, Aqueous SVOCs	GC/MS	Katahdin Analytical Services	N
CA-214	Closed-System Purge-And-Trap And Extraction For Volatile Organics In Soil And Waste Samples Using SW846 Method 5035, 04/06, Revision 4.	Definitive	Soil, Sediment VOCs	TEKMAR, ARCON, ENCON	Katahdin Analytical Services	N
CA-329	Analysis Of PCBs As Total Aroclors By Gas Chromatograph/ Electron Capture Detector (GC/ECD): SW-846 Method 8082, 01/08, Revision 7.	Definitive	Soil, Sediment, Aqueous PCBs	GC/ECD	Katahdin Analytical Services	N
CA-500	Preparation Of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Pesticides/PCBs Analysis, 07/08, Revision 5.	Definitive	Soil, Sediment Extractions	Sonicator	Katahdin Analytical Services	N

Lab SOP Number	Title, Revision Date, and Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
CA-502	Preparation Of Aqueous Samples For Extractable Semivolatile Analysis, 06/08, Revision 5.	Definitive	Aqueous Extractions	Separatory Funnel, Continuous liquid-liquid extraction (CLLE)	Katahdin Analytical Services	N
CA-512	Preparation Of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Extractable Semi-Volatiles Analysis, 07/08, Revision 6.	Definitive	Soil, Sediment Extractions	Sonicator	Katahdin Analytical Services	N
CA-515	Preparation of Aqueous Samples for Pesticides/PCBs Analysis, 06/08, Revision 5.	Definitive	Aqueous Extractions	Separatory Funnel, CLLE	Katahdin Analytical Services	N
CA-524	Preparation Of Sediment/Soil Samples By Soxhlet Extraction Using Method 3540 For Pesticide/PCB Analysis, 07/08, Revision 5.	Definitive	Soil, Sediment Extractions	Soxhlet	Katahdin Analytical Services	N
CA-526	Preparation Of Sediment/Soil Samples By Soxhlet Extraction Using Method 3540 For Subsequent Extractable Semivolatile Analysis, 07/08, Revision 5.	Definitive	Soil, Sediment Extractions	Soxhlet	Katahdin Analytical Services	N
CA-537	Preparation of Sediment/Soil and Tissue Samples by Accelerated Solvent Extraction Using Method 3545 for Subsequent Extractable Pesticide and PCB Analysis, 07/08, Revision 1.	Definitive	Soil, Sediment Extractions	Accelerated Solvent Extraction (ASE)	Katahdin Analytical Services	N

Lab SOP Number	Title, Revision Date, and Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
CA-604	Acid Digestion of Aqueous Samples By USEPA Method 3010 for ICP Analysis of Total or Dissolved Metals, 01/08, Revision 3.	Definitive	Aqueous Metals Prep	Block Digester	Katahdin Analytical Services	N
CA-605	Acid Digestion Of Solid Samples By USEPA Method 3050 For Metals Analysis By ICP-AES(Inductively Coupled Plasma-Atomic Emission Spectroscopy) And Graphite Furnace Atomic Absorption (GFAA), 03/08, Revision 3.	Definitive	Soil, Sediment, Metals Prep	Block Digester	Katahdin Analytical Services	N
CA-608	Trace Metals Analysis By ICP-AES Using USEPA Method 6010, 09/07, Revision 6.	Definitive	Soil, Sediment, Aqueous Metals	ICP-AES	Katahdin Analytical Services	N
CA-611	Digestion And Analysis Of Solid Samples For Mercury By USEPA Method 7471, 03/08, Revision 4.	Definitive	Soil, Sediment Metals	Mercury Analyzer	Katahdin Analytical Services	N
CA-615	Digestion And Analysis Of Aqueous Samples For Mercury By USEPA Method 7470, 04/08, Revision 2.	Definitive	Aqueous Metals	Mercury Analyzer	Katahdin Analytical Services	N
CA-627	Trace Metals Analysis By ICP-MS Using USEPA Method 6020, 04/08, Revision 4.	Definitive	Soil, Sediment, Aqueous Metals	ICP/MS	Katahdin Analytical Services	N
SD-902	Sample Receipt and Internal Control, 02/08 Revision 7.	Definitive	Sample Receiving	NA	Katahdin Analytical Services	N
SD-903	Sample Disposal, 02/08, Revision 3.	Definitive	Sample Receiving	NA	Katahdin Analytical Services	N

SAP Worksheet #24 -- Analytical Instrument Calibration Table
(UFP-QAPP Manual Section 3.2.2)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/ECD (PCBs)	Initial Calibration - six point calibration of Aroclor-1660, Single mid-point calibration of other Aroclors.	Instrument receipt, major instrument change, when Calibration Verification (CV) does not meet criteria.	Coefficient of determination $\geq$ 0.990.	Repeat initial calibration and/or perform necessary equipment maintenance. Check calibration standards. Reanalyze affected data. If single-point calibration Aroclor is identified in analysis of sample, six-point calibration run of identified compound with reanalysis of sample.	Analyst, Supervisor	CA-329
	CV	After every 10 samples; If calibration curve previously analyzed, analyze daily before samples.	Percent Difference (%D) $\leq$ 15 for both the quantitation and confirmation columns.	Evaluate the samples: If the %D >15% and sample results are < QL, narrate. If %D > 15% only on one channel, narrate. If %D >15% for closing CV and is likely a result of matrix interference, narrate. Otherwise, reanalyze all samples back to last acceptable CV.	Analyst, Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS (VOCs)	Initial Calibration	Instrument receipt, instrument change (new column, source cleaning, etc.), when CV is out of criteria. Six-point initial calibration for all analytes.	Relative Standard Deviation (RSD) ≤30 for the continuing calibration check (CCC); System performance check compounds (SPCCs) response factor (RF) ≥ 0.10 and 0.30; %RSD < 15% for all other compounds.	Repeat calibration if criterion is not met.	Analyst, Supervisor	CA-202
	CV	At the beginning of each 12-hour shift immediately after bromofluorobenzene (BFB) tune.	CCCs ≤ 20%D; SPCCs RF ≥0.10 & 0.30.	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification.	Analyst, Supervisor	
	BFB Tune	Every 12 hours.	Mass – Criteria 50 - 15.0-40.0% of mass 95 75 - 30.0-60% of mass 95 95 - base peak, 100% relative abundance 96 - 5.0-9.0% of mass 95 173 - less than 2.0% of mass 174 174 - greater than 50.0% of mass 95 175 - 5.0-9.0% of mass 174 176 - greater than 95.0%, but less than 101.0% of mass 174 177 - 5.0-9.0% of mass 176	Retune and/or clean source.	Analyst, Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS (PAHs)	Initial Calibration - Six-point initial calibration for all analytes.	Instrument receipt, instrument change (new column, source cleaning, etc.), when CV is out of criteria.	RSD ≤30 for the CCCs; SPCCs RF ≥0.050; %RSD < 15% for all other compounds.	Repeat calibration if criterion is not met	Analyst, Supervisor	CA-213
	CV	At the beginning of each 12-hour shift immediately after decafluorotriphenyl-phosphine (DFTPP) tune.	CCCs ≤ 20%D; SPCCs RF ≥0.050	Repeat initial calibration and reanalyze all samples analyzed since the last successful calibration verification.	Analyst, Supervisor	
	DFTPP Tune	Every 12 hours.	Mass - Criteria 51 30.0 to 60.0 percent of mass 198 68 less than 2.0 percent of mass 69 69 present 70 less than 2.0 percent of mass 69 127 40.0-60.0 percent of mass 198 197 less than 1.0 percent of mass 198 198 base peak, 100 percent relative abundance 199 5.0-9.0 percent of mass 198 275 10.0-30.0 percent of mass 198 365 greater than 1.00 percent of mass 198 441 present, but less than mass 443 442 greater than 40.0 percent of mass 198 443 17.0-23.0 percent of mass 442	Retune and/or clean source.	Analyst, Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
ICP (Metals)	Initial Calibration – Two-point calibration per manufacturer's guidelines.	At the beginning of each day or if QC is out of criteria.	Analytes run at their calibration levels must fall within 95 to 105% of true values.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Analyst, Supervisor	CA-608
	Continuing Calibration Verification (CCV)	At the beginning and end of each run sequence and every 10 samples.	90-110% of true values.	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	
ICP-MS (Metals)	Tune	Daily prior to calibration	Mass calibration within 0.1 atomic mass units (amu) of true value, Resolution < 0.9 amu at 10% peak height.	Perform necessary equipment maintenance.	Analyst, Supervisor	CA-627
	Initial Calibration	Daily prior to sample analysis.	Four point calibration plus blank – correlation coefficient $\geq$ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Analyst, Supervisor	
	CCV	At the beginning and end of each run sequence and every 10 samples.	90 to 110% of true values.	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
Mercury analyzer (Mercury)	Initial Calibration	Instrument receipt, major instrument change, at the start of each day.	Six point calibration; Correlation coefficient $\geq$ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards.	Analyst, Supervisor	CA-615, CA-611
	CCV	At beginning and end of each run sequence and every 10 samples.	80 to 120% of true value.	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.	Analyst, Supervisor	

