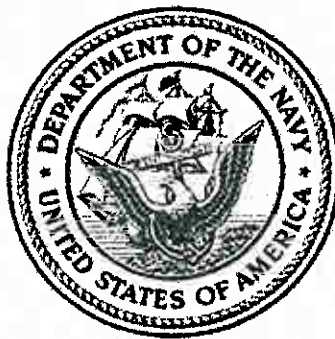


**Sampling and Analysis Plan
for
Landfill Delineation**

Site 3 - Ninth Street Landfill

**Naval Air Station
Joint Reserve Base
Willow Grove, Pennsylvania**



**Naval Facilities Engineering Command
Mid-Atlantic**

**Contract Number N62467-04-D-0055
Contract Task Order 412**

November 2008



TETRA TECH

Project-Specific SAP
Site Name/Project Name: NAS JRB Willow Grove
Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill
Revision Number: 0
Revision Date: November 2008

SAP Worksheet #1 -- Title and Approval Page
(UFP-QAPP Manual Section 2.1)

SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
November 2008

LANDFILL DELINEATION
SITE 3 – NINTH STREET LANDFILL
NAVAL AIR STATION JOIN RESERVE BASE
WILLOW GROVE, PENNSYLVANIA

Prepared for:

Naval Facilities Engineering Command Mid-Atlantic
9742 Maryland Avenue
Norfolk, Virginia 23511-3095

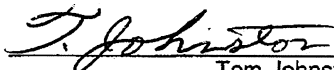
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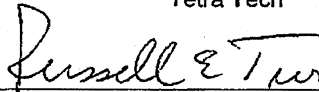
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King Of Prussia, PA 19406
(610) 491-9688

Prepared under:

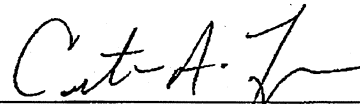
Contract No. N62467-04-D-0055
Contract Task Order 412

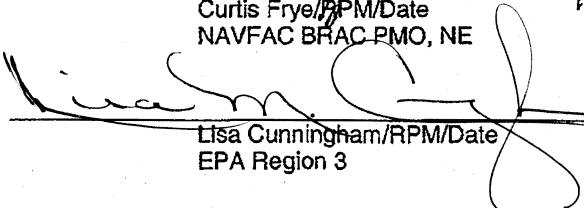
Review Signatures:

 / 11-11-08
Tom Johnston/CLEAN QAM/Date
Tetra Tech

 Nov. 5, 2008
Russell Turner/Project Manager/Date
Tetra Tech

Approval Signatures:

 11/5/2008
Curtis Frye/RPM/Date
NAVFAC BRAC PMO, NE


Lisa Cunningham/RPM/Date
EPA Region 3

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (Tetra Tech) has prepared this Sampling and Analysis Plan (SAP) for the landfill delineation study at Site 3 at the Naval Air Station Joint Reserve Base (NAS JRB) Willow Grove, Pennsylvania under Contract Task Order (CTO) No. 412, Contract N62467-04-D-0055, Comprehensive Long-Term Environmental Action-Navy (CLEAN). Figure 1 shows the locations of the NAS JRB Willow Grove facility and of the Site 3 Ninth Street Landfill (Site 3).

The preliminary draft Remedial Investigation (RI) report for Site 3, reviewed by the Navy in January 2007, concluded that Site 3 soils do not pose a threat to public health or the environment. However, the Navy considered that the soil analytical data generated during the RI up to that time may not have been representative of actual site conditions. In order to be certain that the conclusion of the preliminary draft RI report regarding site soils was correct, the Navy decided to perform additional test pit excavations to document site conditions. Significant quantities of buried waste material at several Site 3 locations were encountered during a subsurface soil test pit and soil sampling investigation performed in April/May 2007.

In April/May 2007, Tetra Tech excavated fourteen test pits as part of the Test Pit Investigation. Test pit locations were chosen in potential historical landfill operations areas based on analysis of historical aerial photography of the site as shown in Figure 3. Five of the fourteen test pits encountered buried charred waste materials consisting of general refuse, shop waste, military refuse and construction debris. Soil samples associated with some of the buried waste contained elevated levels of semivolatile compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), dioxin, and metals.

The purpose of the Landfill Delineation investigation described in this SAP is to delineate the extent of the buried waste and soil contamination discovered during the Test Pit Investigation and to further characterize the soil contamination. This information will be used in the remedial decision process. The Landfill Delineation investigation will include electromagnetic induction (EM) geophysical surveys, additional test pits and soil samples, as well as surface soil samples for ecological screening. Up to eight test pits will be excavated. Eight surface and eight subsurface soil samples will be collected to characterize the nature and extent of the contamination from test pits, and an additional 12 surface soil samples will be collected for analysis and comparison to ecological screening criteria. The overall goal is to support updated human health and ecological risk assessments.

The SAP contained herein was generated for and will comply with applicable Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP), and United States Environmental Protection Agency (EPA) Region 3 requirements, regulations, guidance, and technical standards as appropriate.

This SAP outlines the organization, project management, objectives, planned activities, measurement, data acquisition, assessment, oversight, and data review procedures associated with the planned investigations at Site 3.

The Landfill Delineation investigation will employ EM geophysical surveying to delineate the extent of each known or suspected landfill zone within Site 3. A tight grid pattern will be used around landfill areas discovered during the test pit investigation. A wider grid pattern will be used in areas where no evidence of past landfill operations is apparent. Based on the findings from the EM survey, up to eight test pits will be excavated. The locations of the test pits will be chosen to confirm presence of buried waste where the EM survey indicates buried waste is present, as well as to confirm that no waste is present where the EM survey indicates no waste. Test pits will provide visual confirmation of the presence or absence of buried waste. Where buried waste is encountered, it will be photographed, sampled and a log will be kept to help characterize the nature and extent of the waste for reporting purposes.

Eight surface and eight subsurface soil samples will be collected and analyzed for volatile organic compounds (VOCs), SVOCs, pesticides, PCBs, metals, and cyanide. The samples will be chosen based on direct (visual or olfactory) evidence of contamination, or on the highest photoionization detector (PID) screening responses. All surface soil samples will be analyzed by analytical methods sufficient to provide the detection limits required for comparison of results to typical ecological risk screening values. One subsurface dioxin sample and duplicate will be collected from an area showing evidence of charred waste.

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove
Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0
Revision Date: November 2008

Protocols for sample collection, handling, and storage, chain-of-custody, laboratory and field analyses, data validation, and reporting are also addressed in this SAP. The investigation procedures utilized will comply with Tetra Tech standard operating procedures (SOPs), which are included in Appendix A of this SAP or other procedure if applicable. The fieldwork and sampling are scheduled to begin in April 2008. A complete schedule is detailed in SAP Worksheet #16.

The field activities conducted under this SAP shall meet the requirements of the NAS JRB Willow Grove Site-Specific Health and Safety Plan (Tetra Tech, 2008).

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- 1 Facility Location Map
- 2 Site Location Based on Historical Information
- 3 Soil Boring/Test Pit Sample Location Map
- 4 Test Pit and Subsurface Soil Sampling Location Map
- 5 Test Pit Investigation Subsurface Soil Concentrations above Screening Levels
- 6 Proposed Landfill Delineation EM Study

Tables

TABLE NUMBER

- 1 Test Pit Details
- 2 Soil Sample Summary
- 3 Data Summary of Positive Analytical Results

Appendices

- A – Tetra Tech SOPs
- B – Laboratory SOPs
- C – Project Specific Log Sheets

Acronyms

°C	Degrees Celsius
%	Percent
BRAC	Base Realignment and Closing
BTAG	Biological Technical Assistance Group
CA	Corrective Action
CCC	Calibration Check Compound
CCV	Continuing Calibration Verification
CLEAN	Comprehensive Long-term Environmental Action Navy
CTO	Contract Task Order
DAF	Dilution Attenuation Factor
DoD	Department of Defense
DON	Department of the Navy
DCN	Document Control Number
DQI	Data Quality Indicator
DQO	Data Quality Objective
DVM	Data Validation Manager
ECD	Electron Capture Detector
EICP	Extracted Ion Current Profile
EM	Electromagnetic
EOD	Explosive Ordnance Disposal
EPA	U. S. Environmental Protection Agency
FOL	Field Operations Leader
FTMR	Field Task Modification Request
FS	Feasibility Study
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
GIS	Geographic Information System
GPS	Global Positioning System
GW	Ground Water
HRMS	High Resolution Mass Spectrometry
IAS	Initial Assessment Study
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectroscopy
IDL	Instrument Detection Limit
IDQTF	Intergovernmental Data Quality Task Force
IR	Installation Restoration
LCS	Laboratory Control Sample
MDL	Method Detection Limit
MPC	Measurement Performance Criteria
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSC	Medium Specific Concentration
NA	Not Applicable
NAS JRB	Naval Air Station Joint Reserve Base
NAVFAC	Naval Facilities Engineering Command
NELAP	National Environmental Laboratory Accreditation Program
NFESC	Naval Facilities Engineering Service Center
OPNAV	Office of the Chief of Naval Operations
PADEP	Pennsylvania Department of Environmental Protection
PAH	Polycyclic Aromatic Hydrocarbon
PAL	Project Action Limit
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PDF	Portable Document Format
PG	Professional Geologist
PID	Photoionization Detector
PM	Project Manager
PMO	Program Management Office

Project-Specific SAP**Site Name/Project Name:** NAS JRB Willow Grove**Site Location:** Willow Grove, Pennsylvania**Title:** SAP for Landfill Delineation at Site 3 – Ninth Street Landfill**Revision Number:** 0**Revision Date:** November 2008

ppm	Parts Per Million
PQOs	Project Quality Objectives
PT	Proficiency Testing (previously known as performance evaluation (PE) sample)
PWD	Public Works Detachment
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
RBC	Risk Based Concentration
REG	Regional Environmental Group
RI	Remedial Investigation
ROICC	Resident Officer in Charge of Construction
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SGS	SGS Environmental Services, Inc.
SQL	Structured Query Language
SOP	Standard Operating Procedure
SOW	Statement of Work
SSO	Site Safety Officer
SVOC	Semivolatile Organic Compounds
TAL	Target Analyte List
TBD	To Be Determined
TCE	Trichloroethene
TCL	Target Compound List
Tetra Tech	Tetra Tech NUS, Inc.
UFP	Uniform Federal Policy
VOA	Volatile Organic Analytes
VOC	Volatile Organic Compounds
WS	Worksheet

SAP Worksheet #2 -- SAP Identifying Information
(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: Site 3 – Ninth Street Landfill
Operable Units: OU 5 (Soil), OU 10 (Groundwater)
Contractor Name: Tetra Tech NUS, Inc. (Tetra Tech)
Contract Number: N62467-04-D-0055
Contract Title: CLEAN
Work Assignment Number: CTO 412

1. This SAP was prepared in accordance with the requirements of the Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP) (U.S. EPA 2005) and EPA Guidance for Quality Assurance Project Plans, EPA QA/R-5, EPA QA/G-5, QAMS (U.S. EPA 2002).

2. Identify regulatory program: Department of Defense Installation Restoration Program (CERCLA).

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held:

Scoping Session	Date
<u>Project Planning and Field Sampling Preparation</u>	<u>March 2007</u>
<u>Project Planning and Field Sampling Preparation</u>	<u>June 21, 2007</u>
<u>Team Meeting/Project Planning and Field Sampling Preparation</u>	<u>September 19, 2007</u>

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

Title	Date
<u>QAPP for Test Pit Investigation (Rev. 0)</u>	<u>April 2007</u>
<u>Phase II RI/FS Work Plan for NAS JRB Willow Grove</u>	<u>October 1996</u>
<u>Final Plan of Action for Extended Site Inspections and RI</u>	<u>August 1991</u>

6. List organizational partners (stakeholders) and connection with lead organization:
EPA (regulatory oversight), PADEP (regulatory oversight), BRAC PMO (property owner), Tetra Tech, NUS, Inc. (Navy IRP contractor)

7. Lead organization: NAVFAC

8. If any required 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:

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
----------------------	----------------------	----------------------------------

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

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

SAP Worksheet #3 -- Distribution List

(UFP-QAPP Manual Section 2.3.1)

Name of SAP Recipients	Title/Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	Document Control Number (Optional)
Curtis Frye	Remedial Project Manager	NAVFAC Mid-Atlantic	(215) 897-4914	curtis.frye@navy.mil	NA
Bob Lewandowski	Environmental Coordinator	BRAC PMO NE	(215) 897-4908	robert.f.lewandowski@navy.mil	NA
Dave Barclift	Technical Manager	NAVFAC Atlantic	(215) 897-4913	david.barclift@navy.mil	
Gloria Abarca	Facility Contact	Regional Environmental Group (REG)	(215) 773-2106	gloria.abarca@navy.mil	NA
Lt. Commander Suzanne Montgomery	PWD Coordinator	Public Works Department	(215) 443-6221	suzanne.montgomery@navy.mil	NA
Lisa Cunningham	EPA Regional Project Manager	EPA Region 3	(215) 814-3363	cunningham.lisa@epamail.gov	NA
Charles Clark	PADEP Project Manager	PADEP	(484)-250-5731	tsheehan@state.pa.us	NA
Russell Turner	Project Manager (PM)	Tetra Tech	(610) 382-1534	russ.turner@tetrattech.com	NA
Tom Johnston	CLEAN Quality Assurance Manager (QAM)	Tetra Tech	(412) 921-8615	tom.johnston@tetrattech.com	NA
Don Whalen	Field Operations Leader (FOL)/Site Safety Officer(SSO)	Tetra Tech	(610) 382-1536	don.whalen@tetrattech.com	NA
Megan Ritchie	Project Chemist	Tetra Tech	(610) 382-1527	megan.ritchie@tetrattech.com	NA
Gordon Araujo	Project Engineer	Tetra Tech	(610) 382-1168	gordon.araujo@tetrattech.com	NA
Sherri Eng	NAVFAC Quality Assurance Officer (QAO)	NAVFAC Atlantic	(410) 305-2746	sherri.eng@navy.mil	NA
Mark Ross	Project Manager	CompuChem Labs, Inc. (CompuChem)	(919) 379-4006	markross@compuchemlabs.com	NA
Chris Cornwell	Project Manager	SGS Environmental Services, Inc. (SGS)	(910) 350-1903	chris.cornwell@sgs.com	NA

CLEAN Comprehensive Long-Term Environmental Action Navy
EPA Environmental Protection Agency
FOL Field Operations Leader
NA Not applicable
NAVFAC Naval Facilities Engineering Command
PADEP Pennsylvania Department of Environmental Protection
PWD Public Works Detachment
QAM Quality Assurance Manager

QAO Quality Assurance Officer
REG Regional Environmental Group
ROICC Resident Officer in Charge of Construction
TBD To be determined
Tetra Tech Tetra Tech NUS, Inc.
SGS SGS Environmental Services, Inc.
SSO Site Safety Officer

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

[\(UFP-QAPP Manual Section 2.3.2\)](#)

Signatories to this worksheet will have a complete copy of the section they are attesting to have reviewed, before they provide their signature in the worksheet. Signatures will be provided on a copy of the Worksheet # 4 that will either be scanned and transmitted via email or transmitted via facsimile to the Tetra Tech Project Manager to maintain on file.

Name	Organization/Title/Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
Russell Turner	Tetra Tech PM	(610) 382-1534			
Don Whalen	Tetra Tech FOL/SSO	(610) 382-1536			
Tom Johnston	Tetra Tech QAM	(412) 921-8615			
Joe Samchuck	Tetra Tech DVM	(412) 921-8510			
Megan Ritchie	Tetra Tech Project Chemist	(610) 382-1527			
Sherri Eng	NAVFAC QAO	(410) 305-2746			
Lisa Cunningham	EPA Regional Project Manager	(215) 814-3363			
Charles Clark	PADEP Project Manager	(484) 250-5731			
Curtis Frye	Remedial Project Manager	(215) 897-4914			
Dave Barclift	Technical Manager	(215) 897-4913			
Gloria Abarca	Facility Contact	(215) 773-2106			
Lt. Commander Suzanne Montgomery	PWD Coordinator	(215) 443-6221			
TBD	Test Pit Excavating Subcontractor	TBD			
TBD	Geophysics Subcontractor	TBD			

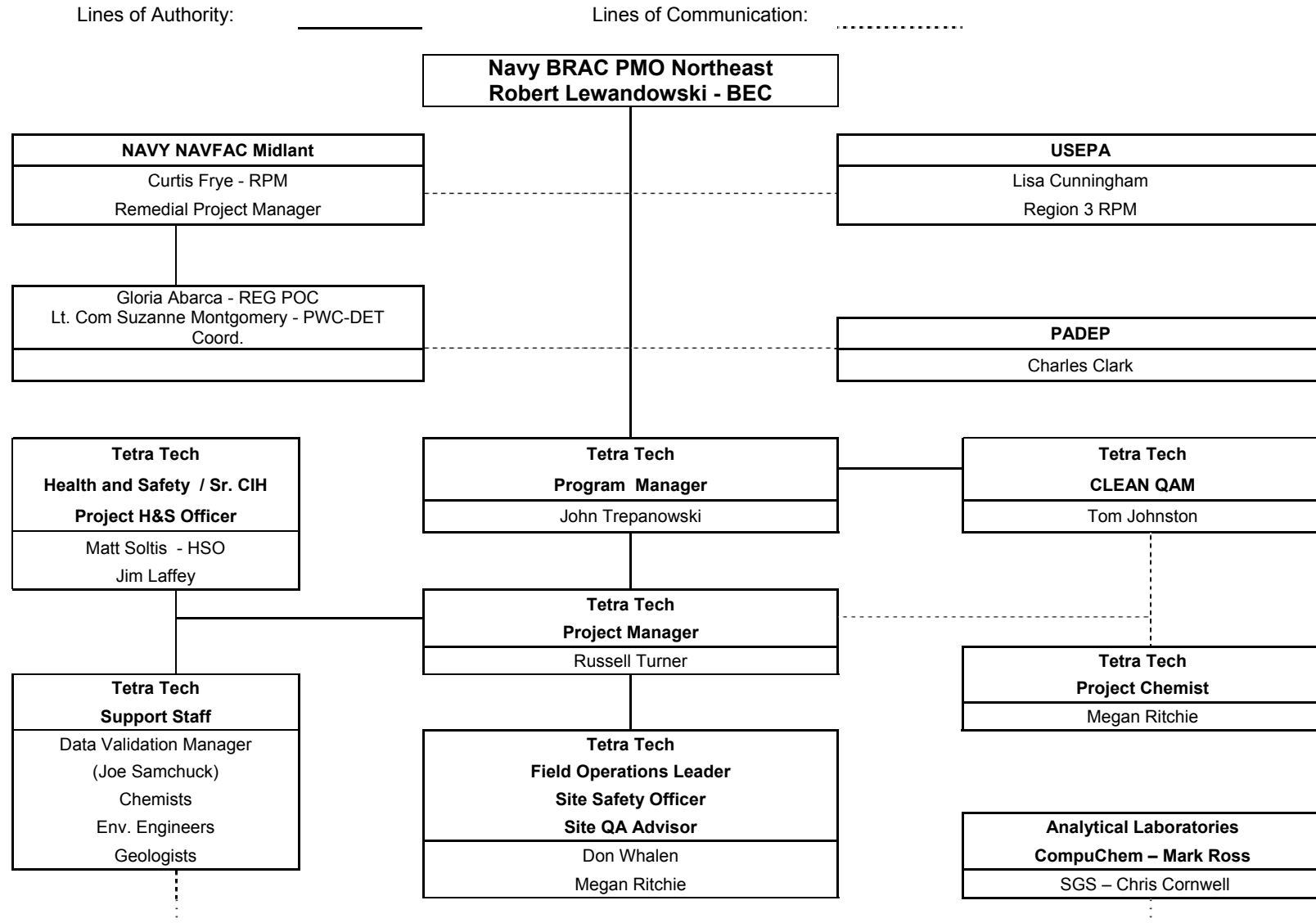
Project-Specific SAP**Site Name/Project Name:** NAS JRB Willow Grove**Site Location:** Willow Grove, Pennsylvania**Title:** SAP for Landfill Delineation at Site 3 – Ninth Street Landfill**Revision Number:** 0**Revision Date:** November 2008

Name	Organization/Title/Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
Mark Ross	CompuChem	(919) 379-4006			
Chris Cornwell	SGS	(910) 350-1903			

DVM Data Validation Manager
FOL Field Operations Leader
PM Project Manager
QAM Quality Assurance Manager
SGS SGS Environmental Services, Inc.
SSO Site Safety Officer
TBD To be determined
Tetra Tech Tetra Tech NUS, Inc.

SAP Worksheet #5 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1)



SAP Worksheet #6 -- Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Regulatory Agency review	EPA RPM PADEP RPM	Lisa Cunningham Charles Clark	(215) 814-3363 (484)-250-5731	Review Technical Documents
Field Task Modification Request (FTMR)	Tetra Tech FOL	Don Whalen	(610) 382-1536	Immediately gets approval from Tetra Tech PM Document via FTMR form
QAPP Amendments	Navy RPM NAVFAC QAO	Cutis Frye Sherri Eng	(215) 897-4914 (410) 305-2746	Immediately informs Tetra Tech PM Document via FTMR form QAPP Amendments submitted to NAVFAC for review and approval
Changes in Schedule	Tetra Tech PM	Russell Turner	(610) 382-1534	Informs Navy via schedule impact letter as soon as impact is realized
Issues in the field that result in changes in scope of field work	Tetra Tech FOL Tetra Tech PM	Don Whalen Russell Turner	(610) 382-1536 (610) 382-1534	FOL informs PM; PM informs RPM; RPM issues scope change if warranted; Scope change to be implemented before work is executed.
Recommendations to stop work and initiate work upon corrective action	Tetra Tech FOL Tetra Tech PM Tetra Tech QAM Tetra Tech HSM Navy RPM	Don Whalen Russell Turner Tom Johnston Matt Soltis Curtis Frye	(610) 382-1536 (610) 382-1534 (412) 921-7273 (412) 921-8912 (215) 897-4914	Responsible Party immediately informs subcontractors, the Navy, and Project Team
Analytical data quality issues	CompuChem SGS Tetra Tech Project Chemist	Mark Ross Chris Cornwell Megan Ritchie	(919) 379-4006 (910) 350-1903 (610) 382-1527	Immediately notify Tetra Tech Project Chemist Notify Data Validation Staff and Tetra Tech PM if necessary

FOL Field Operations Leader
FTMR Field Task Modification Request
PM Project Manager
QAM Quality Assurance Manager
QAPP Quality Assurance Project Plan
RPM Remedial Project Manager
SGS SGS Environmental Services, Inc.
TBD To be determined
Tetra Tech Tetra Tech NUS, Inc.