SAP Worksheet #25 -- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
(UFP-QAPP Manual Section 3.2.3)

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC/ECD (PCBs)	Check pressure and gas supply daily. Change septa and/or liner as needed, replace or cut column as needed. Other maintenance specified in laboratory Equipment Maintenance SOP.	QC standards	Injector liner, septa, column, column flow.	Prior to initial calibration and/or as necessary.	Acceptable calibration or CV.	Correct the problem and repeat calibration or CV.	Analyst, Department Manager	CA329
GC/MS (VOCs)	Check pressure and gas supply daily. Bake out trap and column, manual tune if BFB not in criteria, change septa as needed, cut column as needed, change trap as needed. Other maintenance specified in laboratory Equipment Maintenance SOP.	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap.	Prior to initial calibration and/or as necessary.	Acceptable tune.	Correct the problem and repeat tune check.	Analyst, Department Manager	CA-202

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC/MS (PAHs)	Check pressure and gas supply daily. Manual tune if DFTPP not in criteria, change septa as needed, change liner as needed, cut column as needed. Other maintenance specified in laboratory Equipment Maintenance SOP	QC standards	Ion source, injector liner, column, and column flow.	Prior to initial calibration and/or as necessary.	Acceptable tune	Correct the problem and repeat tune check.	Analyst, Department Manager	CA-213
ICP (Metals)	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed. Other maintenance specified in laboratory Equipment Maintenance SOP.	QC standards	Torch, nebulizer chamber, pump, pump tubing.	Prior to initial calibration and as necessary.	Acceptable calibration or CCV.	Correct the problem and repeat calibration or CCV.	Analyst, Department Manager	CA-608

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
ICP-MS (Metals)	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Torch, nebulizer, spray chamber, pump tubing.	Prior to initial calibration and as necessary	Acceptable calibration or CCV.	Correct the problem and repeat calibration or CCV.	Analyst, Department Manager	CA-627
Mercury Analyzer (Mercury)	Replace peristaltic pump tubing, replace mercury lamp, replace drying tube, clean optical cell and/or clean liquid/gas separator as needed. Other maintenance specified in laboratory Equipment Maintenance SOP.	QC standards	Tubing, sample probe, optical cell.	Prior to initial calibration and as necessary.	Acceptable calibration or CCV.	Correct the problem and repeat calibration or CCV.	Analyst, Department Manager	CA-611, CA-615

SAP Worksheet #26 -- Sample Handling System
(UFP-QAPP Manual Appendix A)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): FOL/TtNUS
Sample Packaging (Personnel/Organization): FOL/TtNUS
Coordination of Shipment (Personnel/Organization): FOL/TtNUS
Type of Shipment/Carrier: Federal Express
Sample Receipt (Personnel/Organization): Sample Receipt Personnel/Katahdin Analytical Services
Sample Custody and Storage (Personnel/Organization): Sample Receipt Personnel/Katahdin Analytical Services
Sample Preparation (Personnel/Organization): Extractions Personnel/Katahdin Analytical Services
Sample Determinative Analysis (Personnel/Organization): Analytical Personnel/Katahdin Analytical Services
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 48 hours
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Extracts may be disposed of 1 year after extraction
Biological Sample Storage (No. of days from sample collection): N/A
SAMPLE DISPOSAL
Personnel/Organization: Environmental Health and Safety Officer/Katahdin Analytical Services
Number of Days from Analysis: Samples may be disposed of 90 days after report mail date
Sample Receipt (Personnel/Organization): Sample Receipt Personnel/Katahdin Analytical Services

SAP Worksheet #27 – Sample Custody Requirements Table
(UFP-QAPP Manual Section 3.3.3)

Laboratory Custody

Custody seals are supplied with all bottle orders and will be affixed to each cooler after sampling. An example of a custody seal is given in Appendix G. The presence or absence of custody seals will be noted on the Sample Receipt Condition Report (SRCR) (see below).

Upon receipt of samples from the field, laboratory sample management personnel will sign the chain-of-custody, open the sample cooler(s), verify sample integrity, and conduct a check against the chain-of-custody. If there is a discrepancy or problem (e.g., broken sample containers), the laboratory will contact the PM or other qualified personnel and resolve the issue. Additionally, the laboratory completes a SRCR, which documents visual inspection of the samples and specific parameters such as cooler temperature, holding times, and preservation. Discrepancies or changes will be documented on the SRCR. An example chain-of-custody and a blank Sample Receipt Condition Report is provided is Appendix G.

Laboratory sample management personnel assign a unique laboratory work order number for entire sample set listed on the chain-of-custody. The samples are then logged into the Laboratory Information System (LIMS) and a Login Chain-of-Custody Report is generated Each sample within a work order is labeled numerically. Each container of a particular sample is uniquely identified by adding an alphabetical suffix to the sample number. The laboratory labels each sample container with a Laboratory Custody Label that will remain on the sample bottle for the duration of laboratory sample storage. The laboratory also initiates the appropriate Internal Custody Record for the sample set. Personnel fill out the Internal Custody Records to document sample removal from and return to sample storage. An example Login Chain-of-Custody Report, Sample Custody Label, and Internal Custody Record is provided in Appendix G.

A laboratory data file is also initiated for the work order. This file includes the Login Chain-of-Custody Report, the field chain-of-custody, and SRCR. The folder also includes a Login File Sheet that summarizes the analyses for which the work order has been logged. This sheet is used to track data completion.

Samples for a project may be batched or grouped together by the laboratory. A series of batched work orders is referred to as a Sample Delivery Group (SDG). The SDG typically includes those samples received together on a chain-of-custody, duplicate samples, and field QA/QC samples and can include samples of different media. QA/QC samples will be run at the frequency specified in the analytical methods. Each SDG is given a specific identification number.

Samples are stored at the laboratory in refrigerators prior to, during, and after analysis. Refrigerators at the laboratory are constantly monitored for temperature. Proper temperatures and lighting are maintained in the refrigerators to ensure sample integrity and preservation. Samples are retained by the laboratory for a period of 90 days after the data report is mailed to the client, unless otherwise specified in a client contract. The laboratory then disposes of non-hazardous samples following certified disposal practices. Hazardous samples are either returned to the client or disposed through a licensed broker. Documentation of disposal is maintained by the laboratory.

Refer to Katahdin Analytical Services SOPs SD-902 Sample Receipt and Internal Control and SD-903 Sample Disposal for more information.

Field Custody

Sample custody is discussed in SOP SA-6.3 in Appendix C.

SAP Worksheet #28 -- Laboratory QC Samples Table
(UFP-QAPP Manual Section 3.4)

Matrix	Soil, Sediment
Analytical Group	PCBs
Analytical Method/SOP Reference	SW-846 8082/ CA-329

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analyte detected > QL.	(1) Investigate source of contamination. (2) Evaluate the samples and associated QC, i.e., If the blank results are above the QL, report sample results which are < QL or > 10X the blank concentration. (3) Otherwise, re-prepare a blank and samples > QL and < 10 X QL.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-contamination	No analyte > QL.
Laboratory Control Sample (LCS)	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs.	(1) If an MS/MSD was performed and acceptable, narrate. (2) If an LCS/LCSD was performed and only one of the set was unacceptable, then narrate. (3) If the LCS recovery is high but the sample results are < QL, then narrate. Otherwise, re-extract blank and affected sample batch.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived acceptance limits.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs.	Evaluate the samples and associated QC. If the LCS results are acceptable, then narrate. If both the LCS and MS/MSD are unacceptable, reprepare the samples and QC.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived acceptance limits.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided Appendix D with lab SOPs. RPD ≤50%	See above.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias and Precision	Statistically derived acceptance limits. RPD ≤ 50%.

Matrix	Soil, Sediment
Analytical Group	PCBs
Analytical Method/SOP Reference	SW-846 8082/ CA-329

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogates	Two per sample	Statistically derived. Tetrachloro-m-xylene: 56 to 115 % recovery Decachlorobiphenyl: 59 to 124 % recovery	(1) No corrective action will be taken when one surrogate is within criteria. (2) If surrogates are outside high and sample is <QL, then no corrective action taken. (3) If surrogates are outside low then the affected samples are re-extracted and reanalyzed.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived. Tetrachloro-m-xylene: 56 to 115 % recovery Decachlorobiphenyl: 59 to 124 % recovery

Matrix	Aqueous
Analytical Group	PCBs
Analytical Method/SOP Reference	SW-846 8082/ CA-329

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analyte detected > QL.	(1) Investigate source of contamination. (2) Evaluate the samples and associated QC, i.e., If the blank results are above the QL, then report sample results which are < QL or > 10X the blank concentration. (3) Otherwise, reprepare a blank and samples > QL and < 10 X QL.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-contamination	No analyte detected > QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs.	(1) If an MS/MSD was performed and acceptable, then narrate. (2) If an LCS/LCSD was performed and only one of the set was unacceptable, then narrate. (3) If the LCS recovery is high but the sample results are < QL, then narrate. Otherwise, re-extract blank and affected sample batch.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived acceptance limits.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with lab SOPs.	(1) Evaluate the samples and associated QC. (2) If the LCS results are acceptable, then narrate. (3) If both the LCS and MS/MSD are unacceptable, then reprepare the samples and QC.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived acceptance limits.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs. RPD ≤30%	See above.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias and Precision	Statistically derived acceptance limits. RPD ≤ 30%

Matrix	Aqueous
Analytical Group	PCBs
Analytical Method/SOP Reference	SW-846 8082/ CA-329

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogates	Two per sample	Statistically derived limits. Tetrachloro-m-xylene: 62 to 111 percent recovery Decachlorobiphenyl: 44 to 135 percent recovery	1) No corrective action will be taken when one surrogate is within criteria. 2) If surrogates are outside high and sample is <QL, then no corrective action taken. 3) If surrogates are outside low, then the affected samples are re-extracted and reanalyzed.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived limits. Tetrachloro-m-xylene: 62 to 111 percent recovery Decachlorobiphenyl: 44 to 135 percent recovery

Matrix	Aqueous
Analytical Group	VOCs
Analytical Method/SOP Reference	SW-846 8260B/ CA-202

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analyte detected > QL, except for common laboratory contaminants methylene chloride, acetone and 2-butanone - 2X.	(1) Investigate source of contamination. (2) Rerun method blank prior to analysis of samples if possible. (3) Evaluate the samples and associated QC: if blank results are above QL, then report sample results which are < QL or > 10X the blank concentration. (4) Reanalyze blank and samples > QL and < 10X the blank.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-contamination	No analyte detected > QL.