SAP Worksheet #7 -- Personnel Responsibilities and Qualifications Table
[\(UFP-QAPP Manual Section 2.4.3\)](#)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
Russell Turner	PM	TtNUS	<p>Oversees project, financial, schedule, and technical day to day management of the project.</p> <ul style="list-style-type: none"> • 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, NASJRB Willow Grove, 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 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. 	B.A. Natural Sciences, 30 years environmental experience
Don Whalen	FOL, SSO	TtNUS	<p>Supervises, coordinates, and performs field sampling activities</p> <ul style="list-style-type: none"> • Ensures that health and safety requirements are implemented. • Functions as the on-site communications link 	B.A. Geology, M.S. Marine Studies, 17 years environmental experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
			<p>between field staff members, the SSO, NAS JRB Willow Grove, and TtNUS PM.</p> <ul style="list-style-type: none"> • Alerts off-site analytical laboratories of any special health and safety hazards associated with environmental samples. • 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 field task modification requests (field change orders) when necessary. • Identifies and resolves problems in the field, resolving difficulties via consultation with the NASJRB Willow Grove POC, implementing and documenting corrective action procedures, and providing communication between the field team and project management. 	
Tom Johnston, PhD	QAM	TtNUS	<p>Reviews QAPP, oversees preparation of lab scope, coordinates with lab, and data quality review. Ensures Quality aspects of the CLEAN program.</p> <ul style="list-style-type: none"> • Develops, maintains, and monitors QA policies and procedures. • Provides training to TtNUS staff in QA/QC policies and procedures. • Conducts systems and performance audits to monitor compliance with environmental 	PH.D Analytical Chemistry, 30 years environmental experience

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
			<p>regulations, contractual requirements, QAPP requirements, and corporate policies and procedures.</p> <ul style="list-style-type: none"> • 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, and PADEP requirements. • Oversees the responsibilities of the TtNUS Project QA/QC Advisor. • Prepares QA reports for management. 	
Megan Ritchie	Lead Chemist	TtNUS	<p>Coordinates analyses with lab chemists, ensures the scope is followed, QA data packages, communicates with TtNUS staff.</p> <ul style="list-style-type: none"> • 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 laboratory and the TtNUS PM. • Coordinates and oversees work performed by the subcontracted laboratory. 	B.S. Biology/Environmental Studies, 11 years environmental experience

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
			<ul style="list-style-type: none"> • Oversees the completion of TtNUS data validation. • Coordinates and oversees review of laboratory deliverables. • Recommends appropriate laboratory corrective actions. 	
Joseph Samchuck	DVM	TtNUS	Quality assurance of data validation deliverables.	B.S. Chemistry, MBA, M.S. Finance, 23 years environmental experience
Matt Soltis	HSM	TtNUS	Oversees CLEAN Program Health and Safety Program <ul style="list-style-type: none"> • Provides technical advice to the TtNUS PM on matters of health and safety. • Oversees the development and review of the Health and Safety Plan (HASP). • Conducts health and safety audits. • Prepares health and safety reports for management. 	B.S. Industrial Safety Sciences, 24 years environmental experience
Curt Frye	RPM	NAVFAC	Oversees project, financial, and schedule, of the project.	B.S. Engineering, P.E.
Bob Lewandowski	Environmental Coordinator	BRAC PMO NE	Oversight officer for BRAC program.	B.S. Engineering, P.E.
Sherri Eng	QAO	NAVFAC	Reviews project SAP. Ensures quality aspects of the Navy and UFP-QAPP guidance.	
Dave Barcliff	Technical Manager	NAVFAC	Reviews project SAP. Ensures technical completeness.	
Lisa Cunningham	RPM	EPA Region 3	Regulatory review of technical documents.	
Charles Clark	PM	PADEP	Regulatory review of technical documents.	
TBD	Test Pit Excavating Subcontractor PM	TBD	Ensures that project specific requirements are communicated to field personnel.	

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and/or Experience Qualifications (Optional)
TBD	Geophysics Subcontractor PM	TBD	Ensures that project specific requirements are communicated to field personnel	

- B.A. Bachelor of Arts
- B.S. Bachelor of Science
- CLEAN Comprehensive Long-Term Environmental Action Navy
- DVM Data Validation Manager
- FOL Field Operations Leader
- HSM Health and Safety Manager
- MBA Masters of Business Administration
- M.S. Masters of Science
- PADEP Pennsylvania Department of Environmental Protection
- PM Project Manager
- QA Quality Assurance
- QAM Quality Assurance Manager
- QAPP Quality Assurance Project Plans
- SGS SGS Environmental Services, Inc.
- SSO Site Safety Officer
- Tetra Tech Tetra Tech NUS, Inc.
- NAVFAC Naval Facilities Engineering Command

In some cases one person may be designated responsibilities for more than one position. For example, the FOL may also be responsible for SSO duties. This action will be performed only as credentials, experience, and availability permits.

Additional responsibilities are as follows:

Laboratory Responsibilities

The subcontracted laboratory for the SI is responsible for analyzing all samples in accordance with the analytical methods and additional requirements specified in this SAP. It will also be the analytical laboratory’s responsibility to properly dispose of unused sample aliquots. Responsibilities of key laboratory personnel are outlined in the following paragraphs.

Laboratory Project Managers

The Laboratory PM will interface directly with the TtNUS Project Chemist, TtNUS PM, and TtNUS QA Advisor and will perform the following tasks:

- Ensure that methods and project-specific requirements are properly communicated and understood by laboratory personnel.

Project-Specific SAP**Site Name/Project Name:** NAS JRB Willow Grove**Site Location:** Willow Grove, Pennsylvania**Title:** SAP for Landfill Delineation at Site 3 – Ninth Street Landfill**Revision Number:** 0**Revision Date:** November 2008

- Ensure that all laboratory resources are available on an as-required basis.
- Ensure compliance with analytical and project QA requirements.
- Review data packages for completeness, clarity, and compliance with project requirements.
- Inform the TtNUS PM of project status and any sample receipt or analytical problems.
- Oversee the preparation of and approving final analytical reports before submittal to TtNUS.

Laboratory Operations Manager

Responsibilities of the Laboratory Operations Manager include the following:

- Supporting the QA program within the laboratory
- Providing management overview of both production- and quality-related laboratory activities
- Maintaining adequate staffing to meet project analytical and quality objectives
- Approving all laboratory SOPs and QA documents
- Supervising in-house chain-of-custody documentation

Laboratory Quality Assurance Officer

The Laboratory QA Officer (QAO) will report 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 or 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.
- Reviews overall data packages and case narratives for completeness according to project requirements and analytical methods.

Laboratory Sample Custodian

The Laboratory Sample Custodian will report to the Laboratory Operations Manager. Responsibilities of the Laboratory Sample Custodian include the following:

- Receiving and inspecting the incoming sample containers.
- Recording conditions of incoming sample containers.
- Signing appropriate documents.
- Verifying chain-of-custody records.
- Notifying the Laboratory PM of sample receipt and inspection.
- Assigning a unique identification number and customer number and entering each into the sample receiving log.
- With the help of the Laboratory PM, initiating transfer of the samples to appropriate laboratory sections.
- Controlling and monitoring access/storage of samples and extracts.

Laboratory Technical Staff

Project-Specific SAP**Site Name/Project Name:** NAS JRB Willow Grove**Site Location:** Willow Grove, Pennsylvania**Title:** SAP for Landfill Delineation at Site 3 – Ninth Street Landfill**Revision Number:** 0**Revision Date:** November 2008

The laboratory technical staff will be responsible for sample analyses based on the analytical methods and requirements specified in this SAP.

Site QA/QC Advisor

The FOL (or designee) will act as the Site QA/QC Advisor and will be responsible for ensuring adherence to all QA/QC requirements as defined in this SAP. Strict adherence to these procedures is critical to the collection of acceptable and representative data. The following is a summary of the Site QA/QC Advisor's responsibilities:

- Ensuring that field QC samples are collected at the proper frequencies.
- 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 bottle ware shipments and overseeing field preservation.
- Preparing a daily log of all work being performed.

Site Safety Officer (SSO). The SSO will be responsible for training and monitoring site conditions. The SSO reports to the Company Health and Safety Officer (CHSO) and indirectly to the FOL and TtNUS PM. Details of the SSO's responsibilities are presented in the HASP and include:

- Controlling specific health and safety-related field operations such as personnel decontamination, monitoring of worker heat or cold stress, and distribution of safety equipment.
- Conducting and documenting a daily health and safety briefing each day while on site.
- Assuring that field personnel comply with all procedures established in the HASP.
- Identifying assistant SSOs in their absence.
- Terminating work in an imminent safety hazard, emergency situation, or other potentially dangerous situation is encountered.
- Assuring the availability and the condition of health and safety monitoring equipment.
- Coordinating with FOL and PM to institute and document any necessary HASP modifications.
- Ensuring that facility personnel and subcontractors are adequately advised and kept clear of potentially contaminated materials.

SAP Worksheet #8 -- Special Personnel Training Requirements Table

[\(UFP-QAPP Manual Section 2.4.4\)](#)

This worksheet is used to identify and describe any specialized/non-routine project specific training requirements or certifications needed by personnel in order to successfully complete the project or task. OPNAV 5090.1 instructions are not considered specialized training; the OPNAV training requirements represent routine, minimum requirements that are mandatory for all Department of Navy (DON) projects.

No specialized training is required for this project. 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 CFR 1910.120(b)(4). Additional information about Health and Safety Training can be found in the site-specific Health and Safety Plan (HASP).

CompuChem and SGS have successfully completed the laboratory evaluation process required as part of the Naval Facilities Engineering Service Center (NFESC) Quality Assurance Program and described in the Department of Defense Quality Systems Manual (DoD QSM) (January 2006) and are additionally certified by the National Environmental Laboratory Accreditation Program (NELAP), which is the recognized certifying authority for the state of Pennsylvania. [The Navy certification letters are included in Appendix B.](#)

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

Project Name: <u>NAS JRB Willow Grove Site 3</u>			Site Name: <u>NAS JRB Willow Grove</u>		
Projected Date(s) of Sampling: <u>April 14 through May 15, 2008</u>			Site Location: <u>Willow Grove, Pennsylvania</u>		
Project Manager: <u>Russell Turner</u>					
Date of Session: June 21, 2007					
Scoping Session Purpose: Preliminary Scoping Meeting					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Russell Turner	PM	Tetra Tech	(610) 382-1534	russ.turner@tetrattech.com	Management
Don Whalen	FOL	Tetra Tech	(610) 382-1536	don.whalen@tetrattech.com	Task Management
Kevin Kilmartin	Geologist	Tetra Tech	(610) 382-1173	kevin.kilmartin@tetrattech.com	Lead Geologist
Megan Ritchie	Project Chemist	Tetra Tech	(610) 382-1527	megan.ritchie@tetrattech.com	Chemist

Comments/Decisions: Discussed physical findings from Test Pit investigation. Reviewed test pit logs. Discussed the steps for the Landfill Delineation investigation.

Action Items: Write implementation plan for Landfill Delineation Study.

Consensus Decisions:

Project Name: <u>NAS JRB Willow Grove Site 3</u>			Site Name: <u>NAS JRB Willow Grove</u>		
Projected Date(s) of Sampling: <u>April 14 through May 15, 2008</u>			Site Location: <u>Willow Grove, Pennsylvania</u>		
Project Manager: <u>Russell Turner</u>					
Date of Session: September 19, 2007					
Scoping Session Purpose: Team Meeting. Discussed Site 3 Landfill delineation planning options.					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Russell Turner	PM	Tetra Tech	(610) 382-1534	russ.turner@tetrattech.com	Management
Curtis Frye	RPM	NAVFAC Mid-Atlantic	(215) 897-4914	curtis.frye@navy.mil	RPM
Lisa Cunningham	RPM	EPA	(215) 814-3363	lisa.cunningham@epa.gov	RPM
Bernice Pasquini	Hydrogeologist	EPA	(215) 814-3326	bernice.pasquini@epa.gov	Hydrogeologist
Linda Watson	Risk Assessor	EPA	(215) 814-3116	linda.watson@epa.gov	Risk Assessor
Bob Lewandowski	BRAC Environmental Coordinator	Navy BRAC PMO N.E.	(215) 897-4908	robert.f.lewandowski@navy.mil	BRAC Environmental Coordinator
Dave Barclift	Technical Manager	NAVFAC Atlantic	(215) 897-4913	david.barclift@navy.mil	Tech Manager
Kevin Kilmartin	Senior Geologist	Tetra Tech	(610) 491-9688	kevin.kilmartin@tetrattech.com	Geologist
Megan Ritchie	Project Chemist	Tetra Tech	(610) 382-1527	megan.ritchie@tetrattech.com	Chemist

Comments/Decisions: Test Pit sampling results were discussed.

Action Items: Prepare Statement of Work (SOW) and this UFP SAP based on meetings. Propose sampling locations.

Consensus Decisions: Tetra Tech assigned task to prepare preliminary draft UFP-SAP.

SAP Worksheet #10 -- Problem Definition

(UFP-QAPP Manual Section 2.5.2)

10.1 LOCATION

NAS JRB (Base), Willow Grove, Pennsylvania is located in Horsham Township, Montgomery County in southeastern Pennsylvania, approximately 20 miles north of the city of Philadelphia. The Ninth Street Landfill occupies about 9 acres immediately north of Ninth Street along the western boundary of NAS JRB Willow Grove (Figure 1).

10.2 SITE HISTORY

The Ninth Street Landfill (Site 3) was active from 1960 to 1967. Reportedly, Site 3 was used for landfill activities by the Public Works Department and also as an open disposal ground by various operations at the Base. An aerial photograph taken in 1964 shows a fenced area measuring approximately 500 feet by 600 feet immediately northwest of Ninth Street (EPA, 1995). This area, shown on Figure 2, is presumed to be the landfill. The landfill method consisted of burning the refuse and burying the residue in trenches. Reportedly, the landfill waste consisted mainly of general refuse, but also included paint wastes; paint stripper; trichloroethene (TCE); sewage sludge; petroleum, oils and lubricants; and industrial pretreatment plant sludge. After closure of the landfill, a salvage yard operated in the eastern portion of the Site 3. Between 1980 and 1983, clean fill and construction debris were deposited in the area southwest of the storm water retention basin.

10.3 PHYSICAL SETTING

10.3.1 Surface Features

The Base is comprised of flat to slightly rolling terrain and is generally bounded by State Route 611 to the east, State Route 463 to the southwest, and Keith Valley Road to the north. Site 3 is located in an undeveloped area between Ninth Street and Dawes Road. The ground surface is well vegetated with a mixture of grass and woody vegetation. The ground surface slopes north toward a wetland area, intermittent stream, and storm water retention basin located approximately 200 feet from what historical information indicates was the northern limit of waste disposal. Surface recreational facilities including a pavilion, playground, and baseball diamond are located in the northeastern portion of Site 3.

10.3.2 Soils

The Soil Survey of Montgomery County (United States Department of Agriculture, 1967) indicates that five major soil series are mapped within the boundaries of four primary Base Installation Restoration (IR) sites. The soil series include the Lansdale, Lawrenceville, Chalfont, and Readington silt loams and the Lansdale loam. Minor areas of other soil series, composed chiefly of silt loam materials, are developed in small, low-lying areas. In general, these soils have a moderate to slow permeability that encourages rapid runoff during normal precipitation events.

Most of the soil within the Base has been disturbed. In addition, large areas have been filled with shale and sandstone mixed earth materials. These soils, known as made land, vary widely in depth and drainage potential. Soil borings collected from the Base during the Site Investigation (SI) and RI were comprised of fine grained soils consisting of clayey silt to sandy silt. The depth to bedrock generally ranges from 5 feet to 15 feet below ground surface.

10.4 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

10.4.1 Initial Assessment Study

An Initial Assessment Study (IAS) of the Site was completed in 1986 (NEESA, 1986). The report identified two areas, which it designated "A" and "B", where most of the waste disposal was believed to have occurred (Figure 2). "Area A", referred to as the primary disposal area, is in the eastern portion of the site and corresponded to an area used as a salvage yard following the closure of the landfill. It is

within the fenced area indicated by the 1964 aerial photograph and partially overlaps the present location of the baseball diamond. "Area B" is a larger, rectangular area in the western portion of the site. Area "B" is southwest of the 1964 fenced area. It is possible that historic waste disposal was not necessarily confined to these two locations, but extended over a much larger portion of the area between Ninth Street and the southeastern boundary of the Base.

The landfill method consisted of burning the refuse and burying the residue in trenches. Reportedly, the waste disposed of in the landfill consisted mainly of general refuse, but also included paint wastes; paint stripper; trichloroethene (TCE); sewage sludge; petroleum, oils and lubricants; and industrial pretreatment plant sludge.

10.4.2 Site Inspection

The SI was completed in 1991 (EA Engineering and Science, May 1990). Prior to the field sampling event, an electromagnetic (EM) survey and a soil vapor contaminant assessment (SVCA) were performed. The EM survey was conducted on a grid pattern to assess the distribution of fill material. Several EM anomalies and SVCA positive detections were observed. The SVCA positive detections were low (less than 1 ppm) and were attributable to tetrachloroethylene (PCE). Several of the EM anomalies corresponded with SVCA positive detections. Six soil borings (B-1 through B-6) were advanced to investigate the subsurface material in the vicinity of the electromagnetic survey and soil gas anomalies. The locations of these borings are shown on Figure 3. One discrete subsurface soil sample corresponding to the highest headspace reading was collected from each boring and submitted for volatile organic compound (VOC) analysis. One composite sample from each boring was submitted for analysis of semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), metals, total organic carbon (TOC), total petroleum hydrocarbon (TPH), and cyanide. One of the borings, 9SLB-3, consisted of glass and metal fragments and tar at depths of 2 feet to the total depth of 10 feet. This boring was located approximately 100 feet west of monitoring well cluster 03MW01. The discrete soil sample from this boring contained low levels of toluene (180 ug/kg) and 1,1,1,-trichloroethane (22J ug/kg) and the composite sample contained low concentrations of several SVOCs. The samples from the baseball diamond area contained various polycyclic aromatic hydrocarbons (PAHs) at concentrations ranging from 2 mg/kg to 16.6 mg/kg and dieldrin at concentrations ranging from 89 ug/kg to 1300 ug/kg, with infrequent detections of other pesticides and volatile organic compounds. Cyanide was detected in both surface and subsurface samples.

10.4.3 Remedial Investigation

The purpose of the RI soils investigation was to further define the nature and extent of shallow soil contamination discovered in the baseball field during the SI, and to identify other potential sources of contamination within Site 3.

Surface soil

During the RI (1991), surface soil samples were obtained from 16 locations (corresponding to boring locations 03SB01 through 03SB16) in the baseball diamond area to further investigate the presence of dieldrin and cyanide detected during the SI (Figure 3). The samples were analyzed for full target compound list (TCL) and target analyte list (TAL) parameters. During the 1997 RI activities, locations 03SS01 through 03SS12 were again sampled and analyzed for TAL metals, TCL SVOCs, and TCL pesticide/PCBs. Samples 03SS04 and 03SS08 were also analyzed for dibenzofuran and dibenzodioxins. There was one surface soil sample collected during the follow-on activities in March 2006, 03SB18-0002.

No VOCs were detected in Site 3 surface soil samples, and none of the SVOCs detected had concentrations statistically greater than background concentrations. Among the semivolatile compounds detected in the Site 3 surface soils, the PAHs benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene were detected at levels exceeding screening criteria.

Dieldrin was detected in the majority of samples, frequently at levels exceeding screening criteria; however, ranges were within background levels. Low levels of dibenzodioxin and dibenzofuran compounds were detected in both Site 3 surface soil samples analyzed for these compounds. No

background samples were analyzed for these compounds. Both samples exceeded the most stringent screening criteria (risk-based concentrations (EPA Region 3) for total tetrachlorodibenzodioxin (TCDD) equivalents, and one of them also exceeded the Pennsylvania Department of Environmental Protection (PADEP) Medium Specific Concentration (MSC) for residential soils; however, the levels were below all other screening criteria.

Arsenic was found in the majority of surface soil samples at levels exceeding screening criteria; however, concentrations were within background levels. Iron was detected at levels exceeding screening criteria and above background at three locations (03SS04, 24,200 mg/kg; 03SS09, 23,400 mg/kg; and 03SS11, 27,200 mg/kg).