Matrix	Aqueous
Analytical Group	VOCs
Analytical Method/SOP Reference	SW-846 8260B/ CA-202

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs.	(1) Evaluate and reanalyze if possible. (2) If the LCS recoveries are high but the sample results are < QL, then narrate. (3) Otherwise re-prepare and reanalyze	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Katahdin Analytical Services statistically derived limits.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Katahdin Analytical Services statistically derived limits.	(1) Corrective action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable, then re-prepare the samples and QC.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Katahdin Analytical Services statistically derived limits.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Katahdin Analytical Services statistically derived limits, RPD $\leq$ 30%.	See above.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias & Precision	Katahdin Analytical Services statistically derived limits, RPD $\leq$ 30%.
Internal Standards (ISs)	Each field and QC sample.	IS area -50% to +100% compared to IS from CV; IS RT window $\pm$ 0.5 minutes compared to CV RT.	Reanalyze affected samples.	Analyst	Accuracy	IS area -50% to +100% compared to IS from CV; IS RT window $\pm$ 0.5 minute compared to CV RT.
Surrogates	Four per sample	Statistically derived acceptance limits. Percent recoveries Dibromofluoromethane: 79 to 110 1,2-dichloroethane-d4: 72 to 117 Toluene-d8: 74 to 113 4-Bromofluorobenzene: 73 to 110	If sample volume available, and within hold time, then reanalyze.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived acceptance limits. Percent recoveries: Dibromofluoromethane: 79 to 110 1,2-dichloroethane-d4: 72 to 117 Toluene-d8: 74 to 113 4-Bromofluorobenzene: 73 to 110

Matrix	Soil, Sediment
Analytical Group	VOCs
Analytical Method/SOP Reference	SW-846 8260B/ CA-202

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analyte detected > QL, except for common lab contaminants methylene chloride, acetone, and 2-butanone - 2X.	(1) Investigate source of contamination. (2) Rerun method blank prior to analysis of samples if possible. (3) Evaluate the samples and associated QC; if blank results are above QL, report sample results which are < QL or > 10X the blank concentration. (4) Reanalyze blank and samples >QL and < 10X the blank.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-contamination	No analyte detected > QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs.	(1) Evaluate and reanalyze if possible. (2) If the LCS recoveries are high but the sample results are <QL narrate. (3) Otherwise re-prepare and reanalyze.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Katahdin Analytical Services statistically derived limits.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Katahdin Analytical Services statistically derived limits. Provided in Appendix D with lab SOPs.	(1) Corrective action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable re-prepare the samples and QC.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Katahdin Analytical Services statistically derived limits.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Katahdin Analytical Services statistically derived limits. Provided in Appendix D with laboratory SOPs. RPD $\leq$ 50%.	See above.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias & Precision	RPD $\leq$ 50%.
ISs	Each field and QC sample	IS area -50% to +100% compared to IS from CV; IS RT window $\pm$ 0.5 minute compared to CV RT.	Reanalyze affected samples.	Analyst	Accuracy	IS area -50% to +100% compared to IS from CV; IS RT window $\pm$ 0.5 minute compared to CV RT.

Matrix	Soil, Sediment
Analytical Group	VOCs
Analytical Method/SOP Reference	SW-846 8260B/ CA-202

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Surrogates	Four per sample	Statistically derived acceptance limits. Percent recoveries: Dibromofluoromethane: 67 to 118 1,2-dichloroethane-d4: 55 to 148 Toluene-d8: 71 to 102 4-Bromofluorobenzene: 53 to 122	If sample volume available and within hold time, then reanalyze.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived acceptance limits. Percent recoveries: Dibromofluoromethane: 67 to 118 1,2-dichloroethane-d4: 55 to 148 Toluene-d8: 71 to 102 4-Bromofluorobenzene: 53 to 122

Matrix	Aqueous
Analytical Group	PAHs
Analytical Method/SOP Reference	SW-846 8270C SIM/CA-213

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analyte detected > QL.	(1) Investigate source of contamination. (2) Evaluate the samples and associated QC; if blank results are above QL, then report sample results which are < QL or > 10X the blank concentration. (3) Reprepare and analyze method blank and all samples processed with the contaminated blank.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-contamination	No analyte detected > QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs.	(1) Evaluate and reanalyze if possible. (2) If an MS/MSD was extracted in the same extraction batch and acceptable narrate. (3) If the LCS recoveries are high but the sample results are <QL, then narrate. (4) Otherwise re-prepare and reanalyze.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Katahdin Analytical Services statistically derived limits.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Katahdin Analytical Services statistically derived limits. Provided in Appendix D with laboratory SOPs.	(1) Corrective action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable re-prepare the samples and QC.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Katahdin Analytical Services statistically derived limits.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Katahdin Analytical Services statistically derived limits. Provided in Appendix D with laboratory SOPs. RPD $\leq$ 30%.	See above.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias and precision	Katahdin Analytical Services statistically derived limits. RPD $\leq$ 30%.

Matrix	Aqueous
Analytical Group	PAHs
Analytical Method/SOP Reference	SW-846 8270C SIM/CA-213

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
ISs	Each field and QC sample.	IS area -50% to +100% compared to IS from CV; IS RT window ± 0.5 minute compared to CV RT.	Reanalyze affected samples.	Analyst	Accuracy	IS area -50% to +100% compared to IS from CV; IS RT window ± 0.5 minutes compared to CV RT.
Surrogates	Three per sample	Statistically derived acceptance limits. Percent recoveries: 2-Methylnaphthalene-D10: 34 to 110 Fluorene-D10: 46 to 122 Pyrene-D10: 36 to 134	If sample volume available and within hold time, then reanalyze.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived acceptance limits. Percent recoveries 2-Methylnaphthalene-D10: 34 to 110 Fluorene-D10: 46 to 122 Pyrene-D10: 36 to 134

Matrix	Soil, Sediment
Analytical Group	PAHs
Analytical Method/SOP Reference	SW-846 8270C SIM/CA-204

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No analyte detected > QL.	(1) Investigate source of contamination. (2) Evaluate the samples and associated QC; if blank results are above QL, then report sample results which are < QL or > 10X the blank concentration. (3) Reprepare and analyze method blank and all samples processed with the contaminated blank	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-contamination	No analyte detected > QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs.	(1) Evaluate and reanalyze if possible. (2) If an MS/MSD was extracted in the same extraction batch and acceptable, then narrate. (3) If the LCS recoveries are high but the sample results are <QL, then narrate (4) Otherwise reprepare and reanalyze.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Katahdin Analytical Services statistically derived limits.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs.	(1) Corrective action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable, then reprepare the samples and QC.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Katahdin Analytical Services statistically derived limits.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Statistically derived acceptance limits. Provided in Appendix D with laboratory SOPs. RPD $\leq$ 50%	See above.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias and precision	Katahdin Analytical Services statistically derived limits. RPD $\leq$ 50%.