Subsurface soil

During 1991 RI activities, shallow subsurface samples (maximum depth of 3 feet) were obtained from 16 locations (03SB01 through 03SB16) in the baseball diamond area. In addition, eight samples were obtained from four test pits (TP-1 through TP-4) excavated at Site 3 (Figure 3). Each test pit was approximately 100 feet long and a maximum of 10 feet deep. The test pits were located in areas that corresponded to the soil gas and EM anomalies observed during the SI, in accordance with the Draft Plan of Action (EA Engineering, 1991). Samples were analyzed for full TAL metals and TCL organic parameters. During the 1997 RI investigation, three subsurface samples were obtained from location 03SB01 at depths of 2 to 4 feet (03SB01-0204), 6 to 8 feet (03SB01-0608), and 14 to 16 feet (03SB01-1416). These samples were analyzed for TCL VOCs. During the follow-on activities in March 2006, 10 soil borings were completed upgradient of the landfill to investigate possible upgradient sources of the observed groundwater VOC contamination.

Neither the test pit excavations nor the soil borings collected during the 1991 RI contained any waste materials.

Arsenic was detected at levels exceeding screening criteria at all sample locations; these levels were not above background, however. Iron exceeded background and the RBC ARAR of 23,000 mg/kg in 18 samples.

No VOCs statistically above background or screening criteria were detected. Benzene (3J ug/kg), chlorobenzene (2J ug/kg), toluene (2J ug/kg), and TCE (2J ug/kg) were detected at low levels in 03SB02. 2-Butanone (14J ug/kg) and acetone (71J ug/kg) were detected at 03SB01-0608.

Three pesticides were detected in subsurface soil at Site 3. Dieldrin exceeded screening criteria at 14 locations but was within background levels. Endosulfan I was detected at two locations (03SB11, 23 ug/kg and 03SB13, 30 ug/kg). Endrin was detected in 03TP02-1 at 25 ug/kg. Neither endosulfan I nor endrin was detected in background samples.

Aroclor 1254 was detected above screening criteria at 03TP02-1 (490 ug/kg) and 03TP02-2 (810 ug/kg). This compound was not detected in background; however, statistical analysis does not indicate this as a site-related compound.

Several SVOCs were detected at Site 3 below regulatory criteria but not in background. PAHs above background levels were detected at 03SB01, 03SB03 through 03SB06, 03SB14, 03SB19, 03TP02-2, and 03TP04-3. Screening criteria were exceeded for five polycyclic aromatic hydrocarbon (PAH) compounds, although only anthracene, benz(a)anthracene, and pyrene are considered site-related. The highest PAH levels were associated with 03SB06.

10.4.4 Test Pit Investigation

The preliminary draft Remedial Investigation (RI) for Site 3 concluded that site soils do not pose a threat to public health or the environment. The subsurface soil investigation, however, did not encounter significant quantities of buried waste material, which historical information indicates may be present at the site. The Navy concluded, therefore, that soil analytical data generated during the RI may not have been representative of actual site conditions. In order to test that the conclusion of the RI regarding site soils is

correct, the Navy decided to perform additional test pit excavations to conclusively document actual site conditions.

Tetra Tech prepared the QAPP for Test Pit Investigation and Soil Sampling at Site 3 at NAS JRB, Willow Grove, Pennsylvania under CTO No. 003 under the CLEAN Contract N62472-03-D-0057.

The field investigation performed from April 30 to May 8, 2007 consisted of the excavation of fourteen test pits and the collection of twenty-six subsurface soil samples plus an additional four field duplicate samples for QA/QC purposes. Figure 4 shows the test pit and soil sample locations. Tables 1 and 2 summarize the test pit details and soil samples collected. Eight test pits were originally scoped and planned. Six additional test pits were subsequently excavated to delineate the waste discovered in the planned test pits. Field procedures followed Tetra Tech SOPs as presented in the QAPP (Rev. 0) for Test Pit Investigation, Site 3 – Ninth Street Landfill (April 2007). Tetra Tech personnel performed all sample collection, sample handling, and sample management throughout the investigation. Berner Construction, Inc., of Gap, Pennsylvania, performed the excavation at Site 3 as a subcontractor to Tetra Tech; Berner Construction provided the excavation equipment and equipment operation. All sampling data were recorded on sample log sheets and in the site log book by the Tetra Tech geologist.

The initial eight test pits, 03TP05 through 03TP12, were approximately 50 feet long and 2.5 feet wide and approximately 10 feet deep (or less if bedrock was encountered). At least two, and as many as four, subsurface soil samples were collected from each of these eight test pits (a total of 19 samples) and analyzed for full TCL/TAL parameters. Two of the samples were also analyzed for dioxin. The samples were chosen based on direct (visual or olfactory) evidence of contamination, or on the highest PID screening responses. If no evidence of contamination was observed, the samples were collected from mid-depth at locations approximately equally spaced along the length of the excavation. The dioxin samples were collected from areas showing evidence of charred waste.

Six additional test pits (03TP13 through 03TP18) were excavated to delineate the extent of the waste encountered in the eight initial test pits. These test pits varied in length from 17 feet to 27 feet and varied in depth from 5 feet to 9 feet. One subsurface soil sample was collected from each of these test pits and analyzed for full TCL/TAL parameters.

Field Results and Observations from Test Pit Investigation

Of the 14 test pits completed, four test pits (03TP05, 03TP06, 03TP08, and 03TP18) contained charred waste, three test pits (03TP11, 03TP12, and 03TP14) contained scattered debris, and the remaining seven test pits (03TP07, 03TP09, 03TP10, 03TP13, 03TP15, 03TP16, and 03TP17) contained only native soil. Bedrock was encountered during each test pit excavation except 03TP14, which was excavated on the slope northwest of the baseball field and only 6 feet deep. The depth to bedrock ranged from 4 feet in test pit 03TP16 to 10 feet in test pits 03TP05, 03TP08, and 03TP09. Photographs of the test pits are included as Appendix C.

Test pits 03TP05 and 03TP06 (see Figure 4) were excavated in “Area B”. Both of these test pits contained charred waste and miscellaneous trash. The location of the waste in the two test pits corresponds with a surface topographic swale (see Figure 4) oriented northwest to southeast. Test pit 03TP05, which was excavated roughly perpendicular to the swale, encountered approximately 25 feet of waste, and test pit 03TP06, which was excavated at an oblique angle to the swale, encountered approximately 35 feet of waste. These two test pits appeared to intercept a former trench into which waste, some of it burned, had been deposited and then buried. (According to the IAS report, burning waste and burying the residue in trenches was the disposal method used at the Ninth Street Landfill.) At both locations, waste extended to the top of bedrock, which was encountered at 10 feet in 03TP05 and 8.5 feet in 03TP06. The buried waste consisted of a variety of materials, including general refuse (soda and beer bottles, eating utensils, china fragments), shop waste (engine parts, scrap metal, wire, cables, chains, saw blade, oil filter, auto parts, crushed empty drums), military refuse (temporary tarmac), and construction debris (cinder blocks, steel posts, asphalt). Much of the debris was charred or otherwise showed evidence of having been burned (some of the bottles were partially melted), and there was ash mixed with the soil. There were no potentially hazardous materials encountered. There was one elevated PID reading of approximately 150 ppm from a small area (approximately one square foot) of the

excavated soil pile from the southern end of 03TP06. Sample 03TP06-0304-01 was collected from this soil. The soil was not wet or stained and exhibited only a faint odor. Although the soil was near a jet engine manifold, the manifold did not appear to be the source of the reading, since there were no additional elevated readings in its immediate vicinity.

Test pits 03TP15, 03TP16, and 03TP17 were excavated to delineate the lateral extent of the landfill. Test pit 03TP15 was excavated approximately 60 feet south of test pit 03TP06, test pit 03TP16 approximately 90 feet west of test pit 03TP06, and test pit 03TP17 approximately 60 feet west of test pit 03TP05. None of these test pits contained buried waste; each were comprised of native soil to the depth of bedrock, which was 9 feet in 03TP15, 4 feet in 03TP16, and 5 feet in 03TP17.

Test pit 03TP18 was excavated approximately 60 feet northeast of test pit 03TP06 in a wooded area characterized by an uneven, hummocky ground surface. Weathered bedrock was encountered during the excavation of the test pit at a depth of approximately 3 feet. Buried waste consisting of charred debris, ash, wire, concrete, and metal and glass fragments was encountered at the northern end of the test pit. Excavation activities were halted when what appeared to be potential ordnance object was uncovered. The Base contact was notified, and security personnel and the Base fire department were called to secure the site. Explosive Ordnance Disposal (EOD) personnel from Fort Monmouth, New Jersey were called to the site. An inspection by EOD personnel revealed that the object was a 200 lb. "practice bomb" – an empty steel shell that could be filled with sand and used for training. The training device could be fitted with a black powder charge to produce smoke for spotters to see. The EOD personnel removed the object from the excavation and took it off-site for disposal. The excavation of test pit 03TP18 was ended at that point per NAS JRB direction, and the excavation was backfilled according to clearance from the EOD specialists.

Test pits 03TP07 and 03TP08 were excavated in the area corresponding to an area of disturbed ground noted on a 1964 aerial photograph (USEPA, 1995). Test pit 03TP07, which was excavated in a generally flat, wooded area, was made of undisturbed native soil to the depth of bedrock, which was approximately 5 feet bgs. Test pit 03TP08 was excavated in a flat clearing adjacent to a short, steep slope that marks the edge of the raised land on which the baseball field is located. Approximately 18 feet of waste was encountered in the southeastern half of the test pit, which intercepted the slope. The waste was similar to waste found in test pits 03TP05 and 03TP06, consisting of miscellaneous trash, charred debris, and ash. The area of waste was approximately 18 feet long by 5 feet deep. Bedrock was encountered at a depth of 6 feet in the portion of the test pit below the slope. The buried waste did not extend beyond the top of the slope in the up-slope direction.

Test pits 03TP10, 03TP11, and 03TP12 were excavated within or near the area referred to as "Area A" or the "Old Supply Scrapyard" in the IAS report, which was reportedly one of the main disposal areas. The area is currently a recreation field used for baseball. 03TP10 encountered undisturbed native soil to the depth of bedrock, approximately 8 feet. Test pits 03TP11 and 03TP12 encountered fill to depths of approximately two feet and three feet, respectively, along their entire lengths. The former grade was marked by a layer of partially decomposed grass at both locations. The fill consisted of silty clay mixed with scattered miscellaneous debris consisting of metal and glass fragments, wire, and automobile parts. Underneath the former grade was undisturbed native soil. Bedrock was encountered at depths of 7 feet to 9 feet in both of the test pits.

Test pits 03TP13 and 03TP14 were excavated approximately 50 feet and 200 feet northeast of 03TP08, respectively, to determine the lateral extent of waste along the slope. 03TP13 encountered native soil to the depth of bedrock, approximately 5 feet. The soil profile of test pit 03TP14 was similar to 03TP11 and 03TP12: fill to a depth of 3 feet, decomposed grass at the former grade, and native soil beneath. The fill consisted of silty clay and miscellaneous debris (metal, glass, and ceramic fragments). Neither of the two test pits contained the type of charred waste that was found in test pit 03TP08.

Test Pit Investigation Analytical Results

The analytical results were compared to EPA Region 3 RBCs and PADEP MSCs for residential soil. SVOCs, pesticides, PCBs, dioxins, and metals were identified at concentrations above these screening

levels. Table 3 summarizes the positive detections from the analytical results and compares them to RBCs and MSCs. Figure 5 shows the locations of the samples containing screening level exceedances.

SVOCs were detected at concentrations above screening levels in four test pits: 03TP06, 03TP08, 03TP12, and 03TP14. Benzo(a)pyrene was the only SVOC that exceeded screening levels in test pits 03TP08 and 03TP14. The highest concentrations of SVOCs were detected in sample 03TP12-0102-03 from test pit 03TP12, which was excavated in an area of the baseball field in which elevated levels of PAHs were detected in shallow subsurface soils during the Site 3 RI. Sample 03TP12-0102-03 contained benzo(a)anthracene (15,000J [J = estimated] ug/kg), benzo(a)pyrene (8,800J ug/kg), benzo(b)fluoranthene (8,600J ug/kg), benzo(k)fluoranthene (4,400J ug/kg) and indeno(1,2,3-cd)pyrene (7,400J ug/kg) at concentrations above screening levels. This sample was collected from the fill encountered in the upper two feet of the test pit.

Pesticides were detected at concentrations above screening levels in five test pits: 03TP05, 03TP06, 03TP08, 03TP12, and 03TP14. Dieldrin was the only pesticide detected above screening levels in test pits 03TP05, 03TP08, 03TP12, and 03TP14. The highest concentrations of pesticides were detected in sample 03TP06-0607-04 from test pit 03TP06. This sample contained heptachlor epoxide (390J ug/kg), dieldrin (10,000 ug/kg), DDE (8,700 ug/kg), DDD (72,000) and DDT (270,000 ug/kg) at concentrations above screening levels.

PCBs were detected at concentrations exceeding screening levels in one test pit: 03TP06. Aroclor-1254 and aroclor-1260 were detected in sample 03TP06-0708-02 at 450 ug/kg and 550 ug/kg, respectively, and in sample 03TP06-0809-03 at 620 ug/kg and 600 ug/kg, respectively.

Arsenic was detected at concentrations exceeding screening levels in all of the test pits. The arsenic concentrations ranged from 2L (L = biased low) mg/kg (in sample 03TP10-0304-02) to 10.7L mg/kg (in sample 03TP06-0607-04). Metals other than arsenic were detected at concentrations exceeding screening levels in five test pits: 03TP05, 03TP06, 03TP08, 03TP10, and 03TP18. Except for 03TP10, these were the test pits in which charred waste was encountered. The following metals exceeded screening levels: antimony (up to 113 mg/kg), cadmium (up to 155 mg/kg), chromium (up to 133 mg/kg), iron (up to 113,000 mg/kg), lead (up to 4,640 mg/kg), and manganese (up to 20,000 mg/kg).

Dioxin was detected in both soil samples analyzed for dioxin at concentrations that exceeded screening levels. Sample 03TP05-0910-02 contained total 2,3,7,8-TCDD toxicity equivalents at 244 ng/kg and sample 03TP06-0809-03 contained 272 ng/kg.

The following contaminants were detected at concentrations exceeding the soil to groundwater RBCs (dilution attenuation factor (DAF) = 20): chromium, manganese, silver, benzo(a)pyrene, benzo(b)fluoranthene, carbazole, DDD, DDT, aldrin, dieldrin, gamma-BHC, and heptachlor epoxide.

10.5 SITE CONCEPTUAL MODEL

Contaminant Sources

The RI concluded that the principal classes of contaminants detected in site soils were PAHs and metals. Concentrations of these substances in site soils were, in general, comparable to background levels. The Test Pit Investigation discovered buried waste and associated soil contamination not found during the RI. The contaminants consisted of SVOCs, pesticides, PCBs, dioxins, and metals. The characterization of this newly discovered contamination is the purpose of the work described in this SAP.

Groundwater in the vicinity of Site 3 has been impacted by VOCs and metals. PCE was detected in downgradient wells but also in wells upgradient of the site. PCE has not been detected in surface or subsurface soil samples collected to date. Although the source of the groundwater PCE contamination has not been identified, based on the current hydrogeological interpretation, Site 3 cannot be ruled out as a contributing source of the contamination in the unconfined groundwater zone wells downgradient of the landfill.

Migration Pathways

The contaminant release pathways from the source areas include wind erosion, overland runoff, and infiltration. Contaminated fugitive dust can be generated during ground-disturbing activities, such as construction or excavation. The contaminants could then be dispersed in the surrounding environment and transported to downwind locations where they could repartition to surface soil, surface water, or sediment through gravitational settling, precipitation, and deposition. However, the turf grass and weeds serve to minimize the airborne contaminant transport pathway. In addition, precipitation runoff can carry contaminants via overland runoff to the pond and drainage ditches to the northwest. An unnamed intermittent tributary of Park Creek is located off Base approximately 100 feet northwest of Site 3. Park Creek is a tributary of Little Neshaminy Creek. Infiltrating precipitation can cause the contamination of subsurface soil and groundwater. Chemicals with a stronger tendency to adsorb to organic matter in soil (e.g., PAHs, dioxins, etc.) are expected to migrate at a slower rate than volatile organics. Upon entering the water column, a chemical is carried with the flow of groundwater to downgradient locations. Contaminants can be deposited subsequently in sediment or surface water.

Exposure Pathways

HUMAN HEALTH RISK

Soil, groundwater, surface water, and sediment at the site may be contacted by human receptors engaged in activities associated with either current or future exposure scenarios. The exposure pathways for soil consist of ingestion, dermal absorption, and inhalation of fugitive dust or ambient air VOCs; for groundwater, ingestion, dermal absorption, and inhalation of VOCs; and for surface water and sediment, ingestion and dermal absorption

ECOLOGICAL RISK

Terrestrial animals at Site 3 can be exposed to soil contaminants through the ingestion of contaminated food items. In addition, animals can incidentally ingest soil while grooming fur, preening feathers, digging, grazing close to the soil, or feeding on items that are covered with soil (such as roots and tubers). Terrestrial vegetation can be exposed to contaminants through direct aerial deposition and root translocation. Aerial deposition, however, is presently minimal due to the presence of vegetation on the site. Terrestrial receptors can also come into contact with contaminants in surface water by using it for drinking, although this exposure route generally represents a negligible portion of total exposure for most receptors. Aquatic and semi-aquatic organisms can be exposed to contaminants through direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Exposure to contaminants in the soil via dermal contact can occur but is unlikely to represent a major exposure pathway because fur, feathers, and chitinous exoskeletons minimize the transfer of contaminants across dermal tissue.

Potential Receptors

HUMAN RECEPTORS

Anticipated exposure scenarios include residential, industrial, construction worker, and limited recreational situations. With the anticipated closure of the base under the Department of Defense (DOD) Base Realignment and Closure (BRAC) process, future land use is expected to remain similar to the current industrial and recreational land usage.

ECOLOGICAL RECEPTORS

The wooded area, shrubby old field, and lake-side areas provide habitat for a variety of terrestrial receptors, although these habitats are isolated to a great extent by surrounding developed areas (golf course, runways, etc.). Terrestrial receptors at the site consist of mammals such as rabbits, raccoons, squirrels, and various rodents (including woodchucks), deer, and foxes. Reptiles and amphibians utilize some portions of the site, particularly the pond and intermittent stream. The old field provides forage (seeds, insects, worms, etc.) for a variety of bird species. Arboreal birds utilize the wooded area and

shrub thickets. Avian raptors are expected to utilize all habitats at the site. The intermittent stream provides no permanent aquatic habitat at the site.

10.6 PROBLEM DEFINITION

During the Test Pit Investigation, buried waste and associated soil contamination were discovered at Site 3. The existence of this contamination was not known at the time of the Site 3 RI. Since potentially complete pathways exist for the transport of contaminants to human and ecological receptors under the current land use as well as any potential future land use, the contaminants could present risks to human and ecological receptors. The nature and extent of the soil contamination need to be determined to revise the risk assessment performed for the Site 3 RI. The size of the landfill needs to be determined in the event that land use controls are considered as a remedial alternative.

The environmental questions being asked:

- What is the areal extent of buried waste at Site 3?
- What is the nature and extent of the soil contamination associated with the buried waste?

A synopsis of secondary data or information from site reports:

See previous paragraphs and test pit investigation discussion.

The possible classes of contaminants and the affected matrices:

VOCs, SVOCs, pesticides, PCBs, Dioxin/Furans, metals (including mercury), and cyanide in soil.

The rationale for inclusion of chemical and non-chemical analyses:

All possible analytical fractions are included to cover items that may have been disposed of in the landfill. See test pit investigation results discussed previously. VOCs have not been detected in site soil samples collected thus far; however, the groundwater underlying the site contains VOC contamination. Although this contamination appears to be originating from a source upgradient of Site 3, the Site cannot be ruled out as a possible contributing source of the groundwater contamination. VOCs are therefore included in the sample analyses.

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

[\(UFP-QAPP Manual Section 2.6.1\)](#)

The following are steps 2 through 7 of the DQO planning process.

Step 2 - DECISIONS TO BE MADE

The primary goal of this investigation is to obtain environmental data for use in making the following decision:

1. Determine whether the landfill boundary and the nature and extent of soil contamination at Site 3 have been fully delineated.

Step 3 - INPUTS REQUIRED TO MAKE THE DECISION

Data and information that will be required to make this decision include the following:

1. Electromagnetic (EM) survey data to determine the locations of the test pits. Figure 6 shows the proposed EM survey area. A geophysical subcontractor will be procured to perform the EM survey. It is anticipated that an EM-31 terrain conductivity meter will be used. EM instruments measure the electrical conductivity and the relative metallic content of subsurface materials. Electrical conductivities are typically higher in areas containing buried waste. To perform the survey, a grid of parallel profile lines will be established across the site. The EM instrument will be moved along each of the lines and measurements of terrain conductivity will be recorded at fixed distance intervals. The acquired data will then be contoured and overlain onto an existing base map of the site. This map will be used to identify terrain conductivity anomalies of the type commonly associated with landfills. Location control will be provided using a global positioning system (GPS). TtNUS SOP GH-3.1, which describes EM survey procedures, is included in Appendix A.

In general, test pits will be excavated at locations where the following conditions apply:

- The EM survey results indicate that buried waste is likely to be present.
- The excavation of a test pit will help to delineate the landfill boundaries or will help provide adequate coverage of the suspected landfill area.

A total of up to eight (8) test pits may be excavated based on the EM survey results.

2. Concentrations in surface and subsurface soils of TCL parameters plus dioxin to determine if these contaminants are present at concentrations greater than PALs (see Worksheet 15). SVOC and pesticide concentrations will also be compared to background concentrations presented in the preliminary draft Site 3 Remedial Investigation Report (TtNUS, 2007). The 95% Upper Tolerance Level (UTL) from the background study will be used for comparisons.