Matrix	Soil, Sediment
Analytical Group	PAHs
Analytical Method/SOP Reference	SW-846 8270C SIM/CA-204

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
ISs	Each field and QC sample.	IS area -50% to +100% compared to IS from CV; IS RT window ± 0.5 minute compared to CV RT	Reanalyze affected samples.	Analyst	Accuracy	IS area -50% to +100% compared to IS from CV; IS RT window ± 0.5 minute compared to CV RT.
Surrogates	Three per sample	Statistically derived acceptance limits. Percent recoveries 2-Methylnaphthalene-D10: 33 to 125 Fluorene-D10: 53 to 136 Pyrene-D10: 16 to 162	f sample volume available, and within hold time, then reanalyze.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Statistically derived acceptance limits. Percent recoveries 2-Methylnaphthalene-D10: 33 to 125 Fluorene-D10: 53 to 136 Pyrene-D10: 16 to 162

Matrix	Aqueous
Analytical Group	Metals – ICP
Analytical Method/SOP Reference	SW-846 6010B/ CA-608

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank	One per preparation batch of twenty or fewer samples of similar matrix.	Absolute value < QL.	(1) Investigate source of contamination. (2) If blank value > QL, then report sample results. If <QL or > 10 x, then report the blank value. (3) Otherwise redigest.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-	Absolute value < QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery within ± 20% of true value.	(1) If the LCS recoveries are >120 % but the sample results are <QL, then narrate. (2) Re-digest and reanalyze all associated samples for affected analytes.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	80 to 120 % recovery.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value.	(1) Flag results for affected analytes for all associated samples with “N.” (2) Perform post-digestion spike for all failing elements.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias, precision	75 to 125 % recovery.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value. RPD ≤ 20%.	See Above. If RPD >20%, then flag results for affected analytes for all associated samples with ”*.”	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	75 to 125 percent recovery. RPD ≤ 20 %.
Serial Dilution	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x Instrument Detection Limit (IDL), five-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E.”	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias, precision	If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.

Matrix	Soil, Sediment
Analytical Group	Metals – ICP
Analytical Method/SOP Reference	SW-846 6010B/ CA-608

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank	One per preparation batch of twenty or fewer samples of similar matrix.	Absolute value < QL.	(1) Investigate source of contamination. (2) If blank value > QL, then report sample results. If < QL or > 10 x, then report the blank value. (3) Otherwise redigest.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-	Absolute value < QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery within reference limits supplied by Standard Reference Material (SRM) vendor.	(1) If the LCS recoveries are > the vendor upper limit but the sample results are <QL, then narrate. (2) Re-digest and reanalyze all associated samples for affected analytes.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Recovery within reference limits supplied by SRM vendor.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value.	(1) Flag results for affected analytes for all associated samples with “N.” (2) Perform post-digestion spike for all failing elements.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias, precision	75 to 125 % recovery.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value. RPD ≤ 20%.	See Above. If RPD > 20%, then flag results for affected analytes for all associated samples with ”*.”	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	75 to 125 % recovery. RPD ≤ 20%.
Serial Dilution	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x IDL, five-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E.”	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias, precision	If original sample result is at least 50x IDL, five-fold dilution must agree within ± 10% of the original result.

Matrix	Aqueous
Analytical Group	Metals – ICPMS
Analytical Method/SOP Reference	SW-846 6020/ CA-627

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank	One per preparation batch of twenty or fewer samples of similar matrix.	Absolute value < QL.	(1) Investigate source of contamination. (2) If blank value > QL then report sample results. If <QL or > 10 x, then report the blank value (3) Otherwise re-digest.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-	Absolute value < QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery within ± 20% of true value.	(1) If the LCS recoveries are > 120 % but the sample results are <QL, then narrate (2) Re-digest and reanalyze all associated samples for affected analytes.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias	80 to 120 % recovery.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value.	(1) Flag results for affected analytes for all associated samples with "N." (2) Perform post-digestion spike for all failing elements.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias, Precision	75 to 125 % recovery.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value. RPD ≤ 20%.	See above. If RPD > 20%, then results for affected analytes for all associated samples with "*."	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	75 to 125 % recovery. RPD ≤ 20%.
Serial Dilution	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x IDL, five-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with "E."	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias, Precision	If original sample result is at least 50x IDL, five-fold dilution must agree within ± 10% of the original result.

Matrix	Aqueous
Analytical Group	Metals – ICPMS
Analytical Method/SOP Reference	SW-846 6020/ CA-627

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
ISs	Appropriate IS required for all analytes in all samples. Mass of IS must be <50 amu different from that of analyte.	For each sample, IS intensity must be within 30% to 120% of that of initial calibration standard. For Initial Calibration Vertification (ICV), Initial Calibration Blank (ICB), Continuing Calibration Vertification (CCV), and Continuing Calibration Blank (CCB), IS intensity within 80% to 120% of that in initial calibration standard.	Reanalyze affected samples.	Analyst, Supervisor, Quality Assurance Manager	Accuracy	For each sample, IS intensity must be within 30% to 120% of that of initial calibration standard. For ICV, ICB, CCV, and CCB, IS intensity within 80% to 120% of that in initial calibration standard.

Matrix	Soil, Sediment
Analytical Group	Metals – ICPMS
Analytical Method/SOP Reference	SW-846 6020 / CA-627

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank	One per preparation batch of twenty or fewer samples of similar matrix.	Absolute value < QL.	(1) Investigate source of contamination. (2) If blank value > QL, then sample results. If < QL or > 10 x, then report the blank value (3) Otherwise redigest.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-	Absolute value < QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery within reference limits supplied by SRM vendor.	(1) If the LCS recoveries are > the vendor upper limit but the sample results are <QL, then narrate. (2) Redigest and reanalyze all associated samples for affected analytes.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	Recovery within reference limits supplied by SRM vendor.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value.	(1) Flag results for affected analytes for all associated samples with "N." (2) Perform post-digestion spike for all failing elements.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias, precision	75 to 125% recovery.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value. RPD ≤ 20%.	See above. If RPD > 20%, then flag results for affected analytes for all associated samples with "*."	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	75 to 125 % recovery. RPD ≤ 20%.
Serial Dilution	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x IDL, five-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with "E."	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias, precision	If original sample result is at least 50x IDL, five-fold dilution must agree within ± 10% of the original result.
ISs	Appropriate IS required for all analytes in all samples. Mass of IS must be <50 amu different from that of analyte.	For each sample, IS intensity must be within 30% to 120% of that of initial calibration standard. For ICV, ICB, CCV, and CCB, IS intensity within 80% to 120% of that in initial calibration standard.	Reanalyze affected samples.	Analyst, Supervisor, Quality Assurance Manager	Accuracy	For each sample, IS intensity must be within 30% to 120% of that of initial calibration standard. For ICV, ICB, CCV, and CCB, IS intensity within 80% to 120% of that in initial calibration standard.