Concentrations in surface and subsurface soils of TAL metals and cyanide to determine if these contaminants are present in soils at concentrations greater than background and screening levels. Background soil concentrations for metals are presented in the Site 3 Remedial Investigation Report (TtNUS, 2007). The 95% UTL from the background study will be used for comparisons.

3. Laboratory reporting limits less than screening levels. Data quality must be sufficient to support a HHRA.

See Worksheets 14, 17, and 18.

Test pit soil sample locations (8) will be determined in the field according to what is encountered in each test pit. The remaining twelve surface soil locations will be marked in the field in agreement among Tetra Tech, the Navy and regulatory agencies if they wish, based upon historical records of reported activities to provide roughly equal distribution across the site. The subsurface soil samples will be chosen based on direct (visual or olfactory) evidence of contamination, or on the highest PID screening responses. The

dioxin sample will be collected from an area showing evidence of charred waste. The test pit confirmation surface soil samples will be collected from areas known to contain buried waste, and will be biased towards areas where exposed waste or staining is present.

Twenty surface soil samples (plus one duplicate sample for QC purposes) and eight subsurface soil samples (plus one duplicate sample for QC purposes) will be collected and analyzed for VOCs, SVOC, pesticides, PCBs, metals, mercury, and cyanide. One (1) subsurface soil sample plus one duplicate sample for QC purposes will be collected and analyzed for dioxins/furans. Concentrations are expected to be low to medium.

EM survey data and reporting will be verified by physical/visual confirmation in the field using confirmation test pit excavation.

Chemical data will undergo 100% validation. The analytical data will get the fullest level of QC and documentation in accordance with Navy guidance. The laboratory must hold a current National Environmental Laboratory Accreditation Program (NELAP) accreditation in Pennsylvania and comply with the requirements of NFESC in analytical results reporting and QA/QC. The data quality must be sufficient to support human health assessment and ecological risk screening.

Step 4 - DELINEATION OF STUDY BOUNDARY

1. The horizontal boundary for the EM study is defined as the area where possible landfill operations took place, based upon historical information, as shown on Figure 15. Test pits will be excavated and soil samples collected in areas where the EM survey indicates that buried waste is likely to be found and that were not investigated during the Test Pit Investigation.
2. The depth of interest for test pits is from 0 to approximately 10 feet below ground surface, which is the approximate depth of bedrock.
3. Each test pit will be from approximately 20 feet to 50 feet in length, approximately 3 feet wide (the width of the backhoe bucket), and approximately 10 feet deep (the limit of a standard backhoe). The exact length of each test pit will be determined in the field based upon observations of the subsurface conditions encountered at each location. Surface soil samples will be collected from a depth of 0 to 6 inches. The depths of the subsurface soil samples will be determined based on observations of subsurface conditions. The objective will be to sample soil that is likely to be contaminated.

Step 5 - DEFINITION OF RULES FOR DECISION MAKING

1. The PALs for the EM survey are specified in the procedures for implementation of the EM survey, evaluation and reporting. The EM survey team, equipment, and procedures, such as equipment calibration, data collection, data evaluation and verification/reporting will follow Navy and Tetra Tech procedures, and will be clearly specified in a SOW for EM survey. Equipment sensitivity, data collection methods and reporting will be specified such that the landfill delineation mapping step will be sufficient to map known areas, and to provide clear evidence to delineate areas where historical landfill operations can be ruled out. All EM survey activities shall adhere, at a minimum, to the requirements of the associated Tetra Tech SOP.

The chemical PAL's for Site 3 surface soils are derived from USEPA Region 3 RBCs including SSLs for groundwater migration (4/2007), Ecological Soil Screening Levels (Eco-SSLs) established by USEPA (2005), and USEPA Region 3 Biological Technical Assistance Group (BTAG) soil screening levels (USEPA, 1995). The chemical PAL's for Site 3 subsurface soils are derived from USEPA Region 3 RBC Screening Values (4/2007) and the Office of Solid Waste and Emergency Response (OSWER) for lead only. Specifically, the most stringent of these values for each analyte is used to determine the PAL for that compound or analyte.

2. If contaminants are detected in any soil sample at concentrations greater than background concentrations (SVOCs, pesticides, metals) and PALs (metals and organics), then the risk assessment will be revised under conditions set in a future UFP-SAP.

Step 6 - PERFORMANCE CRITERIA

Because this is a screening investigation and depends heavily on biased sampling, probability limits for false decision errors were not established.

Step 7 - PLANS FOR OBTAINING THE DATA

Sample Collection and Analyses

1. Sample Collection

- Eight surface soil samples will be collected at 0 to 0.5 feet bgs in areas where buried waste is present. The exact locations will be determined based upon the results of the EM survey and field observations.
- Twelve surface soil samples will be collected at 0 to 0.5 feet bgs in other areas. The exact locations will be determined by a meeting of the project team based upon EM survey results.
- Eight subsurface soil samples will be collected from test pit excavations where buried waste is encountered. The exact sample locations and depths will be determined based upon the results of the EM survey and field observations. (For instance, where the EM report shows conductivity indicative of waste fill, a test pit may be installed to further investigate the subsurface condition at that location. If waste debris is encountered in the excavated soil it will be noted and a soil sample may be collected at that location. PID readings will be used to help choose biased contaminant soil sample locations as well as to further eliminate contaminant concern at excavations where no waste disposal is encountered.

2. Analyses

- Surface and subsurface soil samples will be analyzed for TCL/TAL parameters. In addition, one surface and one subsurface soil sample will be analyzed for dioxins/furans.

Data Generation, Validation, Reporting, and Archiving

The samples will be analyzed and data generated at a fixed base laboratory(s). The laboratory will report the data to TtNUS where the data will be validated. Full data validation (IIb) will be performed on 100% of the data. The validated data will be included in the Final Remedial Investigation Report. Laboratory data deliverables and hard copy reports produced by TtNUS will be archived in the TtNUS docketing and filing system.

Tetra Tech field personnel will collect soil samples as described on Worksheet 18. A chain of custody will accompany all soil samples sent to the laboratory. The laboratory will analyze the soil sample in accordance with this SAP and provide paper and electronic deliverables of the data to Tetra Tech.

The electronic data will be added to the Structured Query Language (SQL) database stored on the Tetra Tech server. A PDF copy of the data will be maintained by Tetra Tech.

SAP Worksheet #12 -- Measurement Performance Criteria Table
 ([UFP-QAPP Manual Section 2.6.2](#))

QC Sample	Analytical Group ¹	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Trip Blank	VOC	1 per cooler	Bias / Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants	S & A
Field Duplicates	All analytical groups	1 per 10 samples	Precision	Values > 5X QL: ± 50% Values < 5X QL: absolute difference must be within ± 2X QL	S & A
Field Blanks	VOC, SVOC, Pesticides, PCBs, Dioxin/Furan	1 per 20 samples	Bias / Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants	S
Field Blanks	Metals, Mercury, Cyanide	1 per 20 samples	Bias / Contamination	No target analytes ≥ QL; with the exception of common field/laboratory contaminants and/or Na, K, and Ca	S
Cooler Temperature Indicators	All analytical groups	1 per cooler	Accuracy / Representativeness	Between 2 and 6 °C	S

¹If information varies within an analytical group, separate by individual analyte.

*Equipment rinsate blanks are not expected to be collected because all the collection equipment will either be dedicated or disposable.

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
Aerial Photographs	Aerial Photographic Site Analysis, Willow Grove Naval Air Station, Willow Grove, Pennsylvania	USEPA, Characterization Research Division, June 1995	Data will be used to generate approximate landfill location on topographic or geographical information system maps and to select proposed test pit locations at Site 3.	None
RI Phase I Analytical Data	RI Report for Sites 1, 2, 3, and 5, Naval Air Station Willow Grove, Pennsylvania	Halliburton NUS Environmental Corporation, February 1993	Data may be used to recalculate environmental risks	None, the data were fully validated.
RI Phase II Analytical Data	Draft Phase II RI Report for NAS JRB Willow Grove	Brown and Root Environmental, 1997	Data may be used to recalculate environmental risks	None, the data were fully validated.
Test Pit Soil Investigation	Test Pit Soil Sampling Report Site 3 – Ninth Street Landfill, NAS JRB Willow Grove	Tetra Tech, NUS, Inc., 2007	Planning for Landfill Delineation Investigation. Jointly, the Test Pit Investigation and Landfill Delineation data may be used to recalculate human and environmental risks	None

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

14.1 FIELD INVESTIGATION TASK PLAN

The field activities include mobilization and demobilization, utility clearance, EM surveying, test pit excavation and soil sampling, surface soil sampling, surveying, and IDW management. The following sections provide additional details regarding these subtasks.

14.1.1 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. Mobilization activities shall also include construction of a temporary decontamination pad. Site-specific Health and Safety Training to all TtNUS subcontractors will be provided as part of the site mobilization.

Demobilization shall consist of the prompt and timely removal of all equipment, materials, and supplies from the site following completion of the work. Demobilization includes the cleanup and removal of waste generated during the conduct of the investigation (i.e., IDW).

14.1.2 Utility Clearance

Prior to the commencement of any intrusive activities, TtNUS will coordinate with the Base to identify and mark-out utilities that may be present within the proposed excavation areas. Subsurface utilities will also be cleared by the excavation subcontractor by notifying the Pennsylvania One-Call utility clearing service.

14.1.3 EM Survey

Figure 6 shows the proposed EM survey area. A geophysical subcontractor will be procured to perform the EM survey. It is anticipated that an EM-31 terrain conductivity meter will be used. EM instruments measure the electrical conductivity and the relative metallic content of subsurface materials. Electrical conductivities are typically higher in areas containing buried waste. To perform the survey, a grid of parallel profile lines will be established across the site. The EM instrument will be moved along each of the lines and measurements of terrain conductivity will be recorded at fixed distance intervals. The acquired data will then be contoured and overlain onto an existing base map of the site. This map will be used to identify terrain conductivity anomalies of the type commonly associated with landfills. Location control will be provided using a global positioning system (GPS). Appropriate profile line spacing will be chosen to provide sufficient resolution for delineation of areas of buried waste. It is expected that relatively narrow line spacing will be used in two areas: the area of buried waste discovered during the 2007 test pit investigation, and in the vicinity of test pit TP-09 (see Figure 6). TP-09 was excavated at the location of SI boring B-3, in which waste materials, consisting of metal wire and glass fragments, were encountered. TP-09, however, did not encounter buried waste. A possible explanation for the discrepancy is that the location of TP-09 did not correspond exactly with that of boring B-3. The EM survey will be used to determine the location of any buried waste in this area. TtNUS SOP GH-3.1, which describes EM survey procedures, is included in Appendix A.

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

14.1.4 Surface Soil Sampling

A total of twenty surface soil samples will be collected and analyzed for full TCL/TAL parameters. The samples will be collected from landfill areas: eight from new test pit locations and 12 from areas to be designated by the project team after the EM survey. The samples will be collected from a depth of 0 to 6 inches. Test pit soil sample locations will be chosen based upon visual evidence of contamination, such as exposed waste or soil staining. If no evidence of contamination is observed, then the sample locations will be chosen in order to provide representative coverage of the landfill area.

The soil will be described by the site geologist and will be screened for evidence of contamination with a PID. Any qualitative visual signs of potential contamination (such as soil staining) will be noted. Soil sampling procedures are discussed in TtNUS SOP SA-1.3, soil logging procedures are documented in TtNUS SOP GH-1.5, and the use of the PID is discussed in TtNUS SOP ME-12. These SOPs are included in Appendix A of this work plan.

The VOC samples will be obtained with EnCore™ sampling equipment, preserved and prepared at the laboratory through SW-846 Method 5035, and analyzed through SW-846 Method 8260B. Field and laboratory QC samples will also be collected.

14.1.5 Test Pit Investigation

A total of up to eight test pits will be excavated to visually characterize the buried waste at the site and to provide a means for the collection of subsurface soil samples to investigate the nature and extent of soil contamination. The results of the EM survey will be used as a guide in selecting the locations of the test pits. Test pits will be excavated in areas that the EM survey indicates are probable locations of buried waste. Test pits will also be used to confirm the conclusions of the EM survey regarding areas where waste is not indicated.

Each test pit will be from approximately 20 feet to 50 feet in length, approximately 3 feet wide (the width of the backhoe bucket), and approximately 10 feet deep (the limit of a standard backhoe). The exact length of each test pit will be determined in the field based upon observations of the subsurface conditions encountered at each location. All excavated materials will be used as backfill at the conclusion of the excavation activities at each location. If potentially hazardous material is encountered, such as drums or liquid waste, work will halt and the Navy facility contact will be notified. A plan for segregation and disposal will then be formulated. Each test pit will be excavated and backfilled during the same day to prevent leaving an open excavation overnight. Under no circumstances will anyone be allowed to enter a test pit during the excavation activities. The Health and Safety procedures and protocols for test pit excavation (included in the attached addendum) will be strictly enforced.

A total of eight subsurface soil samples will be collected from the eight test pits. The samples will be analyzed for full TCL/TAL parameters. One of the samples will also be analyzed for dioxin. The samples will be chosen based on direct (visual or olfactory) evidence of contamination, or on the highest PID screening responses. For the dioxin sample, preference will be given to areas that show evidence of charred waste. Soil samples will only be collected from test pits in which buried waste or other evidence of possible soil contamination is encountered.

The samples will be obtained from excavated material either directly from the backhoe bucket or after it has been deposited on the ground. Alternatively, a remote sampling device such as that described in SOP SA-1.3 may be used to collect samples. Entry into the excavation pit is strictly forbidden. The soil will be described by the site geologist and will be screened for evidence of contamination with a PID. Any qualitative

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

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visual signs of potential contamination (such as soil staining) will be noted. Soil sampling procedures for test pits are discussed in TtNUS SOP SA-1.3, soil logging procedures are documented in TtNUS SOP GH-1.5, and the use of the PID is discussed in TtNUS SOP ME-12. These SOPs are included in Appendix A of this work plan.

The VOC samples will be obtained with EnCore™ sampling equipment, preserved and prepared at the laboratory through SW-846 Method 5035, and analyzed through SW-846 Method 8260B. Field and laboratory QC samples will also be collected.

14.2 SAMPLE DESIGNATION SYSTEM

Each sample collected for analysis will be assigned a unique sample tracking number. This number will consist of a two-segment alphanumeric code that identifies the site, the sample type [sample medium or quality control (QC) sample designation], the sample location, and the sample depth indicator. TtNUS SOP CT-04 addresses sample nomenclature (Appendix A). The alphanumeric coding system to be used is as follows:

Site Identifier:

03 = Site 3

Sample Medium:

TP = Test Pit Sample

SS = Surface Soil Sample

Quality Assurance/Quality Control (QA/QC) Sample Designation:

TB = Trip Blank

FB = Field Blank

Sample Location:

Each test pit will be assigned a two digit consecutive number in the order of installation. Sample locations within a given test pit will be assigned a two digit consecutive number in the order of collection.

Surface soil samples will be assigned a two digit consecutive number in the order of collection.

The sample depth will be indicated by a four digit number. The first two digits will represent the upper limit of the sample depth interval (rounded to the nearest foot) and the bottom two digits will represent the lower limit of the depth interval.

QC Sample Number:

Project-Specific SAP

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All QC samples will be assigned a sequential sample number. The field duplicate, matrix spike (MS), and matrix spike duplicate (MSD) samples will be collected from the same station. For example, the first trip blank will be assigned the tracking number 03-TB-01.

The field duplicate will be given the same type of sample designation as the samples so that it will be “blind” to the laboratory. The sampling time recorded on the Chain-of-Custody (COC) Form, labels and tags for the duplicate samples will be 0000. Notes detailing the sample number, time, date, and type will be recorded on the routine sample log sheets and will document the location of the duplicate sample (sample log sheets are not provided to the laboratory).

All pertinent information regarding sample identification will be recorded in the field logbooks and on sample log sheets where appropriate.

14.4 EQUIPMENT/SAMPLE CONTAINERS CLEANING AND DECONTAMINATION PROCEDURE

Sample containers will be provided certified-clean from the analytical laboratories. Decontamination of sampling equipment will not be necessary for this project because dedicated and disposable hand trowels will be used. However, if decontamination is necessary, these requirements will apply. Decontamination of sampling equipment (e.g., non-disposable hand trowels, hand augers) 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.

Decontamination of the excavator bucket will be performed over the completed, backfilled test pit using a high pressure spray washer with water supplied by the Air Station. All decontamination water will be allowed to infiltrate to the test pit. In the event that free product is encountered, the excavator bucket wash water will be captured and containerized for sampling and appropriate disposal according to analysis.

14.5 FIELD DOCUMENTATION PROCEDURES

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

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 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 of site visitors.
- Arrival/departure of equipment.
- Sampling activities and sample log sheet references.
- Description of subcontractor activities.

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

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- Sample pick-up information including COC numbers, air bill numbers, carrier, time, and date.
- Description of borehole or monitoring well installation activities and operations.
- Health and safety issues.
- Description 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.

14.6 SAMPLE COLLECTION DOCUMENTATION, HANDLING, TRACKING, AND CUSTODY PROCEDURES

The following sections outline the procedures that will be used to document project activities and sample collection, handling, tracking, and custody procedures during performance monitoring tasks. Detailed and accurate documentation is necessary to ensure data integrity, authenticity, and defensibility.

14.6.1 Sample Collection Documentation

Samples will be collected following procedures outlined in Appendix A. The equipment used to collect the sample will be noted in the logbook, along with date and time of sampling, sampler's name, sample description, depth at which the sample was collected, and the volume and number of containers collected. QC sample information will be appropriately recorded. Measurements made will be recorded. All instruments used to make measurements will be identified, along with the date of calibration.

Standard log sheets will be used to record data and will include:

- Test Pit log;
- Soil sample log; and
- COC record.

Log sheets will include entries in every blank, with appropriate use of the abbreviations NA (not applicable) and NR (not recorded). All "NR" entries should be accompanied by an explanation. All entries will be recorded in waterproof ink and signed and dated by the person making the entry. No erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, the correct entry recorded, and the change initialed and dated by the person making the correction.

14.6.2 Sample Handling and Tracking System

The following subsections outline the procedures that will be used by field and laboratory personnel to document sample collection activities during the performance monitoring sampling event. Detailed and accurate documentation is necessary in order to ensure data integrity.

14.6.2.1 Sample Handling

Sample handling is described in Worksheet #26.

14.6.2.2 Sample delivery

The shipment of samples to the laboratory will be made by a shipping courier service (e.g., Federal Express), unless the laboratory is close enough to the site to provide a pickup service. After samples have been collected, they will be sent to the laboratory within 24 to 72 hours depending on the analyte holding time. Under no circumstances will sample holding times be exceeded.

14.6.3 Sample Custody

To ensure the integrity of a sample from collection through analysis, it is necessary to have an accurate written record that traces the possession and handling of the sample. This documentation is referred to as the COC form. The chain of custody begins at the time of sample collection. The laboratory will provide forms that will be used for chain of custody documentation.

A sample is under custody if:

- The sample is in the physical possession of an authorized person.
- The sample is in view of an authorized person after being in his/her possession.
- The sample is placed in a secure area by an authorized person after being in his/her possession.
- The sample is in a secure area, restricted to authorized personnel only.

Custody documentation is designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. A multi-part form is used. Each page of the form is 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 each retain a copy of the form each time a sample transfer occurs.

Integrity of the samples collected during the site investigation 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 analytical report. Sample custody is described in Worksheet #27.

The Field Operations Leader (FOL) is responsible for the care and custody of the samples collected until they are delivered to the laboratory or are entrusted to a shipping courier. When transferring samples, the individuals relinquishing and receiving the samples will each sign the chain-of-custody form and the date and time will be recorded to document the sample custody transfer from the sampler to the shipping courier, and finally to the laboratory. Upon arrival at the laboratory, internal sample custody procedures will be followed as defined in the laboratory SOPs included in Appendix B.

14.7 INVESTIGATION DERIVED WASTE MANAGEMENT

Solid or semi-solid IDW (i.e., soil, sediment, etc.) will not be generated during this field activity during the test pit excavation. Soils will be replaced into the test pit where the soils were excavated. The only solid IDW anticipated is personal protective equipment (PPE), which will be bagged and deposited in an appropriate facility waste container.

Equipment decontamination fluids will be generated during the test pit activities. The backhoe will be cleaned after each test pit. The decontamination water will be discharged to the ground surface over the corresponding back filled test pit.

14.8 SURVEYING

A Pennsylvania licensed surveyor will be subcontracted by Tetra Tech to survey the horizontal location and dimensions of each of the test pit excavation and surface soil location. The horizontal measurements shall be accurate to 0.1 foot. Each of the locations will be surveyed relative to the coordinates of established site benchmarks.

14.9 DATA HANDLING AND MANAGEMENT

The data-handling procedures to be followed by the laboratories will meet the requirements in the laboratory subcontract. All analytical and field data will be maintained in the project files. The project files will contain copies of the COC forms, sample log forms, sample location maps, and documentation of quality assurance of data manipulation.

14.9.1 Data Tracking and Control

A “cradle-to-grave” sample tracking system will be used from the beginning to the end of the sampling event. Before field mobilization, the FOL will coordinate/initiate the sample tracking process. Sample jar labels will be hand-written in the field.

The labels will be reviewed for adherence to work plan requirements as well as for accuracy. The Project Manager will coordinate with the analytical laboratory to ensure that they are aware of the number and type of samples and analyses.

When field sampling is underway, the FOL forwards the COC forms to the PM or designee and the laboratory for each day that samples are collected. The PM or designee will confirm that the COC forms provide the information required by the work plan.

This will allow for early detection of errors made in the field so that adjustments can be made while the field team is mobilized. After successful completion of all requested analyses, the laboratory will submit an electronic deliverable for every sample delivery group (SDG). When all electronic deliverables have been received from the laboratory, the PM or designee will ensure that the laboratory performed all the requested analyses. Ideally, discrepancies can be noted early enough so that all samples can be analyzed within the prescribed holding times.

14.9.2 Sample Information

Data from field measurements will be recorded using the appropriate log sheets.

Reduction of field data entails the summarization and presentation of these data in tabular form. The reduction of laboratory data entails manipulation of raw data instrument output into reportable results. Field data (e.g., photo-ionization detection) will be verified on a daily basis by the FOL. Laboratory data will be verified by the group supervisor and then by the laboratory's QC/Documentation Department.

For field data, the FOL will coordinate with the geographical information system (GIS) lead to ensure that all survey technical specifications are consistent with the underlying coordinate system in the GIS.

Project-Specific SAP**Site Name/Project Name:** NAS JRB Willow Grove**Site Location:** Willow Grove, Pennsylvania**Title:** SAP for Landfill Delineation at Site 3 – Ninth Street Landfill**Revision Number:** 0**Revision Date:** November 2008

Electronic data arriving from the laboratory will pass through to the DVM for database compilation and validation. The DVM will compile all the formatted laboratory electronic deliverables into a working project database. Data that are to be validated will be printed as data packages, which include the samples as part of each SDG and the appropriate analytical fraction. The data packages will be distributed to the appropriate data validators. The data validators will enter all data qualifiers and qualifier codes into the database and print out a hard copy and return it to the DVM. The DVM will check the data qualifiers and qualifier codes in the project database and print the final validated data for incorporation into the data validation letter. When all samples and analyses have been accounted for and validated, the PM will ensure that the analytical data are incorporated into the project database.

14.9.3 Project Data Compilation

The analytical laboratory will generate a PDF file of the analytical data packages, as well as electronic database deliverables. The electronic database will be checked against the pdf file provided by the laboratory and updated as required, based on data qualifier flags applied during the data validation process. The data generated during the implementation of the SAP will be incorporated into the NAS JRB Willow Grove database and GIS. All data, such as units of measure and chemical nomenclature, will be manipulated to maintain consistency with the project database.

14.9.4 Geographical Information System

Data management systems consist of a relational database and GIS that are being used to manage environmental information pertaining to NAS JRB Willow Grove. The relational database stores chemical, geological, hydrogeologic, and other environmental data collected during environmental investigations. The GIS is built from the relational database and contains subsets of the larger data pool. Using the GIS, environmental data can be posted on base mapping to provide a graphical representation of the information.

Upon compilation of sample, chemical, biological, and positional data, the data will be compiled and incorporated into the NAS JRB Willow Grove GIS. The GIS system can be used to generate various maps for NAS JRB Willow Grove data including site location maps, sample location maps, and contaminant tag maps, as needed. The GIS software that is used will be documented in performance monitoring reports.

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

Matrix: Surface Soil

Analytical Group: Volatile Organic Compounds (VOCs)

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Dichlorodifluoromethane	75-71-8	1.10E+04	SSL Soil to GW	5	5	0.53
Chloromethane	74-87-3	9.30E+02	SSL Soil to GW	5	5	1.09
Vinyl chloride	75-01-4	1.20E-01	SSL Soil to GW	1.2	5	0.7
Bromomethane	74-83-9	4.10E+01	SSL Soil to GW	5	5	2.44
Chloroethane	75-00-3	1.90E+01	SSL Soil to GW	5	5	0.59
Trichlorofluoromethane	75-69-4	2.30E+04	SSL Soil to GW	5	5	0.8
1,1-Dichloroethene	75-35-4	2.90E+03	SSL Soil to GW	5	5	0.79
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	2.30E+06	SSL Soil to GW	5	5	1.12
Acetone	67-64-1	2.20E+04	SSL Soil to GW	12.05	12.05	7.06
Carbon disulfide	75-15-0	1.90E+04	SSL Soil to GW	5	5	0.66
Methyl acetate	79-20-9	2.50E+04	SSL Soil to GW	5	5	1.2
Methylene chloride	75-09-2	1.90E+01	SSL Soil to GW	5	5	0.6
trans-1,2-Dichloroethene	156-60-5	7.20E-01	SSL Soil to GW	5	5	0.77
Methyl tert-butyl ether	1634-04-4	1.20E+01	SSL Soil to GW	5	5	0.53
1,1-Dichloroethane	75-34-3	300	Region 3 BTAG	5	5	0.63
cis-1,2-Dichloroethene	156-59-2	300	Region 3 BTAG	5	5	0.55
2-Butanone	78-93-3	2.90E+04	SSL Soil to GW	12.5	12.5	1.62
Bromochloromethane	74-97-5	---	---	5	5	0.80
Chloroform	67-66-3	9.10E-01	SSL Soil to GW	5	5	0.54
1,1,1-Trichloroethane	71-55-6	3.24E+04	SSL Soil to GW	5	5	0.62
Cyclohexane	108-94-1	1.20E+06	SSL Soil to GW	5	5	0.92
Carbon tetrachloride	56-23-5	2.10E+00	SSL Soil to GW	5	5	0.98
Benzene	71-43-2	1.90E+00	SSL Soil to GW	5	5	0.51

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
					1,2-Dichloroethane	107-06-2
Trichloroethene	79-01-6	2.60E-01	SSL Soil to GW	2.6	5	0.56
Methylcyclohexane	108-87-2	---	---	5	5	1.13
1,2-Dichloropropane	78-87-5	3.41E+00	SSL Soil to GW	5	5	1.02
Bromodichloromethane	75-27-4	1.10E+00	SSL Soil to GW	5	5	0.74
cis-1,3-Dichloropropene	10061-01-5	3.10E+00	SSL Soil to GW	5	5	0.22
4-Methyl-2-pentanone	108-10-1	5.90E+04	SSL Soil to GW	12.5	12.5	1.77
Toluene	108-88-3	100	Region 3 BTAG	5	5	0.00
trans-1,3-Dichloropropene	10061-02-6	3.10E+00	SSL Soil to GW	5	5	0.80
1,1,2-Trichloroethane	79-00-5	7.80E-01	SSL Soil to GW	5	5	0.95
Tetrachloroethene	127-18-4	4.70E+00	SSL Soil to GW	5	5	1.64
2-Hexanone	591-78-6	---	---	12.5	12.5	2.86
Dibromochloromethane	124-48-1	8.30E-01	SSL Soil to GW	5	5	0.82
1,2-Dibromoethane	106-93-4	6.00E-02	SSL Soil to GW	0.6	5	0.87
Chlorobenzene	108-90-7	100	Region 3 BTAG	5	5	0.81
Ethylbenzene	100-41-4	100	Region 3 BTAG	5	5	1.11
o-Xylene	95-47-6	100	Region 3 BTAG	5	5	0.53
m,p-Xylene	179601-23-1	100	Region 3 BTAG	5	5	0.53
Styrene	100-42-5	100	Region 3 BTAG	5	5	1.02
Bromoform	75-25-2	6.70E+01	SSL Soil to GW	5	5	0.71
Isopropylbenzene	98-82-8	6.40E+04	SSL Soil to GW	5	5	1.33
1,1,2,2-Tetrachloroethane	79-34-5	6.80E-04	SSL Soil to GW	5	5	0.74
1,3-Dichlorobenzene	541-73-1	2.90E+02	SSL Soil to GW	5	5	0.94
1,4-Dichlorobenzene	106-46-7	3.41E+00	SSL Soil to GW	5	5	1.00
1,2-Dichlorobenzene	95-50-1	100	Region 3 BTAG	5	5	1.14
1,2-Dibromo-3-chloropropane	96-12-8	3.70E-03	SSL Soil to GW	0.04	5	1.52
1,2,4-Trichlorobenzene	120-82-1	2.40E+03	SSL Soil to GW	5	5	0.87
1,2,3-Trichlorobenzene	87-61-6	---	---	5	5	1.28

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

¹ SSL Soil to GW – EPA Region 3 Soil Screening Levels for groundwater migration (10/2007); Region 3 BTAG – EPA Region 3 BTAG Soil Screening Levels (8/95)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

³ It is recognized that some QLs are greater than the compound PALs. For many of these, the QLs meet an elevated RBC (increased by a factor of ten for carcinogens) to correspond to a single-chemical risk of 10⁻⁵. For those compounds that do not meet this elevated criterion, it is not anticipated that this will be a problem for planned data use.

Matrix: Surface Soil
 Analytical Group: Semivolatile Organic Compounds (SVOCs)

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Benzaldehyde	100-52-7	7.8E+06	HH-Region 3 RBC	170	170	113.28
Phenol	108-95-2	100	Region 3 BTAG	100	170	113.28
Bis(2-chloroethyl) ether	111-44-4	4.40E-02	SSL Soil to GW	0.4	170	114.81
2-Chlorophenol	95-57-8	100	Region 3 BTAG	100	170	94.75
2-Methylphenol	95-48-7	100	Region 3 BTAG	100	170	103.72
2,2'-Oxybis(1-chloropropane)	108-60-1	1.70E+00	SSL Soil to GW	17	170	126.86
Acetophenone	98-86-2	3.20E+03	SSL Soil to GW	170	170	67.70
4-Methylphenol	106-44-5	3.90E+05	HH-Region 3 RBC	330	330	87.81
N-Nitroso-di-n propylamine	621-64-7	4.70E-02	SSL Soil to GW	0.5	170	111.18
Hexachloroethane	67-72-1	3.60E+02	SSL Soil to GW	170	170	113.14
Nitrobenzene	98-95-3	2.30E+01	SSL Soil to GW	2.3	170	92.81
Isophorone	78-59-1	4.10E+02	SSL Soil to GW	170	170	108.35
2-Nitrophenol	88-75-5	---	---	170	170	114.04
2,4-Dimethylphenol	105-67-9	100	Region 3 BTAG	100	170	95.48
Bis(2-chloroethoxy) methane	111-91-1	---	---	170	170	100.73
2,4-Dichlorophenol	120-83-2	1.20E+03	SSL Soil to GW	170	170	88.74
4-Chloroaniline	106-47-8	9.70E+02	SSL Soil to GW	170	170	107.11
Hexachlorobutadiene	87-68-3	8.20E+03	HH-Region 3 RBC	170	170	141.97
Caprolactam	105-60-2	3.90E+07	HH-Region 3 RBC	330	330	34.54
4-Chloro-3-methylphenol	59-50-7	---	---	170	170	88.62
Hexachlorocyclopentadiene	77-47-4	4.70E+05	HH-Region 3 RBC	170	170	TBD
2,4,6-Trichlorophenol	88-06-2	100	Region 3 BTAG	100	170	93.06
2,4,5-Trichlorophenol	95-95-4	100	Region 3 BTAG	100	170	91.77
1,1'-Biphenyl	92-52-4	9.60E+04	SSL Soil to GW	330	330	49.54
2-Chloronaphthalene	91-58-7	3.20E+04	SSL Soil to GW	170	170	115.22
2-Nitroaniline	88-74-4	---	---	170	170	87.45
Dimethylphthalate	131-11-3	---	---	170	170	85.36

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
2,6-Dinitrotoluene	606-20-2	2.50E+02	SSL Soil to GW	170	170	86.74
3-Nitroaniline	99-09-2	---	---	170	170	TBD
2,4-Dinitrophenol	51-28-5	---	---	170	170	133.44
4-Nitrophenol	100-02-7	100	Region 3 BTAG	100	170	TBD
Dibenzofuran	132-64-9	7.82E+01	HH-Region 3 RBC	7.8	170	94.24
2,4-Dinitrotoluene	121-14-2	5.70E+02	SSL Soil to GW	170	170	86.43
Diethylphthalate	84-66-2	4.50E+05	SSL Soil to GW	170	170	74.47
4-Chlorophenyl-phenyl ether	7005-72-3	---	---	170	170	77.00
4-Nitroaniline	100-01-6	---	---	170	170	67.01
4,6-Dinitro-2-methylphenol	534-52-1	---	---	170	170	117.68
N-Nitrosodiphenylamine	86-30-6	7.60E+02	SSL Soil to GW	170	170	69.32
1,2,4,5-Tetrachlorobenzene	95-94-3	6.60E+02	SSL Soil to GW	170	170	95.92
4-Bromophenyl-phenylether	101-55-3	---	---	170	170	73.54
Hexachlorobenzene	118-74-1	4.00E+02	HH-Region 3 RBC	170	170	TBD
Atrazine	1912-24-9	8.80E+00	SSL Soil to GW	88	330	35.87
Pentachlorophenol	87-86-5	100	Region 3 BTAG	100	170	104.40
Carbazole	86-74-8	4.70E+02	SSL Soil to GW	170	170	TBD
Di-n-butylphthalate	84-74-2	5.00E+06	SSL Soil to GW	170	170	160.12
Butylbenzylphthalate	85-68-7	1.60E+07	HH-Region 3 RBC	170	170	104.53
3,3'-dichlorobenzidine	91-94-1	4.90E+00	SSL Soil to GW	49	170	TBD
Bis(2-ethylhexyl) phthalate	117-81-7	4.60E+04	HH-Region 3 RBC	170	170	166.37
Di-n-octylphthalate	117-84-0	---	---	170	170	TBD
2,3,4,6-Tetrachlorophenol	58-90-2	2.30E+06	HH-Region 3 RBC	170	170	88.20
Naphthalene	91-20-3	100	Region 3 BTAG	100	170	112.69
2-Methylnaphthalene	91-57-6	1.10E+03	Eco SSL	170	170	102.89
Acenaphthylene	208-96-8	1.00E+05	SSL Soil to GW	170	170	99.29
Acenaphthene	83-32-9	100	Region 3 BTAG	100	170	89.77
Fluorene	86-73-7	100	Region 3 BTAG	100	170	80.44
Phenanthrene	85-01-8	100	Region 3 BTAG	100	170	79.50
Anthracene	120-12-7	100	Region 3 BTAG	100	170	73.67

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Fluoranthene	206-44-0	100	Region 3 BTAG	100	170	78.40
Pyrene	129-00-0	100	Region 3 BTAG	100	170	83.69
Benzo(a)anthracene	56-55-3	100	Region 3 BTAG	100	170	76.63
Chrysene	218-01-9	100	Region 3 BTAG	100	170	69.44
Benzo(b) fluoranthene	205-99-2	100	Region 3 BTAG	100	170	146.93
Benzo(k) fluoranthene	207-08-9	100	Region 3 BTAG	100	170	68.58
Benzo(a) pyrene	50-32-8	2.20E+01	HH-Region 3 RBC	170	170	79.12
Indeno(1,2,3,-cd) pyrene	193-39-5	100	Region 3 BTAG	100	170	89.33
Dibenzo(a,h) anthracene	53-70-3	2.20E+01	HH-Region 3 RBC	170	170	78.62
Benzo(g,h,i) perylene	191-24-2	---	---	170	170	94.12

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Tables (10/2007); SSL Soil to GW - Region 3 Soil Screening Levels for groundwater migration (10/2007); Region 3 BTAG – EPA Region 3 BTAG Soil Screening Levels (8/95); Eco SSL – EPA Ecological Soil Screening Levels (OSWER Directive, 8/07)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

³ It is recognized that some QLs are greater than the compound PALs. For many of these, the QLs meet an elevated RBC (increased by a factor of ten for carcinogens) to correspond to a single-chemical risk of 10-5. For those compounds that do not meet this elevated criterion, it is not anticipated that this will be a problem for planned data use. For many compounds, including PAHs, if they are not detected at levels above the QL, then they will be reanalyzed using the 8270-SIM method.

Matrix: Surface Soil
Analytical Group: SVOCs by SIM

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
2-Chlorophenol	95-57-8	100	Region 3 BTAG	21.3	21.3	9.38
2-Methylphenol	95-48-7	100	Region 3 BTAG	21.3	21.3	16.53
N-Nitroso-di-n propylamine	621-64-7	4.70E-02	SSL Soil to GW	0.5	10.7	2.15
2,4-Dimethylphenol	105-67-9	100	Region 3 BTAG	21.3	21.3	1.58
2,4,6-Trichlorophenol	88-06-2	100	Region 3 BTAG	21.3	21.3	6.35
2,4,5-Trichlorophenol	95-95-4	100	Region 3 BTAG	21.3	21.3	6.14
4-Nitrophenol	100-02-7	100	Region 3 BTAG	64	64	14.52
Pentachlorophenol	87-86-5	100	Region 3 BTAG	21.3	21.3	9.59
3,3'-dichlorobenzidine	91-94-1	4.90E+00	SSL Soil to GW	10.7	10.7	2.44

¹ SSL Soil to GW - Region 3 Soil Screening Levels for groundwater migration (10/2007); Region 3 BTAG – EPA Region 3 BTAG Soil Screening Levels (8/95).

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

³ The QL for N-Nitroso-di-n propylamine is greater than the PAL. For 3,3'-dichlorobenzidine, the QL meets an elevated RBC (increased by a factor of ten for carcinogens) to correspond to a single-chemical risk of 10⁻⁵. It is not anticipated that this will be a problem for planned data use.

Matrix: Surface Soil
Analytical Group: PAHs by SIM

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Naphthalene	91-20-3	100	Region 3 BTAG	8.3	8.3	0.27
2-Methylnaphthalene	91-57-6	3.10E+03	HH-Region 3 RBC	8.3	8.3	0.57
Acenaphthylene	208-96-8	100	Region 3 BTAG	8.3	8.3	0.4
Acenaphthene	83-32-9	100	Region 3 BTAG	8.3	8.3	0.62
Fluorene	86-73-7	100	Region 3 BTAG	8.3	8.3	0.36
Phenanthrene	85-01-8	100	Region 3 BTAG	8.3	8.3	0.31
Anthracene	120-12-7	100	Region 3 BTAG	8.3	8.3	0.28
Fluoranthene	206-44-0	100	Region 3 BTAG	8.3	8.3	0.31
Pyrene	129-00-0	100	Region 3 BTAG	8.3	8.3	0.24
Benzo(a)anthracene	56-55-3	100	Region 3 BTAG	8.3	8.3	0.23
Chrysene	218-01-9	100	Region 3 BTAG	8.3	8.3	0.23
Benzo(b) fluoranthene	205-99-2	100	Region 3 BTAG	8.3	8.3	0.31
Benzo(k) fluoranthene	207-08-9	100	Region 3 BTAG	8.3	8.3	0.29
Benzo(a) pyrene	50-32-8	2.20E+01	HH-Region 3 RBC	8.3	8.3	0.24
Indeno(1,2,3,-cd) pyrene	193-39-5	100	Region 3 BTAG	8.3	8.3	0.32
Dibenzo(a,h) anthracene	53-70-3	2.20E+01	HH-Region 3 RBC	8.3	8.3	0.3
Benzo(g,h,i) perylene	191-24-2	---	---	8.3	8.3	0.31

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Table (10/2007); SSL Soil to GW - Region 3 Soil Screening Levels for groundwater migration (10/2007); Region 3 BTAG – EPA Region 3 BTAG Soil Screening Levels (8/95); Eco SSL – EPA Ecological Soil Screening Levels (OSWER Directive, 8/07)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Surface Soil
 Analytical Group: Pesticides

Analyte	CAS Number	Project Action Level (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
alpha-BHC	319-84-6	8.90E-01	SSL Soil to GW	0.42	0.42	0.09
beta-BHC	319-85-7	3.10E+00	SSL Soil to GW	0.83	0.83	0.44
delta-BHC	319-86-8	---	---	0.42	0.42	0.17
gamma-BHC (Lindane)	58-89-9	4.30E+00	SSL Soil to GW	0.42	0.42	0.07
Heptachlor	76-44-8	1.40E+02	HH-Region 3 RBC	0.42	0.42	0.14
Aldrin	309-00-2	7.70E+00	SSL Soil to GW	0.42	0.42	0.35
Heptachlor epoxide	1024-57-3	2.50E+01	SSL Soil to GW	0.42	0.42	0.23
Endosulfan I	959-98-8	2.00E+04	SSL Soil to GW	0.83	0.83	0.05
Dieldrin	60-57-1	2.20E+00	SSL Soil to GW	0.83	0.83	0.30
4,4'-DDE	72-55-9	100	Region 3 BTAG	0.83	0.83	0.12
Endrin	72-20-8	5.40E+03	SSL Soil to GW	1.67	1.67	0.09
Endosulfan II	33213-65-9	2.00E+04	SSL Soil to GW	1.67	1.67	0.11
4,4'-DDD	72-54-8	100	Region 3 BTAG	1.67	1.67	0.09
Endosulfan sulfate	1031-07-8	2.00E+04	SSL Soil to GW	1.67	1.67	0.18
4,4'-DDT	50-29-3	21	Eco SSL	2.5	2.5	0.12
Methoxychlor	72-43-5	3.10E+05	SSL Soil to GW	4.17	4.17	0.64
Endrin ketone	53494-70-5	5.40E+03	SSL Soil to GW	4.17	4.17	0.11
Endrin aldehyde	7421-93-4	5.40E+03	SSL Soil to GW	1.67	1.67	0.12
alpha-Chlordane	5103-71-9	9.20E+02	SSL Soil to GW	0.83	0.83	0.10
gamma-Chlordane	5103-74-2	9.20E+02	SSL Soil to GW	0.42	0.42	0.08
Toxaphene	8001-35-2	5.80E+02	HH-Region 3 RBC	83	83	25.50

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Tables (10/2007) SSI Soil to GW – EPA Region 3 soil-to-groundwater Soil Screening Level, DAF=20 (10/2007); Region 3 BTAG – EPA Region 3 BTAG Soil Screening Levels (8/95); Eco SSL – EPA Ecological Soil Screening Levels (OSWER Directive, 8/07)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Surface Soil

Analytical Group: Polychlorinated Biphenyls (PCBs)