Matrix	Aqueous
Analytical Group	Metals – Mercury
Analytical Method/SOP Reference	SW-846 7470A/ CA-615

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank	One per preparation batch of twenty or fewer samples of similar matrix.	Absolute value < QL.	(1) Investigate source of contamination. (2) If blank value > QL, then report sample results if < QL or > 10 x, then report the blank value. (3) Otherwise re-digest.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-	Absolute value < QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery within ± 20% of true value.	(1) If the LCS recoveries are > 120 % but the sample results are <QL, then narrate. (2) Re-digest and reanalyze all associated samples.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias	80-120 % recovery.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value.	(1) Flag results for affected analytes for all associated samples with "N." (2) Perform post-digestion spike for all failing elements.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias, Precision	75 to 125 percent recovery.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value. RPD ≤ 20%.	See above. If RPD > 20%, then flag results for affected analytes for all associated samples with "*."	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	75 to 125 percent recovery. RPD ≤ 20%.
Serial Dilution	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with "E."	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias, Precision	If original sample result is at least 50x IDL, five-fold dilution must agree within ± 10% of the original result.

Matrix	Soil, Sediment
Analytical Group	Metals – Mercury
Analytical Method/SOP Reference	SW-846 7471A/ CA-611

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Preparation Blank	One per preparation batch of twenty or fewer samples of similar matrix.	Absolute value < QL.	(1) Investigate source of contamination. (2) If blank value > QL, then report sample results. If < QL or > 10 x, then report the blank value (3) Otherwise re-digest.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias-	Absolute value < QL.
LCS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery within reference limits supplied by SRM vendor.	(1) If the LCS recoveries are > the vendor upper limit but the sample results are <QL, then narrate. (2) Re-digest and reanalyze all associated samples.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias	Recovery within reference limits supplied by SRM vendor.
MS	One per preparation batch of twenty or fewer samples of similar matrix.	Recovery ± 25 % of true value, if sample < 4x spike value.	(1) Flag results for affected analytes for all associated samples with “N.” (2) Perform post-digestion spike for all failing elements.	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias, Precision	75 to 125 % recovery.
MSD	One per preparation batch of twenty or fewer samples of similar matrix.	RPD ≤ 20%.	See above. If RPD > 20%, then flag results for affected analytes for all associated samples with ”*.”	Analyst, Supervisor, Quality Assurance Manager	Accuracy/bias	75 to 125 % recovery. RPD ≤ 20%.
Serial Dilution	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x IDL, five-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E.”	Analyst, Supervisor, Quality Assurance Manager	Accuracy/Bias, Precision	If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.

SAP Worksheet #29 -- Project Documents and Records Table
(UFP-QAPP Manual Section 3.5.1)

Document	Where Maintained
Sample Collection Documents and Records Field logbook (and sampling notes) Field sample forms (e.g., boring logs, sample log sheets, drilling logs, etc.) Chain-of-custody records Sample shipment airbills Equipment calibration logs Photographs Field Task Modification Request Forms Sampling and Analysis Plan Field Sampling SOPs	TtNUS Project File, results will be discussed in subject document.
Laboratory Documents and Records Sample receipt/login forms Sample storage records Sample preparation logs Standard traceability logs Equipment calibration logs Sample analysis run logs Equipment maintenance, testing, and inspection logs Corrective action forms Reported field sample results Reported results for standards, quality control checks, and quality control samples Data completeness checklists Sample storage and disposal records Telephone logs Extraction/clean-up records Raw data	TtNUS Project File, long-term data package storage at third-party professional document storage firm, results will be discussed in subject document.
Data Assessment Documents and Records Field Sampling Audit Checklist (if an audit is conducted) Analytical Audit Checklist (if an audit is conducted) Data Validation Memoranda	TtNUS Project File, results will be discussed in subject document.

SAP Worksheet #30 -- Analytical Services Table
(UFP-QAPP Manual Section 3.5.2.3)

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical Method	Data Package Turnaround Time	Laboratory/Organization	Backup Laboratory/ Organization
Soil, Sediment, and Aqueous	TCL VOCs	See Worksheet #18	SW-846 8260B	28 calendar days	Andrea Colby Katahdin Analytical Services 600 Technology Way Scarborough, ME 04074 Telephone: (207) 874-2400	NA
	PAHs	See Worksheet #18	SW-846 8270C	28 calendar days	Same as above	NA
	PCBs	See Worksheet #18	SW-846 8082	28 calendar days	Same as above	NA
	TAL Metals	See Worksheet #18	SW-846 6010B or 6020 7470A/7471A	28 calendar days	Same as above	NA

SAP Worksheet #31 -- Planned Project Assessments Table
(UFP-QAPP Manual Section 4.1.1)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
Field Supervision	Daily during sampling events	Internal	TtNUS	TtNUS FOL (TBD)	TtNUS FOL (TBD)	TtNUS FOL and field crew	TtNUS FOL, PM (Mark Sladic), and TtNUS QAM (Kelly Carper)
Project Supervision	Every sampling event	Internal	TtNUS	TtNUS PM (Mark Sladic)	TtNUS FOL (TBD)	TtNUS PM (Mark Sladic) and FOL	TtNUS PM (Mark Sladic) and FOL
Field Sampling System Audit	One per contract year [1]	Internal	TtNUS	TBD	TtNUS PM (Mark Sladic) and FOL	Field auditor and PM	TtNUS QAM (Kelly Carper)
Laboratory System Audit [2]	Every 18 months	External	NFESC	NFESC	Laboratory QAM or Laboratory Manager	Laboratory Manager and Laboratory QAM	NFESC

1 Project to be audited is determined at the TtNUS program level.
2 The analytical laboratory, Katahdin Analytical Services, Inc., located in Scarborough, Maine, has successfully completed the laboratory evaluation process as part of the Naval Facilities Engineering Service Center (NFESC) QA Program as described in the Department of Defense (DoD) Quality Systems Manual (QSM) (January 2006). The laboratory has been approved by the Navy for the analytical methods listed in this SAP.

SAP Worksheet #32 -- Assessment Findings and Corrective Action Responses
(UFP-QAPP Manual Section 4.1.2)

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Field Supervision	Site Log Book and sample collection logs	Mark Sladic, TtNUS PM TBD, TtNUS FOL	Immediately	Entry in site logbook	Mark Sladic, PM, TtNUS TBD, FOL, TtNUS	24 hours
Project Supervision	Written report	Debra Humbert, TtNUS Program Manager Mark Perry, TtNUS Deputy Program Manager	Monthly	Written memo	Debra Humbert, TtNUS Program Manager, Mark Perry, TtNUS Deputy Program Manager	Within one week of notification
Field Sampling System Audit	Audit checklist and written audit finding summary	Mark Sladic, TtNUS PM TBD, FOL, TtNUS Debra Humbert, TtNUS Program Manager Mark Perry, TtNUS Deputy Program Manager	Dependant on the finding. If major a stop work may be issued immediately; however, if minor, within 1 week of audit	Written memo	Kelly Carper, TtNUS QAM TBD, TtNUS Field Auditor Debra Humbert, TtNUS Program Manager Mark Perry, TtNUS Deputy Program Manager	Within 48 hours of notification
Laboratory System Audit	Written audit report	Laboratory Manager Laboratory QAM	Not specified by NFESC	Letter	NFESC	Specified by NEFSC