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Aroclor-1016	12674-11-2	100	Region 3 BTAG	31	31	11.78
Aroclor-1221	11104-28-2	100	Region 3 BTAG	42	42	20.27
Aroclor-1232	11141-16-5	100	Region 3 BTAG	31	31	7.51
Aroclor-1242	53469-21-9	100	Region 3 BTAG	21	21	11.22
Aroclor-1248	12672-29-6	100	Region 3 BTAG	21	21	7.52
Aroclor-1254	11097-69-1	100	Region 3 BTAG	21	21	NA
Aroclor-1260	11096-82-5	100	Region 3 BTAG	31	31	5.00

¹ Region 3 BTAG – EPA Region III BTAG Soil Screening Levels (8/95)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Surface Soil
Analytical Group: Dioxin/Furans

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
2,3,7,8-TCDD	1746-01-6	4.30E-03	HH-Region 3 RBC	0.001	0.001	0.00006
1,2,3,7,8-PeCDD	40321-76-4	2.20E-03	HH-Region 3 RBC	0.005	0.005	0.000288
1,2,3,6,7,8-HxCDD	57653-85-7	4.30E-04	HH-Region 3 RBC	0.005	0.005	0.000276
1,2,3,4,7,8-HxCDD	39227-28-6	4.30E-04	HH-Region 3 RBC	0.005	0.005	0.000187
1,2,3,7,8,9-HxCDD	19408-74-3	4.30E-04	HH-Region 3 RBC	0.005	0.005	0.000288
1,2,3,4,6,7,8-HpCDD	35822-46-9	4.30E-05	HH-Region 3 RBC	0.005	0.005	0.000293
OCDD	3268-87-9	4.30E-06	HH-Region 3 RBC	0.01	0.01	0.000644
2,3,7,8-TCDF	51207-31-9	4.30E-04	HH-Region 3 RBC	0.001	0.001	0.000162
1,2,3,7,8-PeCDF	57117-41-6	2.20E-04	HH-Region 3 RBC	0.005	0.005	0.000367
2,3,4,7,8-PeCDF	57117-31-4	2.20E-03	HH-Region 3 RBC	0.005	0.005	0.000247
1,2,3,6,7,8-HxCDF	57117-44-9	4.30E-04	HH-Region 3 RBC	0.005	0.005	0.000153
1,2,3,7,8,9-HxCDF	72918-21-9	4.30E-04	HH-Region 3 RBC	0.005	0.005	0.000304
1,2,3,4,7,8-HxCDF	70648-26-9	4.30E-04	HH-Region 3 RBC	0.005	0.005	0.000336
2,3,4,6,7,8-HxCDF	60851-34-5	4.30E-04	HH-Region 3 RBC	0.005	0.005	0.00105
1,2,3,4,6,7,8-HpCDF	67562-39-4	---	---	0.005	0.005	0.000604
1,2,3,4,7,8,9-HpCDF	55673-89-7	4.30E-05	HH-Region 3 RBC	0.005	0.005	0.000257
OCDF	39001-02-0	4.30E-06	HH-Region 3 RBC	0.01	0.01	0.000694

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Tables (10/2007)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Surface Soil
 Analytical Group: Inorganic Compounds

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific ² (mg/kg)	
					QLs	MDLs
Aluminum	7429-90-5	1	Region 3 BTAG	1	20	3.495
Antimony	7440-36-0	0.27	Eco SSL	0.27	1	0.150
Arsenic	7440-38-2	2.60E-02	SSL Soil to GW	0.026	1	0.202
Barium	7440-39-3	4.40E+02	Region 3 BTAG	20	20	0.096
Beryllium	7440-41-7	2.00E-03	Region 3 BTAG	0.002	0.5	0.037
Cadmium	7440-43-9	0.36	Eco SSL	0.36	0.5	0.023
Calcium	7440-70-2	---	---	500	500	4.214
Chromium	7440-47-3	7.50E-03	Region 3 BTAG	0.008	1	0.033
Cobalt	7440-48-4	1.00E-01	Region 3 BTAG	0.1	0.5	0.037
Copper	7440-50-8	1.50E+01	Region 3 BTAG	0.5	0.5	0.141
Iron	7439-89-6	1.20E-02	Region 3 BTAG	0.01	10	1.241
Lead	7439-92-1	1.00E-02	Region 3 BTAG	0.01	0.3	0.114
Magnesium	7439-95-4	4.4	Region 3 BTAG	4.4	500	0.392
Manganese	7439-96-5	220	Eco SSL	1	1	0.042
Mercury	7439-97-6	5.80E-03	Region 3 BTAG	0.006	0.2	0.042
Nickel	7440-02-0	2	Region 3 BTAG	2	4.0	0.062
Potassium	7440-9-7	---	---	500	500	0.963
Selenium	7782-49-2	0.52	Eco SSL	0.5	0.5	0.297
Silver	7440-22-4	9.80E-03	Region 3 BTAG	0.01	0.5	0.053
Sodium	7440-23-5	---	---	500	500	17.816
Thallium	7440-28-0	1.00E-03	Region 3 BTAG	0.001	1.0	0.766
Vanadium	7440-62-2	0.5	Region 3 BTAG	0.5	2.0	0.020
Zinc	7440-66-6	10	Region 3 BTAG	2	2.0	0.192
Cyanide	57-12-5	5.00E-03	Region 3 BTAG	0.005	10	0.14

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Tables (10/2007); SSL Soil to GW - Region 3 Soil Screening Levels for groundwater migration (10/2007); Region 3 BTAG – EPA Region 3 BTAG Soil Screening Levels (8/95); Eco SSL – EPA Ecological Soil Screening Levels (OSWER Directive, 8/07)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Subsurface Soil
 Analytical Group: VOCs

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Dichlorodifluoromethane	75-71-8	1.10E+04	SSL Soil to GW	5	5	0.53
Chloromethane	74-87-3	9.30E+02	SSL Soil to GW	5	5	1.09
Vinyl chloride	75-01-4	1.20E-01	SSL Soil to GW	1.2	5	0.7
Bromomethane	74-83-9	4.10E+01	SSL Soil to GW	5	5	2.44
Chloroethane	75-00-3	1.90E+01	SSL Soil to GW	5	5	0.59
Trichlorofluoromethane	75-69-4	2.30E+04	SSL Soil to GW	5	5	0.8
1,1-Dichloroethene	75-35-4	2.90E+03	SSL Soil to GW	5	5	0.79
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	2.30E+06	SSL Soil to GW	5	5	1.12
Acetone	67-64-1	2.20E+04	SSL Soil to GW	12.05	12.05	7.06
Carbon disulfide	75-15-0	1.90E+04	SSL Soil to GW	5	5	0.66
Methyl acetate	79-20-9	2.50E+04	SSL Soil to GW	5	5	1.2
Methylene chloride	75-09-2	1.90E+01	SSL Soil to GW	5	5	0.6
trans-1,2-Dichloroethene	156-60-5	7.20E-01	SSL Soil to GW	5	5	0.77
Methyl tert-butyl ether	1634-04-4	1.20E+01	SSL Soil to GW	5	5	0.53
1,1-Dichloroethane	75-34-3	5.10E+03	SSL Soil to GW	5	5	0.63
cis-1,2-Dichloroethene	156-59-2	7.80E+05	HH-Region 3 RBC	5	5	0.55
2-Butanone	78-93-3	2.90E+04	SSL Soil to GW	12.5	12.5	1.62
Bromochloromethane	74-97-5	---	---	5	5	0.80
Chloroform	67-66-3	9.10E-01	SSL Soil to GW	5	5	0.54
1,1,1-Trichloroethane	71-55-6	3.24E+04	SSL Soil to GW	5	5	0.62
Cyclohexane	108-94-1	1.20E+06	SSL Soil to GW	5	5	0.92
Carbon tetrachloride	56-23-5	2.10E+00	SSL Soil to GW	5	5	0.98
Benzene	71-43-2	1.90E+00	SSL Soil to GW	5	5	0.51
1,2-Dichloroethane	107-06-2	1.00E+00	SSL Soil to GW	5	5	0.78
Trichloroethene	79-01-6	2.60E-01	SSL Soil to GW	2.6	5	0.56
Methylcyclohexane	108-87-2	---	---	5	5	1.13
1,2-Dichloropropane	78-87-5	3.41E+00	SSL Soil to GW	5	5	1.02

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Bromodichloromethane	75-27-4	1.10E+00	SSL Soil to GW	5	5	0.74
cis-1,3-Dichloropropene	10061-01-5	3.10E+00	SSL Soil to GW	5	5	0.22
4-Methyl-2-pentanone	108-10-1	5.90E+04	SSL Soil to GW	12.5	12.5	1.77
Toluene	108-88-3	2.70E+04	SSL Soil to GW	5	5	0.00
trans-1,3-Dichloropropene	10061-02-6	3.10E+00	SSL Soil to GW	5	5	0.80
1,1,2-Trichloroethane	79-00-5	7.80E-01	SSL Soil to GW	5	5	0.95
Tetrachloroethene	127-18-4	4.70E+00	SSL Soil to GW	5	5	1.64
2-Hexanone	591-78-6	---	---	12.5	12.5	2.86
Dibromochloromethane	124-48-1	8.30E-01	SSL Soil to GW	5	5	0.82
1,2-Dibromoethane	106-93-4	6.00E-02	SSL Soil to GW	0.6	5	0.87
Chlorobenzene	108-90-7	6.80E+02	SSL Soil to GW	5	5	0.81
Ethylbenzene	100-41-4	1.50E+04	SSL Soil to GW	5	5	1.11
o-Xylene	95-47-6	3.00E+03	SSL Soil to GW	5	5	0.53
m,p-Xylene	179601-23-1	3.00E+03	SSL Soil to GW	5	5	0.53
Styrene	100-42-5	5.70E+04	SSL Soil to GW	5	5	1.02
Bromoform	75-25-2	6.70E+01	SSL Soil to GW	5	5	0.71
Isopropylbenzene	98-82-8	6.40E+04	SSL Soil to GW	5	5	1.33
1,1,2,2-Tetrachloroethane	79-34-5	6.80E-04	SSL Soil to GW	5	5	0.74
1,3-Dichlorobenzene	541-73-1	2.90E+02	SSL Soil to GW	5	5	0.94
1,4-Dichlorobenzene	106-46-7	3.41E+00	SSL Soil to GW	5	5	1.00
1,2-Dichlorobenzene	95-50-1	4.60E+03	SSL Soil to GW	5	5	1.14
1,2-Dibromo-3-chloropropane	96-12-8	3.70E-03	SSL Soil to GW	5	5	1.52
1,2,4-Trichlorobenzene	120-82-1	2.40E+03	SSL Soil to GW	5	5	0.87
1,2,3-Trichlorobenzene	87-61-6	2.40E+03	SSL Soil to GW	5	5	1.28

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Tables (10/2007); SSL Soil to GW - Region 3 Soil Screening Levels for groundwater migration (10/2007)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

³ It is recognized that some QLs are greater than the compound PALs. For many of these, the QLs meet an elevated RBC (increased by a factor of ten for carcinogens) to correspond to a single-chemical risk of 10-5. For those compounds that do not meet this elevated criteria, it is not anticipated that this will be a problem for planned data use.

Matrix: Subsurface Soil
Analytical Group: SVOCs

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Benzaldehyde	100-52-7	7.8E+06	HH-Region 3 RBC	170	170	113.28
Phenol	108-95-2	6.7E+04	SSL Soil to GW	170	170	113.28
Bis(2-chloroethyl) ether	111-44-4	4.4E-02	SSL Soil to GW	0.4	170	114.81
2-Chlorophenol	95-57-8	3.9E+05	HH-Region 3 RBC	170	170	94.75
2-Methylphenol	95-48-7	3.9E+06	HH-Region 3 RBC	170	170	103.72
2,2'-Oxybis(1-chloropropane)	108-60-1	1.7E+00	SSL Soil to GW	17	170	126.86
Acetophenone	98-86-2	3.2E+03	SSL Soil to GW	170	170	67.70
4-Methylphenol	106-44-5	3.9E+05	HH-Region 3 RBC	170	330	87.81
N-Nitroso-di-n propylamine	621-64-7	4.7E-02	SSL Soil to GW	0.5	170	111.18
Hexachloroethane	67-72-1	3.6E+02	SSL Soil to GW	170	170	113.14
Nitrobenzene	98-95-3	2.3E+01	SSL Soil to GW	2.3	170	92.81
Isophorone	78-59-1	4.1E+02	SSL Soil to GW	170	170	108.35
2-Nitrophenol	88-75-5	---	---	170	170	114.04
2,4-Dimethylphenol	105-67-9	6.7E+03	SSL Soil to GW	170	170	95.48
Bis(2-chloroethoxy) methane	111-91-1	---	---	170	170	100.73
2,4-Dichlorophenol	120-83-2	1.2E+03	SSL Soil to GW	170	170	88.74
Naphthalene	91-20-3	1.5E+02	SSL Soil to GW	150	170	112.69
4-Chloroaniline	106-47-8	9.7E+02	SSL Soil to GW	170	170	107.11
Hexachlorobutadiene	87-68-3	8.2E+00	HH-Region 3 RBC	170	170	141.97
Caprolactam	105-60-2	3.9E+07	HH-Region 3 RBC	330	330	34.54
4-Chloro-3-methylphenol	59-50-7	---	---	170	170	88.62
2-Methylnaphthalene	91-57-6	4.4E+00	SSL Soil to GW	4.4	170	102.89
Hexachlorocyclopentadiene	77-47-4	4.7E+05	HH-Region 3 RBC	170	170	TBD
2,4,6-Trichlorophenol	88-06-2	5.8E+04	HH-Region 3 RBC	170	170	93.06
2,4,5-Trichlorophenol	95-95-4	7.8E+06	HH-Region 3 RBC	170	170	91.77
1,1'-Biphenyl	92-52-4	9.6E+04	SSL Soil to GW	330	330	49.54
2-Chloronaphthalene	91-58-7	3.2E+04	SSL Soil to GW	170	170	115.22

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
2-Nitroaniline	88-74-4	---	---	170	170	87.45
Dimethylphthalate	131-11-3	---	---	170	170	85.36
2,6-Dinitrotoluene	606-20-2	2.5E+02	SSL Soil to GW	170	170	86.74
Acenaphthylene	208-96-8	1.0E+05	SSL Soil to GW	170	170	99.29
3-Nitroaniline	99-09-2	---	---	170	170	TBD
Acenaphthene	83-32-9	1.0E+05	SSL Soil to GW	170	170	89.77
2,4-Dinitrophenol	51-28-5	1.6E+05	HH-Region 3 RBC	170	170	133.44
4-Nitrophenol	100-02-7	---	---	170	170	TBD
Dibenzofuran	132-64-9	7.82E+01	HH-Region 3 RBC	7.8	170	94.24
2,4-Dinitrotoluene	121-14-2	5.7E+02	SSL Soil to GW	170	170	86.43
Diethylphthalate	84-66-2	4.5E+05	SSL Soil to GW	170	170	74.47
Fluorene	86-73-7	1.4E+05	SSL Soil to GW	170	170	80.44
4-Chlorophenyl-phenyl ether	7005-72-3	---	---	170	170	77.00
4-Nitroaniline	100-01-6	---	---	170	170	67.01
4,6-Dinitro-2-methylphenol	534-52-1	---	---	170	170	117.68
N-Nitrosodiphenylamine	86-30-6	7.6E+02	SSL Soil to GW	170	170	69.32
1,2,4,5-Tetrachlorobenzene	95-94-3	6.6E+02	SSL Soil to GW	170	170	95.92
4-Bromophenyl-phenylether	101-55-3	---	---	170	170	73.54
Hexachlorobenzene	118-74-1	4.0E+02	HH-Region 3 RBC	170	170	TBD
Atrazine	1912-24-9	8.8E+00	SSL Soil to GW	88	330	35.87
Pentachlorophenol	87-86-5	5.3E+03	HH-Region 3 RBC	170	170	104.40
Phenanthrene	85-01-8	---	---	170	170	79.50
Anthracene	120-12-7	4.7E+05	SSL Soil to GW	170	170	73.67
Carbazole	86-74-8	4.7E+02	SSL Soil to GW	170	170	TBD
Di-n-butylphthalate	84-74-2	5.0E+06	SSL, Soil to GW	170	170	160.12
Fluoranthene	206-44-0	3.1E+06	HH-Region 3 RBC	170	170	78.40
Pyrene	129-00-0	6.8E+05	SSL Soil to GW	170	170	83.69
Butylbenzylphthalate	85-68-7	1.6E+07	HH-Region 3 RBC	170	170	104.53
3,3'-dicholorobenzidine	91-94-1	4.9E+00	SSL Soil to GW	49	170	TBD
Benzo(a)anthracene	56-55-3	2.2E+02	HH-Region 3 RBC	170	170	76.63

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Chrysene	218-01-9	2.2E+04	HH-Region 3 RBC	170	170	69.44
Bis(2-ethylhexyl) phthalate	117-81-7	4.6E+04	HH-Region 3 RBC	170	170	166.37
Di-n-octylphthalate	117-84-0	---	---	170	170	TBD
Benzo(b) fluoranthene	205-99-2	2.2E+02	HH-Region 3 RBC	170	170	146.93
Benzo(k) fluoranthene	207-08-9	2.2E+03	HH-Region 3 RBC	170	170	68.58
Benzo(a) pyrene	50-32-8	2.2E+01	HH-Region 3 RBC	170	170	79.12
Indeno(1,2,3,-cd) pyrene	193-39-5	2.2E+02	HH-Region 3 RBC	170	170	89.33
Dibenzo(a,h) anthracene	53-70-3	2.2E+01	HH-Region 3 RBC	170	170	78.62
Benzo(g,h,i) perylene	191-24-2	---	---	170	170	94.12
2,3,4,6-Tetrachlorophenol	58-90-2	2.3E+06	HH-Region 3 RBC	170	170	88.20

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Tables (10/2007); SSL Soil to GW - Region 3 Soil Screening Levels for groundwater migration (10/2007)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Subsurface Soil
Analytical Group: SVOCs by SIM

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal ³ (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
2-Chlorophenol	95-57-8	3.9E+05	HH-Region 3 RBC	21.3	21.3	9.38
2-Methylphenol	95-48-7	3.9E+06	HH-Region 3 RBC	21.3	21.3	16.53
N-Nitroso-di-n propylamine	621-64-7	4.70E-02	SSL Soil to GW	0.5	10.7	2.15
2,4-Dimethylphenol	105-67-9	6.7E+03	SSL Soil to GW	21.3	21.3	1.58
2,4,6-Trichlorophenol	88-06-2	5.8E+04	HH-Region 3 RBC	21.3	21.3	6.35
2,4,5-Trichlorophenol	95-95-4	7.8E+06	HH-Region 3 RBC	21.3	21.3	6.14
4-Nitrophenol	100-02-7	---	---	64	64	14.52
Pentachlorophenol	87-86-5	5.3E+03	HH-Region 3 RBC	21.3	21.3	9.59
3,3'-dichlorobenzidine	91-94-1	4.90E+00	SSL Soil to GW	10.7	10.7	2.44

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Table (10/2007); SSL Soil to GW - Region 3 Soil Screening Levels for groundwater migration (10/2007)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

³ The QL for N-Nitroso-di-n propylamine is greater than the PAL. For 3,3'-dichlorobenzidine, the QL meets an elevated RBC (increased by a factor of ten for carcinogens) to correspond to a single-chemical risk of 10⁻⁵. It is not anticipated that this will be a problem for planned data use.

Matrix: Subsurface Soil
Analytical Group: PAHs by SIM

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Naphthalene	91-20-3	1.5E+02	SSL Soil to GW	8.3	8.3	0.27
2-Methylnaphthalene	91-57-6	4.4E+00	SSL Soil to GW	8.3	8.3	0.57
Acenaphthylene	208-96-8	1.00E+05	SSL Soil to GW	8.3	8.3	0.4
Acenaphthene	83-32-9	1.0E+05	SSL Soil to GW	8.3	8.3	0.62
Fluorene	86-73-7	1.4E+05	SSL Soil to GW	8.3	8.3	0.36
Phenanthrene	85-01-8	---	---	8.3	8.3	0.31
Anthracene	120-12-7	4.7E+05	SSL Soil to GW	8.3	8.3	0.28
Fluoranthene	206-44-0	3.1E+06	HH-Region 3 RBC	8.3	8.3	0.31
Pyrene	129-00-0	6.8E+05	SSL Soil to GW	8.3	8.3	0.24
Benzo(a)anthracene	56-55-3	2.2E+02	HH-Region 3 RBC	8.3	8.3	0.23
Chrysene	218-01-9	2.2E+04	HH-Region 3 RBC	8.3	8.3	0.23
Benzo(b) fluoranthene	205-99-2	2.2E+02	HH-Region 3 RBC	8.3	8.3	0.31
Benzo(k) fluoranthene	207-08-9	2.2E+03	HH-Region 3 RBC	8.3	8.3	0.29
Benzo(a) pyrene	50-32-8	2.2E+01	HH-Region 3 RBC	8.3	8.3	0.24
Indeno(1,2,3,-cd) pyrene	193-39-5	2.2E+02	HH-Region 3 RBC	8.3	8.3	0.32
Dibenzo(a,h) anthracene	53-70-3	2.2E+01	HH-Region 3 RBC	8.3	8.3	0.3
Benzo(g,h,i) perylene	191-24-2	---	---	8.3	8.3	0.31

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Table (10/2007); SSL Soil to GW - Region 3 Soil Screening Levels for groundwater migration (10/2007)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Subsurface Soil
Analytical Group: Pesticides

Analyte	CAS Number	Project Action Level (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
alpha-BHC	319-84-6	8.9E-01	SSL, Soil to GW	0.42	0.42	0.09
beta-BHC	319-85-7	3.1E+00	SSL, Soil to GW	0.83	0.83	0.44
delta-BHC	319-86-8	---	---	0.42	0.42	0.17
gamma-BHC (Lindane)	58-89-9	4.3E+00	SSL, Soil to GW	0.42	0.42	0.07
Heptachlor	76-44-8	1.4E+02	HH-Region 3 RBC	0.42	0.42	0.14
Aldrin	309-00-2	7.7E+00	SSL Soil to GW	0.42	0.42	0.35
Heptachlor epoxide	1024-57-3	2.5E+01	SSL Soil to GW	0.42	0.42	0.23
Endosulfan I	959-98-8	2.0E+04	SSL Soil to GW	0.83	0.83	0.05
Dieldrin	60-57-1	2.2E+00	SSL Soil to GW	0.83	0.83	0.30
4,4'-DDE	72-55-9	1.9E+03	HH-Region 3 RBC	0.83	0.83	0.12
Endrin	72-20-8	5.4E+03	SSL Soil to GW	1.67	1.67	0.09
Endosulfan II	33213-65-9	2.0E+04	SSL Soil to GW	1.67	1.67	0.11
4,4'-DDD	72-54-8	2.7E+03	HH-Region 3 RBC	1.67	1.67	0.09
Endosulfan sulfate	1031-07-8	2.0E+04	SSL Soil to GW	1.67	1.67	0.18
4,4'-DDT	50-29-3	1.2E+03	SSL Soil to GW	2.5	2.5	0.12
Methoxychlor	72-43-5	3.1E+05	SSL Soil to GW	4.17	4.17	0.64
Endrin ketone	53494-70-5	2.3E+04	HH-Region 3 RBC	4.17	4.17	0.11
Endrin aldehyde	7421-93-4	2.3E+04	HH-Region 3 RBC	1.67	1.67	0.12
alpha-Chlordane	5103-71-9	1.8E+03	HH-Region 3 RBC	0.83	0.83	0.10
gamma-Chlordane	5103-74-2	1.8E+03	HH-Region 3 RBC	0.42	0.42	0.08
Toxaphene	8001-35-2	5.8E+02	HH-Region 3 RBC	83	83	25.50

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Table (10/2007), SSL Soil to GW – EPA Region 3 Soil Screening Level for groundwater migration, (10/2007)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Subsurface Soil

Analytical Group: Polychlorinated Biphenyls (PCBs)

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
Aroclor-1016	12674-11-2	4.2E+03	SSL Soil to GW	31	31	11.78
Aroclor-1221	11104-28-2	3.2E+02	HH-Region 3 RBC	42	42	20.27
Aroclor-1232	11141-16-5	3.2E+02	HH-Region 3 RBC	31	31	7.51
Aroclor-1242	53469-21-9	3.2E+02	HH-Region 3 RBC	21	21	11.22
Aroclor-1248	12672-29-6	3.2E+02	HH-Region 3 RBC	21	21	7.52
Aroclor-1254	11097-69-1	3.2E+02	HH-Region 3 RBC	21	21	NA
Aroclor-1260	11096-82-5	3.2E+02	HH-Region 3 RBC	31	31	5.00

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Screening Values (10/2007), SSL Soil to GW – EPA Region 3 Soil Screening Level for groundwater migration, (10/2007).

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Soil
Analytical Group: Dioxin/Furans

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference ¹	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific ² (µg/kg)	
					QLs	MDLs
2,3,7,8-TCDD	1746-01-6	4.3E-03	HH-Region 3 RBC	0.001	0.001	0.00006
1,2,3,7,8-PeCDD	40321-76-4	2.2E-03	HH-Region 3 RBC	0.005	0.005	0.000288
1,2,3,6,7,8-HxCDD	57653-85-7	4.3E-04	HH-Region 3 RBC	0.005	0.005	0.000276
1,2,3,4,7,8-HxCDD	39227-28-6	4.3E-04	HH-Region 3 RBC	0.005	0.005	0.000187
1,2,3,7,8,9-HxCDD	19408-74-3	4.3E-04	HH-Region 3 RBC	0.005	0.005	0.000288
1,2,3,4,6,7,8-HpCDD	35822-46-9	4.3E-05	HH-Region 3 RBC	0.005	0.005	0.000293
OCDD	3268-87-9	4.3E-06	HH-Region 3 RBC	0.01	0.01	0.000644
2,3,7,8-TCDF	51207-31-9	4.3E-04	HH-Region 3 RBC	0.001	0.001	0.000162
1,2,3,7,8-PeCDF	57117-41-6	2.2E-04	HH-Region 3 RBC	0.005	0.005	0.000367
2,3,4,7,8-PeCDF	57117-31-4	2.2E-03	HH-Region 3 RBC	0.005	0.005	0.000247
1,2,3,6,7,8-HxCDF	57117-44-9	4.3E-04	HH-Region 3 RBC	0.005	0.005	0.000153
1,2,3,7,8,9-HxCDF	72918-21-9	4.3E-04	HH-Region 3 RBC	0.005	0.005	0.000304
1,2,3,4,7,8-HxCDF	70648-26-9	4.3E-04	HH-Region 3 RBC	0.005	0.005	0.000336
2,3,4,6,7,8-HxCDF	60851-34-5	4.3E-04	HH-Region 3 RBC	0.005	0.005	0.00105
1,2,3,4,6,7,8-HpCDF	67562-39-4	---	---	0.005	0.005	0.000604
1,2,3,4,7,8,9-HpCDF	55673-89-7	4.3E-05	HH-Region 3 RBC	0.005	0.005	0.000257
OCDF	39001-02-0	4.3E-06	HH-Region 3 RBC	0.01	0.01	0.000694

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Table (10/2007),

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Subsurface Soil
 Analytical Group: Inorganic Compounds

Analyte	CAS Number	Project Action Limit	Project Action Limit Reference ¹	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific ² (mg/kg)	
		(mg/kg)			QLs	MDLs
Aluminum	7429-90-5	7.82E+04	HH-Region 3 RBC	20	20	3.495
Antimony	7440-36-0	1.3E+01	SSL Soil to GW	1	1	0.150
Arsenic	7440-38-2	2.6E-02	SSL Soil to GW	0.002	1	0.202
Barium	7440-39-3	6.0E+03	SSL Soil to GW	20	20	0.096
Beryllium	7440-41-7	1.6E+02	HH-Region 3 RBC	0.5	0.5	0.037
Cadmium	7440-43-9	2.7E+01	SSL Soil to GW	0.5	0.5	0.023
Calcium	7440-70-2	---	---	500	500	4.214
Chromium	7440-47-3	4.2E+01	SSL Soil to GW	1	1	0.033
Cobalt	7440-48-4	---	---	0.5	0.5	0.037
Copper	7440-50-8	3.1E+03	HH-Region 3 RBC	0.5	0.5	0.141
Iron	7439-89-6	5.5E+04	HH-Region 3 RBC	10	10	1.241
Lead	7439-92-1	4.0E+02	OSWER	0.3	0.3	0.114
Magnesium	7439-95-4	---	---	500	500	0.392
Manganese	7439-96-5	9.5E+02	SSL Soil to GW	1	1	0.042
Mercury	7439-97-6	7.8E+00	HH-Region 3 RBC	0.2	0.2	0.042
Nickel	7440-02-0	1.6E+03	HH-Region 3 RBC	4	4.0	0.062
Potassium	7440-9-7	---	---	500	500	0.963
Selenium	7782-49-2	1.9E+01	SSL Soil to GW	0.5	0.5	0.297
Silver	7440-22-4	3.1E+01	SSL Soil to GW	0.5	0.5	0.053
Sodium	7440-23-5	---	---	500	500	17.816
Thallium	7440-28-0	3.6E+00	SSL Soil to GW	1	1.0	0.766
Vanadium	7440-62-2	7.8E+01	HH-Region 3 RBC	2	2.0	0.020
Zinc	7440-66-6	1.4E+04	SSL Soil to GW	2	2.0	0.192
Cyanide	57-12-5	1.5E+02	SSL Soil to GW	10	10	0.14

¹ HH-Region 3 RBC – EPA Region 3 Risk Based Concentration Table (10/2007)

² Laboratory-specific MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

DAF – Dilution Attenuation Factor

GW - Groundwater

MDL – Method Detection Limit

QL – Quantitation Limit

RBC – Risk Based Concentration

TBD – To Be Determined

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

Phase	Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
			Anticipated Date(s) of Initiation	Anticipated Date of Completion		
I	Test Pits and Soil Sampling	Tetra Tech	4/30/2007	5/11/2007	Test Pit Soil Investigation Report Site 3 – Ninth Street Landfill	7/30/2007 (draft) 11/16/2007 (final)
II	EM Survey	TBD	04/07/2008	04/11/2008	EM Report of Field Activities	Daily reports and final cumulative report due one week after completion
II	Test Pits and Soil Sampling	Tetra Tech	04/21/2008	05/02/2008	Landfill Delineation Report Site 3 – Ninth Street Landfill	6/18/2008 (draft) 8/13/2008 (final)

EM - Electromagnetic
 TBD – To Be Determined

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

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

The test pit locations will be chosen with a bias to correspond with areas likely to contain buried waste, based upon the results of the Test Pit Investigation and the EM survey from this SAP. Up to eight test pits will be excavated. Eight subsurface soil samples will be collected from the eight test pits and analyzed for VOCs, SVOCs, pesticides, PCBs, metals (including mercury), and cyanide. The samples will be chosen based on direct (visual or olfactory) evidence of contamination, or on the highest PID screening responses. One (1) of the eight (8) test pits will be sampled for Dioxin/Furans where evidence of charred waste is observed.

Test pit soil sample locations will be chosen based on a biased sampling approach based on the results of the EM survey and field observations. The intent will be to sample those areas that are likely to be the most contaminated.

The surface soil samples will be collected from areas containing buried waste that are judged most likely to be contaminated based on direct (visual or olfactory) evidence of contamination. If no direct evidence of surface contamination is observed, then the sample locations will be chosen in order to provide representative coverage of the landfill area. The samples will be analyzed for VOCs, SVOCs, pesticides, PCBs, metals (including mercury), and cyanide.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:

See SAP Worksheet 18 and sampling location map in Figure 15.

The goal of the sampling will be to use the data for both human health and ecological risk assessment purposes.

- Eight surface soil samples will be collected at 0 to 1.0 feet bgs in areas where buried waste is present. The exact locations will be determined based upon the results of the EM survey and field observations.
- Twelve surface soil samples will be collected at 0 to 0.5 feet bgs in other areas. The exact locations will be determined by the project team based upon results of the EM survey .
- Eight subsurface soil samples will be collected from test pit excavations where buried waste is encountered. The exact sample locations and depths will be determined based upon the results of the EM survey, PID readings, and field observations.

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

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference ¹
SS17	03SS17-01	Soil	0 – 0.5	VOCs	2	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	2	
				Pesticides	2	
				PCBs	2	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	2	
SS18	03SS18-01	Soil	0 – 0.5	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	
SS19	03SS19-01	Soil	0 – 0.5	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	
SS20	03SS20-01	Soil	0 – 0.5	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	
SS21	03SS21-01	Soil	0 – 0.5	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference ¹
SS22	03SS22-01	Soil	0 – 0.5	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	
SS23	03SS23-01	Soil	0 – 0.5	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	
SS24	03SS24-01	Soil	0 – 0.5	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	
Site 3 Test Pit 19	03TP19-XXXX ² -01 and 03-DUP-01 ³	Soil	TBD	VOCs	2	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	2	
				Pesticides	2	
				PCBs	2	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	2	
	03TP19-XXXX ² -02	Soil	TBD	VOCs	1	
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	
Site 3 Test Pit 20	03TP20-XXXX ² -01	Soil	TBD	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	

Sampling Location	ID Number	Matrix	Depth (feet)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference ¹
Site 3 Test Pit 20	03TP20-XXXX ² -01	Soil	TBD	Metals/Cyanide	1	
	03TP20-XXXX ² -02	Soil	TBD	VOCs	1	
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
				Metals/Cyanide	1	
Site 3 Test Pit 21	03TP21-XXXX ² -01	Soil	TBD	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
	Metals/Cyanide	1				
	03TP21-XXXX ² -02	Soil	TBD	VOCs	1	
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
Dioxin/Furans ⁴				TBD		
Site 3 Test Pit 22	03TP22-XXXX ² -01	Soil	TBD	VOCs	1	SA-1.3, CT-04, SA-6.1, SA-6.3
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
				Dioxin/Furans ⁴	TBD	
	Metals/Cyanide	1				
	03TP22-XXXX ² -02	Soil	TBD	VOCs	1	
				SVOCs	1	
				Pesticides	1	
				PCBs	1	
Dioxin/Furans ⁴				TBD		

¹ Standard operating procedure (SOP) or worksheet that describes the sample collection procedures.

² XXXX represents depth of the sample. Depth will be determined in the field. For example if sample is collected from 5 to 6 feet the depth will be recorded as 0506.

³ Field duplicate locations may change in the field based on visual and olfactory observations and PID readings.

⁴ Only one location (plus 1 field duplicate) will be chosen for dioxin analysis based on the presence of burnt waste material.

TBD – To Be Determined

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

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference ¹	Containers (number, size, and type)	Sample volume ² (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time ³ (preparation / analysis)
Soil	Volatiles	SW-846 5035/8260B CompuChem 1.3.2.4	3 – 5g Encores	15g	Cool to 4 degrees C; no headspace	48 hours for preparation; 14 days to analysis
Soil	SVOCs	SW-846 3550B/8270C CompuChem 2.5.2.3/2.5.2.7/2.4.4.5 (SIM)	1 – 8oz wide-mouth glass jar	250g	Cool to 4 degrees C	14 days to extraction; 40 days analysis
Soil	Pesticides	SW-846 3550B/8081A CompuChem 2.2.4.2/2.2.4.10				
Soil	PCBs	SW-846 3550B/8082 CompuChem 2.2.5.2/2.2.5.3				
Soil	Dioxins/Furans	SW-846 8290 SGS	1 – 8oz wide-mouth amber glass jar	10g	Cool to 4 degrees C	30 days to extraction; 45 days to analysis
Soil	Metals	SW-846 3050B/ 6010B CompuChem 3.2.1.6/3.2.1.7	1 – 8oz wide-mouth glass jar	250g	Cool to 4 degrees C	180 days to analysis
Soil	Mercury	SW-846 7471A CompuChem 3.3.2/3.3.4				28 days to analysis
Soil	Cyanide	SW-846 9012A CompuChem 3.4.5/3.4.6				14 days to analysis
Aqueous (Blank)	Volatiles	SW-846 8260B CompuChem 1.3.2.4	3 – 40mL clear glass vials	120mL	Cool to 4 degrees C; HCl to pH < 2	14 days to analysis
Aqueous (Blank)	SVOCs	SW-846 3550B/8270C CompuChem 2.5.2.3/2.5.2.7	4 – 1L amber glass bottles	4L	Cool to 4 degrees C	7 days for preparation; 40 days to analysis
Aqueous (Blank)	Pesticides	SW-846 3550B/8081A CompuChem 2.2.4.2/2.2.4.10				
Aqueous (Blank)	PCBs	SW-846 3550B/8082 CompuChem 2.2.5.2/2.2.5.3				
Aqueous (Blank)	Dioxins/Furans	SW-846 8290 SGS Sec. 4 8290	2 – 1L amber glass bottles	2L	Cool to 4 degrees C	7 days for preparation; 40 days to analysis
Aqueous (Blank)	Metals	SW-846 3050B/ 6010B CompuChem 3.2.1.6/3.2.1.7	1 – 1L plastic bottle	1L	Cool to 4 degrees C; HNO ₃ to pH < 2	180 days to analysis
Aqueous (Blank)	Mercury	SW-846 7470A CompuChem 3.3.2/3.3.4				28 days to analysis
Aqueous (Blank)	Cyanide	SW-846 9012A CompuChem 3.4.5/3.4.6				14 days to analysis

¹ Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

² Provide the minimum sample volume or mass requirement if it differs from the container volume.

³ Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

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

Matrix	Analytical Group	No. of Sampling Locations ²	No. of Field Duplicates	No. of MS/MSDs ¹	No. of Field Blanks	No. of Equip. Blanks	No. of VOA Trip Blanks	No. of PT Samples ³	Total No. of Samples to Lab
Soil	VOC	8	1	1	1	0	3	0	13
Soil	SVOC	8	1	1	1	0	0	0	10
Soil	Pesticides	8	1	1	1	0	0	0	10
Soil	PCBs	8	1	1	1	0	0	0	10
Soil	Dioxin/Furans	1	1	1	1	0	0	0	3
Soil	Metals	8	1	1	1	0	0	0	10
Soil	Mercury	8	1	1	1	0	0	0	10
Soil	Cyanide	8	1	1	1	0	0	0	10

¹Although the Matrix Spike/Matrix Spike Duplicate (MS/MSD) is not typically considered a field QC it is included here because location determination is often established in the field. The MS/MSD is not included in the Total No. of Samples to Lab.

²If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.

³The number of Batch or Project-specific proficiency testing (PT) samples are optional but highly recommended.

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

Reference Number	Title, Revision Date and / or Number ¹	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
CT-04	Sample Nomenclature Rev. 1, September 2003	Tetra Tech	NA	Y	Although samples will be soils, the abbreviation "TP" will be used in place of "SB"
CT-05	Database Records and Quality Assurance Rev. 2, January 29, 2001	Tetra Tech	NA	N	
DV-02	Data Validation – Non-CLP Organics for Solid Matrices Rev. 0, August 13, 2001	Tetra Tech	NA	N	
DV-04	Data Validation – Non-CLP Inorganics for Solid and Aqueous Matrices Rev. 0, August 13, 2001	Tetra Tech	NA	N	
DV-06	Data Validation – Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans for Solid and Aqueous Matrices	Tetra Tech	NA	N	
GH-3.1	Resistivity and Electromagnetic Induction Rev. 1, June 1999	Tetra Tech	Terrain conductivity meter	N	
HS-1.0	Utility Locating and Excavation Clearance Rev. 2, December 2003	Tetra Tech	NA	N	
ME-12	Photovac 2020 Photo-Ionization Air Monitor Rev. 1, June 1999	Tetra Tech	Calibration and operation	N	
SA-1.3	Soil Sampling Rev. 7, September 2003	Tetra Tech	Sampling Procedures, Methods	N	
SA-6.1	Non-radiological Sample Handling Rev. 3, February 2004	Tetra Tech	Sample Bottle ware, Packaging Material, Shipping Materials	N	
SA-6.3	Field Documentation Rev. 2, September 2003	Tetra Tech	Field Logbook, Field Sample Forms, Boring Logs	N	
SA-7.1	Decontamination of Field Equipment Rev. 3, September 2003	Tetra Tech	Decontamination Equipment (scrub brushes, phosphate free detergent, de-ionized water)	Y	Decontamination of sampling equipment is not anticipated however if required, Nitric acid removed from decontamination procedure. Isopropyl Alcohol to be used if field conditions warrant

¹ The Tetra Tech SOPs are currently in review. Tetra Tech will review, update, or revise these SOPs on a periodic basis. (e.g., every two to three years).
 NA – Not Applicable SOP – Standard Operating Procedure

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

Field Equipment	Activity ¹	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference ²	Comments
PID	Calibration	Daily	Manufacturer's Guidance	Replace	FOL	ME-12	
Backhoe / Excavating Machinery	Inspection	Daily	Equipment Inspection Sheet Criteria	Replace	FOL	SA-1.3	
Disposable Hand Trowel	Inspection	Per Use	NA	Replace	FOL	SA-1.3	
Terrain conductivity meter	Calibration	Daily	Manufacturer's Guidance	Replace	TBD	GH-3.1	

¹ Activities may include: calibration, verification, testing, maintenance, and/or inspection.

² Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

FOL – Field Operations Leader
 NA – Not Applicable
 PID – Photoionization Detector
 SOP – Standard Operating Procedure
 TBD – To Be Determined

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)
1.3.2.4	GC/MS Analysis of Low Concentration Volatiles in Soil/Sediment/Sludge Samples by SW-846 and NYSASP (Revision 10, 2/8/05)	Definitive	Soil – VOC	GC/MS	CompuChem	N
2.5.2.3	Preparation of Soil/Sediment/Sludge/Samples for the Analysis of Semivolatiles by SW-846 and NYSASP (Revision 10, 1/15/06)	Definitive	Soil – SVOC	NA	CompuChem	N
2.5.2.7	GC/MS Analysis of Extractable Semivolatiles in Water and Soild Sample Extracts by SW-846 (Revision 11, 12/15/06)	Definitive	Soil – SVOC	GC/MS	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)	Definitive	Soil-SVOC	GC/MS	CompuChem	N
2.2.4.10	GC/ECD Analysis of Organochlorine Pesticides in Water and Soil Extracts by SW-846	Definitive	Soil – Pesticides	GC	CompuChem	N
2.2.4.2	Low-Level Preparation for Analysis of Pesticides/PCBs in Soil/Sediment/Sludge by SW-846 and NYSASP (Revision 10, 10/11/07)	Definitive	Soil-Pesticides	GC	CompuChem	N
2.2.5.2	Low-Level Preparation for Analysis of PCBs only in Soil/Sediment/Sludge by SW-846 and NYSASP (Revision 8, 2/18/07)	Definitive	Soil-PCBs	GC	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)
2.2.5.3	GC/ECD Analysis of Polychlorinated Biphenyls (PCBs) as Aroclors in Water and Soil Extracts (Revision 7, 2/20/08)	Definitive	Soil-PCBs	GC	CompuChem	N
3.2.1.6	Inductively Coupled Plasma Atomic Emission Spectroscopy by SW-846 and NYSASP (Revision 15, 8/4/06)	Definitive	Soil – Metals	ICP-AES	CompuChem	N
3.2.1.7	Digestion Block Preparation of Solid Samples for ICP-MS Determination of Total Metals by SW-846 (Revision 0, 9/20/06)	Definitive	Soil – Metals	ICP-AES	CompuChem	N
3.3.2	Solid Sample Mercury Digestion by SW-846 and NYSASP (Revision 15, 5/18/06)	Definitive	Soil – Mercury	CVAA	CompuChem	N
3.3.4	Automated Cold Vapor Determination for Mercury by CLP, SW-846, and NYSASP (Revision 21, 7/23/07)	Definitive	Soil – Mercury	CVAA	CompuChem	N
3.4.5	Cyanide Analysis of Water and Soil/Sediment/Distillates by CLP, MCAWW	Definitive	Soil-Cyanide	Spectrometer	CompuChem	N
3.5.6	Solid Sample for Total and Free Cyanide Midi-Distillation by SW-846 and NYSASP (Revision 3, 8/25/06)	Definitive	Soil-Cyanide	Spectrometer	CompuChem	N
Section 4 8290	Section 4: 8290 Data Analysis & Reporting Paradigm Analytical Labs - Standard Operating Procedure	Definitive	Soil – Dioxin/Furans	HRGC/HRMS	SGS	N

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.