SAP Worksheet #33 -- QA Management Reports Table
(UFP QAPP Manual Section 4.2)

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Data validation report	Per SDG	Completion of data validation	TtNUS DVM and staff chemists	TtNUS PM and project file
Major analysis problem identification (internal memo)	When persistent analysis problems are detected	Immediately	TtNUS QAM	TtNUS PM, TtNUS QAM, Program Manager, and project file
Project monthly progress report	Monthly for duration of project	Monthly	TtNUS PM	Navy, project file
Field progress reports	Daily, oral, during the course of sampling	Every day that field sampling is occurring	TtNUS FOL	TtNUS PM
Laboratory QA report	When significant plan deviations result from unanticipated circumstances	Immediately	Katahdin Analytical Services PM	TtNUS project file
Audit report(s)	In conjunction with audits	After completion of audits (usually 3 weeks)	TtNUS or Third Party Auditor(s)	TtNUS PM, TtNUS QAM, and audited entity

SAP Worksheet #34 -- Verification (Step I) Process Table
(UFP-QAPP Manual Section 5.2.1)

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Chain-of-custody forms	The TtNUS FOL (or designee) will review and sign the chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and that the sample information is accurate. The forms will be signed by the sampler, and a copy will be retained for the project file, TtNUS PM, and data validators. See SOP SA-6.3	Internal	TtNUS sampler and FOL
SAP sample tables	Verify that all proposed samples listed in the SAP tables have been collected.	Internal	TtNUS FOL or designee
Sample log sheets	Verify that information recorded on the log sheets is accurate and complete.	Internal	TtNUS FOL or designee
Sample coordinates	Verify that sample locations are correct and in accordance with the SAP proposed locations.	Internal	TtNUS FOL or designee
Field QC samples	Check that field QC samples listed in Worksheet #20 were collected as required.	Internal	TtNUS FOL or designee
Chain-of-custody forms	The laboratory sample custodian will review the sample shipment for completeness and integrity, and will sign accepting the shipment. The data validators will check that the chain-of-custody form was signed/dated by the TtNUS FOL or designee relinquishing the samples and also by the laboratory sample custodian receiving the samples for analyses.	Internal/ External	1 - Laboratory sample custodian 2 - TtNUS data validators
Analytical data package	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The Laboratory QAM will sign the case narrative for each data package.	Internal	Laboratory QAM (Katahdin Analytical Services)
Analytical data package	The data package will be verified for completeness by TtNUS data validators. Missing information will be requested from the laboratory, and validation will be suspended until missing data are received.	External	TtNUS data validators
Analytical data package and Electronic data deliverables	The electronic data will be verified against the chain-of-custody and hard copy data package for accuracy and completeness. Laboratory analytical results will be verified and compared to the electronic analytical results for accuracy. Sample results will be evaluated for laboratory contamination and will be qualified for false positives using the laboratory method/preparation blank summaries. Positive results reported between the method detection limit and the reporting limit will be qualified as estimated. Extraneous laboratory qualifiers will be removed from the validation qualifier.	External	TtNUS data validators

SAP Worksheet #35 -- Validation (Steps IIa and IIb) Process Table

(UFP-QAPP Manual Section 5.2.2) (Figure 37 UFP-QAPP Manual) (Table 9 UFP-QAPP Manual)

Step IIa/ IIb	Validation Input	Description	Responsible for Validation
IIa	Field SOPs/Field Logs/Sample Collection	Ensure that all sampling SOPs were followed. Verify that deviations have been documented and MPCs have been achieved. Particular attention should be given to verify that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken trail of documented chain-of-custody from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented.	TtNUS PM, FOL or designee
IIa	Analytical SOPs	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Laboratory QAM, Katahdin Analytical Services
IIa	Documentation of Method QC Results	Establish that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the laboratory will contact TtNUS for guidance prior to report preparation.	Laboratory QAM, Katahdin Analytical Services
IIa	Chain-of-custody	Ensure that the custody and integrity of the samples was maintained from collection to analysis and that custody records are complete and any deviations are recorded.	TtNUS project chemist or data validators
IIa	Holding Times	Review that the samples were shipped and stored at the required temperature and that sample pH values for chemically preserved samples meet the requirements listed in Worksheet #19. Ensure that the analyses were performed within the holding times listed in Worksheet #19.	TtNUS project chemist or data validators
IIa/IIb	Laboratory Data Results for Accuracy	Ensure that the laboratory QC samples listed in Worksheet #28 were analyzed and that the measurement performance criteria (MPC) listed in Worksheet #12 were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical quality control criteria set up for this project were met.	TtNUS project chemist or data validators
IIa/IIb	Field and Laboratory Duplicate Analyses for Precision	Check the field sampling precision by calculating the RPD for field duplicate samples. Check the laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; MS/MSD; and LCS/LCSD. Ensure compliance with the methods and project MPC accuracy goals listed in Worksheet #12.	TtNUS project chemist or data validators
IIa/IIb	Sample Results for Representativeness	Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis.	TtNUS project chemist or data validators
IIa/IIb	Project Action Limits	Discuss the impact on matrix interferences or sample dilutions, performed because of the high concentration of one or more contaminant, on the other target compounds reported as non-detected. Document this usability issue and inform the TtNUS PM.	TtNUS project chemist or data validators

Step IIa/ IIb	Validation Input	Description	Responsible for Validation
IIa/IIb	Data Validation Reports	Summarize deviations from methods, procedures, or contracts. Qualify data results based on method or QC deviations and explain all the data qualifications. Print a copy of the project database qualified data depicting data qualifiers and data qualifiers codes that summarize the reason for data qualifications. Determine if the data met the MPCs and determine the impact of any deviations on the technical usability of the data.	TtNUS project chemist or data validators
IIa, IIb	SAP QC Sample Documentation	Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within prescribed SAP acceptance limits. Ensure that QC samples and standards prescribed in analytical SOPs were analyzed and within the prescribed control limits. If any significant QC deviations occur, the laboratory shall have contacted the TtNUS PM.	TtNUS PM or designee
IIa, IIb	Documentation of Analytical Reports for Completeness	Ensure from the chain-of-custody form generated in the field that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied throughout the sample handling process. Validator will verify that elements of the data package required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed in accordance with Worksheet #36. Check that all data have been transferred correctly and completely to the final Structured Query Language (SQL) database.	TtNUS project chemist or data validators
IIa/IIb	Project Action Limits	Review and add PALs to the laboratory electronic data deliverable. Flag samples and notify TtNUS PM of samples that exceed PALs as listed on Worksheet #15.	TtNUS PM or designee
IIb	Project Quantitation Limits for Sensitivity	Ensure that the PQLs listed in Worksheet #15 were achieved.	TtNUS project chemist or data validators
IIb	Analytical Data Deviations	Determine the impact of any deviations from sampling or analytical methods, and SOP requirements, and matrix interferences effect on the analytical results.	TtNUS project chemist or data validators

SAP Worksheet #36 –Analytical Data Validation (Steps IIa and IIb) Summary Table
(UFP-QAPP Manual Section 5.2.2.1)

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa and IIb	Soil, Sediment, and Aqueous	TCL VOCs, PAHs, and PCBs	100% limited (i.e., no raw data are required and calculations are not checked) data validation will be performed. SW-846 8260B, 8270C, and 8082 method-specific criteria and those criteria listed in Worksheets #s 12, 15 and 28. If not included in Worksheet #s 12, 15 or 28, the logic outlined in USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review EPA-540/R-99-008, October 1999, will be used to apply qualifiers to data.	TtNUS Data Validatiors
IIa and IIb	Soil, Sediment, and Aqueous	TAL Metals	100% limited (i.e., no raw data is required and calculations are not checked) data validation will be performed. SW-846 6010B and 6020 method specific criteria and those listed in Worksheets #12, #15 and #28. If not included in Worksheet #12, #15 or #28, the logic outlined in USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review EPA 540-R-04-004, October 2004, will be used to apply qualifiers to data.	TtNUS Data Validatiors

SAP Worksheet #37 -- Usability Assessment
(UFP-QAPP Manual Section 5.2.3)

Data Usability Assessment
The usability of the data directly affects whether project objectives can be achieved. The following characteristics will be evaluated at a minimum. The results of these evaluations will be included in the project report. The characteristics will be evaluated for multiple concentration levels if the evaluator determines that this is necessary. To the extent required by the type of data being reviewed, the assessors will consult with other technically competent individuals to render sound technical assessments of these data characteristics: **Completeness** ○ For each matrix that was scheduled to be sampled, the FOL acting on behalf of the project team will prepare a table listing planned samples/analyses to collected samples/analyses. If deviations from the scheduled sample collection or analyses are identified the TtNUS PM and risk assessor will determine whether the deviations compromise the ability to meet project objectives. If they do, the TtNUS PM will consult with the Navy RPM and other project team members, as necessary (determined by the Navy RPM), to develop appropriate corrective actions. **Precision** ○ The Project Chemist acting on behalf of the project team will determine whether precision goals for field duplicates and laboratory duplicates were met. This will be accomplished by comparing duplicate results to precision goals identified in Worksheets 12 and 28. This will also include a comparison of field and laboratory precision with the expectation that field duplicate results will be no less precise than laboratory duplicate results. If the goals are not met, or data have been flagged as estimated (J qualifier), limitations on the use of the data will be described in the project report. **Accuracy** ○ The Project Chemist acting on behalf of the project team will determine whether the accuracy/bias goals were met for project data. This will be accomplished by comparing percent recoveries of LCS, LCSD, MS, MSD, and surrogate compounds to accuracy goals identified in Worksheet 28. This assessment will include an evaluation of field and laboratory contamination; instrument calibration variability; and analyte recoveries for surrogates, matrix spike, and laboratory control samples. If the goals are not met, limitations on the use of the data will be described in the project report. Bias of the qualified results and a description of the impact of identified non-compliances on a specific data package or on the overall project data will be described in the project report. **Representativeness** ○ A project scientist identified by the TtNUS PM and acting on behalf of the project team will determine whether the data are adequately representative of intended populations, both spatially and temporally. This will be accomplished by verifying that samples were collected and processed for analysis in accordance with the SAP, by reviewing spatial and temporal data variations, and by comparing these characteristics to expectations. The data usability report will describe the representativeness of the data for each matrix and analytical fraction. This will not require quantitative comparisons unless the project scientist determines that a quantitative analysis is required. **Comparability** ○ The Project Chemist acting on behalf of the project team will determine whether the data generated under this project are sufficiently comparable to historical site data generated by different methods and for samples collected using different procedures and under different site

conditions. This will be accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction. This will not require quantitative comparisons unless the Project Chemist determines that such quantitative analysis is required.

Sensitivity

- The Project Chemist acting on behalf of the project team will determine whether project sensitivity goals listed in Worksheet #15 are achieved. The overall sensitivity and quantitation limits from multiple data sets for each matrix and analysis will be compared. If sensitivity goals are not achieved, the limitations on the data will be described. The Project Chemist will enlist the help of the project risk assessor to evaluate deviations from planned sensitivity goals.

Project Assumptions and Data Outliers

- The TtNUS Project Manager and designated team members will evaluate whether project assumptions are valid. This will typically be a qualitative evaluation. The type of evaluation depends on the assumption being tested. Potential outliers will be removed if a review of the associated indicates that the results have an assignable cause that renders them inconsistent with the rest of the data. During this evaluation, the team will consider whether outliers could be indications of unanticipated site conditions.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

After completion of the data validation, the data and data quality will be reviewed to determine whether sufficient data of acceptable quality are available for decision making. In addition to the evaluations described above, a series of inspections and statistical analyses will be performed to estimate these characteristics. The statistical evaluations will include simple summary statistics for target analytes, such as maximum concentration, minimum concentration, number of samples exhibiting non-detected results, number of samples exhibiting positive results, and the proportion of samples with detected and non-detected results. The project team members identified by the project manager will assess whether the data collectively support the attainment of project objectives. They will consider whether any missing or rejected data have compromised the ability to make decisions or to make the decisions with the desired level of confidence. The data will be evaluated to determine whether missing or rejected data can be compensated by other data. Although rejected data will generally not be used, there may be reason to use them in a weight of evidence argument, especially when they supplement data that have not been rejected. If rejected data are used, their use will be supported by technically defensible rationales.

For statistical comparisons and mathematical manipulations, non-detected values will be represented by a concentration equal to one-half the sample-specific reporting limit. Duplicate results (original and duplicate) will not be averaged for the purpose of representing the range of concentrations. However, the average of the original and duplicate samples will be used to represent the concentration at a particular sampled location.

Identify the personnel responsible for performing the usability assessment:

The TtNUS Project Manager, Project Chemist, FOL, and Project Scientist will be responsible for conducting the listed data usability assessments. The data usability assessment will be reviewed with the Navy RPM, TtNUS Project Manager, and the EPA Remedial Project Manager. If deficiencies affecting the attainment of project objectives are identified, the review will take place either in a face to face meeting or a teleconference depending on the extent of identified deficiencies. If no significant deficiencies are identified, the data usability assessment will simply be documented in the project report and reviewed during the normal document review cycle.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

The data will be presented in tabular format, including data qualifications such as estimation (J, UJ) or rejection (R). Written documentation will support the non-compliance estimated or rejected data results. The project report will identify and describe the data usability limitations and suggest re-sampling or other corrective actions, if necessary.