CVAA – Cold Vapor Atomic Absorption
GC/MS – Gas Chromatograph/Mass Spectrometer
GC/ECD - Gas Chromatograph/Electron Capture Detector
HR – High Resolution
ICP-AES – Inductively Coupled Plasma/Atomic Emission Spectroscopy

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 ²	SOP Reference ¹
GC/MS	Tuning	Beginning of 12 hour analytical sequence	Must meet the ion abundance criteria required by the method	Manual tuning; replacement of the ion source of filament	Area supervisor or manager	1.3.2.4 2.5.2.7
GC/MS	Initial Calibration	After major maintenance; upon 2 nd consecutive failure of CCV standard	Must meet the minimum average RRF value and maximum % RSD criteria required by the DOD-QSM	Recalibrate	Area supervisor or manager	1.3.2.4 2.5.2.7
GC/MS	Continuing Calibration	Beginning of 12 hour analytical sequence after the analysis of the tuning standard	Must meet the minimum % Difference or % drift criteria required by the DOD-QSM	Reanalyze; recalibration and reanalyze upon failure of reanalysis	Area supervisor or manager	1.3.2.4 2.5.2.7
GC	Initial Calibration	After major instrument maintenance; upon failure of 2 nd consecutive CCV	Must meet all resolution, retention time, breakdown, and % RSD criteria by DOD-QSM on both analytical columns	Recalibrate	Area supervisor or manager	2.2.4.10 2.2.5.3
GC	Continuing Calibration	Beginning of analytical sequence; after each 10 field samples; at the end of the analytical sequence	Must meet all resolution, retention time, breakdown, and % difference, % drift criteria by DOD-QSM on both analytical columns	Recalibrate	Area supervisor or manager	2.2.4.10 2.2.5.3
ICP-AES	Initial Calibration	Daily prior to sample analysis	None; only one standard analyzed	N/A	Area supervisor or manager	3.2.1.6
ICP-AES	Continuing Calibration	Every 10 samples and at the end of the analytical sequence	± 10% of the expected value	Reanalyzed; recalibrate, if reanalysis fails	Area supervisor or manager	3.2.1.6
CVAA	Initial Calibration	Daily prior to sample analysis	The correlation coefficient must be ≥ 0.995	Recalibrate	Area Supervisor or manager	3.3.4
CVAA	Continuing Calibration	Every 10 samples and at the end of the analytical sequence	± 20% of the expected value	Recalibrate	Area supervisor or manager	3.3.4
Spectrometer	Initial Calibration	Daily prior to sample analysis	The correlation coefficient must be ≥ 0.995	Recalibrate	Area supervisor or manager	3.4.5

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA²	SOP Reference¹
Spectrometer	Calibration verification	After each initial calibration	± 15% of the expected value	Reanalyzed; recalibrate, if reanalysis fails	Area supervisor manager	3.4.5
HRGC/HRMS	Mass Resolution	Beginning of every 12 hour run window	Mass resolution must be at 10,000 as estimated from a printout of a PFK peak.	MS maintenance.	Area supervisor manager	Section 4 8290
HRGC/HRMS	Initial Calibration	Annually	Mean RFs must be within ±20% RSD must be within ±30% Signal to noise ratio ≥10 Ion abundance ratios within limits on Table 3 of Method	Recalibrate when continuing calibration is not met.	Area supervisor manager	Section 4 8290
HRGC/HRMS	Continuing Calibration (CCAL)	Every 12 hour run window	20/30%. Average CCALs if no more than 2 unrelated compounds above 20/30% but less than 25/35% on the back end.	Acceptable bracketing CCALs must be established before sample reporting may begin.	Area supervisor manager	Section 4 8290

¹ Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

² Name or title of responsible person may be used.

CVAA – Cold Vapor Atomic Absorption
HR – High Resolution

GC/MS – Gas Chromatograph/Mass Spectrometer
ICP-AES – Inductively Coupled Plasma-Atomic Emission Spectroscopy

GC/ECD - Gas Chromatograph/Electron Capture Detector

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/clean ion source; clean injector ;replace liner; replace/clip capillary column Flush/replace tubing on purge and trap devise; replace trap	QC standards	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	As needed	See SOP	See SOP	Area supervisor or manager	1.3.2.4 2.5.2.7
GC/ECD	ECD maintenance; replace/clip capillary column	QC standards	ECD, injector, injector liner, column flow	As needed	See SOP	See SOP	Area supervisor or manager	12.2.4.10 2.2.5.3
ICP-AES	Clean plasma torch; clean filters; clean spray and nebulizer chambers; replace pump tubing	QC standards	Torch, filters, nebulizer chamber, pump, pump tubing	As needed	See SOP	See SOP	Area supervisor or manager	3.2.1.6
CVAA	Clean/replace dehydrator tubing and sample mixing coil tubing; replace sample probe; replace pump tubing; clean optical cell	QC standards	Tubing, sample probe, optical cell	As needed	See SOP	See SOP	Area supervisor or manager	3.3.4
Spectrometer	Flush/replace tubing	QC standards	Tubing	As needed	See SOP	See SOP	Area supervisor or manager	3.4.5
HRGC/HRMS	Replace/clean ion source; clean injector ;replace liner; replace/clip capillary column Flush/replace tubing on purge and trap devise; replace trap	Mass Resolution and Calibration	Ion source, injector liner, column, column flow, purge lines, purge flow, trap	As needed	See SOP	See SOP	Area supervisor or manager	Section 4 8290

¹ Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

² Name or title of responsible person may be used.

CVAA – Cold Vapor Atomic Absorption
 GC/MS – Gas Chromatograph/Mass Spectrometer
 GC/ECD - Gas Chromatograph/Electron Capture Detector
 HR – High Resolution
 ICP-AES – Inductively Coupled Plasma-Atomic Emission Spectroscopy

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

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Don Whalen / Tetra Tech
Sample Packaging (Personnel/Organization): Don Whalen / Tetra Tech
Coordination of Shipment (Personnel/Organization): Don Whalen / Tetra Tech
Type of Shipment/Carrier: Overnight courier service (Federal Express)
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample custodians / TBD
Sample Custody and Storage (Personnel/Organization): Sample custodians / TBD
Sample Preparation (Personnel/Organization): Preparation laboratory staff / TBD
Sample Determinative Analysis (Personnel/Organization): GC/MS, ICP, GC/ECD, HRGC/HRMS, Spectrophotometer / TBD
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 30 days from submittal of final report
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 30 days from submittal of final report
Biological Sample Storage (No. of days from sample collection): Not Applicable
SAMPLE DISPOSAL
Personnel/Organization: Sample custodians / TBD
Number of Days from Analysis: 30 days from submittal of final report

SAP Worksheet #27 – Sample Custody Requirements Table

[\(UFP-QAPP Manual Section 3.3.3\)](#)

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Following sample collection into the appropriate bottle ware, all samples will be immediately placed on ice in a cooler. The glass sample containers will be enclosed in bubble-wrap in order to protect the bottle ware during shipment. The cooler will be secured using duct or clear packaging tape along with a signed custody seal. Sample coolers will be delivered to a local courier location for priority overnight delivery to the selected laboratory for analysis. Samples will be preserved as appropriate based on the analytical method. Laboratories will provide pre-preserved sample containers for sample collection. Samples will be maintained at 4° centigrade (degrees C) until delivery to the laboratories. Proper custody procedures will be followed throughout all phases of sample collection and handling. Chain of custody protocols will be used throughout sample handling to establish the evidentiary integrity of sample containers. These protocols will be used to demonstrate that the samples were handled and transferred in a manner that would eliminate possible tampering. Samples for the laboratory will be packaged and shipped in accordance with Tetra Tech SOP SA-6.1.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

CompuChem SOP 4.1 and 4.6 (Sample Receiving and Sample Storage)
SGS Standard Operating Procedure for the Login and Storage of Samples and Sample Processing

Sample Identification Procedures:

Sample nomenclature will be conducted in general accordance with the procedures outlined in Tetra Tech SOP CT-04 (Sample Nomenclature). Sample nomenclature put forth for this field event has been selected based on historical usage. The sample nomenclature for each tracking number includes the site being investigated, sample media identifier, and sample location number. The standard sample matrix and type codes used for this field event are as follows: “TP” for test pit samples obtained from the test pits. Duplicate samples will be submitted to the laboratory as blind duplicates. Therefore duplicate codes will be reflective of the standard sample matrix code followed by a “DUP” tag and sequentially listed. Due to the blind nature of the duplicate samples, no sample depth or date will be listed with the duplicated sample. An example of a duplicate sample would be “03DUP001”. The QA/QC type codes used for this field event are as follows: TB for Trip Blanks and FB for field blanks. Trip blanks and field blanks will be labeled sequentially followed by the date (i.e., TB20070430, FB20070501). Samples to be used for matrix spikes and matrix spike duplicates will be labeled MS/MSD on the bottle label and noted on the chain-of-custody, as required in the laboratory QA Plan; however, “MS/MSD” will not be part of the unique sample identifier in order to maintain consistency with the project database. Additional information regarding protocol for sample labeling is contained in Tetra Tech SOP SA-6.3.

Chain-of-custody Procedures:

After recovery, each sample will be maintained in the sampler's custody until formally transferred to another party (e.g., Federal Express). For all samples recovered, custody records will document the date and time of sample collection, the sampler's name, and the names of all others who subsequently held custody of the sample. Specifications for chemical analyses will also be documented on the custody record. Attached SOP SA-6.3 (Field Documentation) provides further details on the COC procedure. COC requirements are also documented with instructions contained in each shipment from the laboratory. (CompuChem SOP 4.1 and SGS Sample Processing SOP)

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

QC Samples Table

Quality Control Sample:	Frequency/Number	Method/SOP Quality Control Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix	Soil/Aqueous Blanks					
Analytical Group	VOCs					
Analytical Method/SOP Reference	SW-846 8260B CompuChem 1.3.2.4					
Trip Blank	One per cooler of VOC samples shipped to laboratory	No target analytes \geq QL; with the exception of common field/laboratory contaminants	No corrective action by laboratory. Flag associated samples in batch.	Data Validator	Bias / Contamination	No target analytes \geq QL; with the exception of common field/laboratory contaminants
Method Blank	One every 12 hours prior to sample analysis	No target compounds \geq QL except common lab contaminants which should be $<$ 2x QL	Re-clean, retest, re-extract, reanalyze, and/or qualify data. Flag associated samples.	Analyst, Laboratory Supervisor Data Validator	Bias / Contamination	No target compounds \geq QL except common lab contaminants which should be $<$ 2x QL
Surrogates	4 per sample	Dibromofluoromethane 33 – 150% 1,2-Dichloroethane-d4 43 – 145% Toluene-d8 55 – 125% Bromofluorobenzene-4 46 – 150%	Re-prep and reanalyze for confirmation of matrix interference when appropriate. Flag samples with outliers.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	50 – 150%
Laboratory Control Sample (LCS)	One per batch of 20 or less	1,1-Dichloroethene 75 – 138% Trichloroethene 75 – 121% Benzene 75 – 129% Toluene 76 – 119% Chlorobenzene 78 – 122%	Evaluate and reanalyze if possible. If an MS/MSD was performed in the same 12 hour clock and acceptable narrate. If the LCS recoveries are high but the sample results are $<$ QL narrate otherwise re-prepare and reanalyze. No qualification for LCS alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	70 – 130%

QC Samples Table

Quality Control Sample:	Frequency/Number	Method/SOP Quality Control Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards (IS)	3 per sample	Retention time \pm 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS.	Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning. Flag samples with outliers.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	Retention time \pm 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS.
MS/MSD	One per SDG or every 20 samples	1,1-Dichloroethene 59 – 172% RPD 22% Trichloroethene 62 – 137% RPD 24% Benzene 66 – 142% RPD 21% Toluene 59 – 139% RPD 21% Chlorobenzene 78 – 122% RPD 21% All others 50 – 150% RPD 25%	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable re-prepare the samples and QC. No qualification on MS/MSD alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	Recovery criteria same as laboratory. RPD \leq 20%

Quality Control Sample:	Frequency/Number	Method/SOP Quality Control Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per batch of 20 or less	No target compounds \geq QL except common lab contaminants which should be $<$ 5x QL.	Re-clean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Supervisor and Data Validator	Bias / Contamination	No target compounds \geq QL except common lab contaminants which should be $<$ 5x QL.
Surrogates	6 per sample	Phenol-d5 40 – 100% 2-fluorobiphenyl 45 – 105% Terphenyl-d14 30 – 125% 2,4,6-Tribromophenol 35 – 125% 2-Fluorophenol 35 – 105% Nitrobenzene-d5 35 – 100%	Re-prep and reanalyze for confirmation of matrix interference when appropriate. Flag samples with more than 2 outliers.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	50 – 150 %
LCS	One per batch of 20 or less	All target compounds, see laboratory limits in Attachment 6 of Method 2.5.2.7.	Evaluate and reanalyze if possible If an MS/MSD was performed in the same 12 hour clock and acceptable narrate. If the LCS recoveries are high but the sample results are $<$ QL narrate otherwise re-prep and reanalyze. No qualification for LCS alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	50 – 150%
IS	6 per sample	Retention time \pm 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS.	Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning. Flag samples with outliers.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	Retention time \pm 30 seconds; EICP area within -50% to +100% of last calibration verification (12 hours) for each IS.

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

Matrix	Soil/Aqueous Blanks
Analytical Group	SVOCs
Analytical Method/ SOP Reference	SW-846 8270C CompuChem 2.5.2.7/2.4.4.5 (SIM)

Quality Control Sample:	Frequency/Number	Method/SOP Quality Control Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MS/MSD	One per sample delivery group or every 20 samples	All target compounds, see laboratory limits in Attachment 6 of Method 2.5.2.7. RPD ≤30%	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met If both the LCS and MS/MSD are unacceptable re-prep the samples and QC. No qualification on MS/MSD alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	Recovery criteria same as laboratory. RPD ≤30%

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

Matrix	Soil/Aqueous Blanks
Analytical Group	Pesticides
Analytical Method/ SOP Reference	SW-846 8081A CompuChem 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 per 20 samples or less	No target compounds $\geq 1/2$ QL	Re-clean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Supervisor Data Validator	Bias / Contamination	No target compounds $\geq 1/2$ QL
Surrogates	2 per sample	Decachlorobiphenyl 55 - 130% Tetrachloro-m-xylene 70 - 125%	If both surrogates are out on both columns, re-extract and reanalyze. Qualify if more than 2 outliers.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	50 – 150%
LCS	One per sample delivery group or every 20 samples	50 – 150% for compounds listed in Attachment 3 of Method 2.2.4.10	Evaluate and reanalyze all associated samples. No qualification on LCS data alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	50 – 150%
MS/MSD	One per sample delivery group or every 20 samples	50 – 150% and RPD $\leq 40\%$ for compounds listed in Attachment 3 of Method 2.2.4.10	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. No qualification on MS/MSD alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	50 – 150% RPD $\leq 40\%$

Matrix	Soil/Aqueous Blanks
Analytical Group	PCBs
Analytical Method/ SOP Reference	SW-846 8082 CompuChem 2.2.5.2

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 20 samples or less	No target compounds \geq QL	Re-clean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Supervisor Data Validator	Bias / Contamination	No target compounds \geq QL
Surrogates	1 per sample	Decachlorobiphenyl 60 - 125%	If both surrogates are out on both columns, re-extract and reanalyze. Qualify if recovery exceedance.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	50 – 150%
LCS	One per sample delivery group or every 20 samples	Aroclor 1260 40 – 140% Aroclor 1016 60 – 130%	Evaluate and reanalyze all associated samples. No qualification on LCS data alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	50 – 150%
MS/MSD	One per sample delivery group or every 20 samples	Same control limits as LCS RPD \leq 30%	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. No qualification on MS/MSD alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	50 – 150% RPD \leq 30%

Matrix	Soil/Aqueous Blanks
Analytical Group	Dioxin/Furans
Analytical Method/ SOP Reference	SW-846 8290 SGS

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 extraction batch of 20 or less	No PCDD/Furan > RL and must be < 10% level in sample.	Re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Supervisor Data Validator	Bias / Contamination	No PCDD/Furan > RL and must be < 10% level in sample.
Extraction Standard	9 standards, see Method Table 4	40 – 135% Recovery	Re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	25 – 150% Recovery
Clean-up Standard	5 standards, see Method Table 4	No criteria.	Re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	25 – 150% Recovery
Injection Standards	2 standards, see Method Table 4	No criteria.	Re-prepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	25 – 150% Recovery
LCS/LCSD	One per extraction batch of 20 or less	70 – 130% Recovery RPD ≤20%	Re-extract and reanalyze if low recovery. Flag associated samples.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	70 – 130% Recovery RPD ≤20%
MS/MSD	One per extraction batch of 20 or less	70 – 130% Recovery RPD ≤20%	Narrate. No qualifiers based on MS/MSD alone.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	70 – 130% Recovery RPD ≤20%

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 digestion batch of 20 or fewer samples	Target analytes \leq 1/2 QL	Flag samples.	Analyst, Laboratory Supervisor Data Validator	Bias / Contamination	Target analytes \leq 1/2 QL
Interference Check Sample	One per digestion batch of 20 or fewer samples	80 – 120% Recovery Non-spiked analytes < 2x MDL	Terminate analysis and recalibrate instrument. Determine if interference qualifies the sample results.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	80 – 120% Recovery Non-spiked analytes < MDL and interferences in sample within order of magnitude of spike concentration.
Low Range Standard	One per digestion batch of 20 or fewer samples	80 - 120% Recovery	Reanalyze. Determine if results near QL are affected.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Sensitivity	80 – 120%, check results near QL
LCS	One per digestion batch of 20 or fewer samples	80 – 120%	Investigate source of problem. Re-digest and reanalyze all associated samples. Flag associated samples.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias / Contamination	80 – 120%
Duplicate Sample	One per digestion batch of 20 or fewer samples	RPD \leq 20, if result > 10 x MDL	Flag results.	Analyst, Laboratory Supervisor Data Validator	Precision	RPD \leq 20, if result > 10 x MDL
MS/MSD	One per digestion batch of 20 or fewer samples	75 – 125%, if sample < 4x spike added.	Prepare post digestion spike for analytes outside limits. Flag results.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	75 – 125%, if sample < 4x spike added.
ICP Serial Dilution	One per digestion batch	If original sample result is at least 50x IDL, 5-fold dilution must agree within \pm 10% of the original result.	Flag result or dilute and reanalyzed sample to eliminate interference.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	If original sample result is at least 50x IDL, 5-fold dilution must agree within \pm 10% of the original result.

Matrix	Soil/Aqueous Blanks					
Analytical Group	Mercury					
Analytical Method/ SOP Reference	SW-846 7471A CompuChem 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
Preparation Blank	One per prep batch	No analyte detected > ½ QL	Reanalyze sample batch with new preparation blank. Flag samples affected by prep. blank.	Analyst, Laboratory Supervisor Data Validator	Bias Contamination	No analyte detected > ½ QL
LCS	One per prep batch	80-120 %R	Redigest and/or reanalyze as necessary. Flag associated samples.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	80-120 %R
Duplicate Sample	One sample duplicate per 20 samples	RPD ≤20 %	Report original result with notation or narration. Flag associated sample.	Analyst, Laboratory Supervisor Data Validator	Precision	RPD ≤20 %
MS	One for every set of 20 samples	80-120 %R	Narrate exceedances. Flag associated samples.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	80-120 %R
Serial Dilution	One for every set of 20 samples	If sample result >25 MDL, then 85 – 115% Recovery	Narrate. Flag associated sample.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Bias	If sample result >25 MDL, then 85 – 115% Recovery

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

Matrix	Soil/Aqueous Blanks
Analytical Group	Cyanide
Analytical Method/ SOP Reference	SW-846 9012A CompuChem 3.4.5

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 per 20 samples or less	No target compounds >QL	Re-clean, retest, re-extract, reanalyze, and/or qualify data.	Analyst, Laboratory Supervisor Data Validator	Bias / Contamination	No target compounds >QL
QL Check Standard	One per 20 samples or less	70 – 130%	Narrate. Determine if results near QL are affected.	Analyst, Laboratory Supervisor Data Validator	Accuracy / Sensitivity	70 – 130%
LCS	One per 20 samples or less	80 – 120%	Re-prepare and reanalyze samples. Flag associated samples.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	80 – 120%
Duplicate Sample	One per 20 samples or less	RPD ≤20%	Narrate. Flag associated samples.	Analyst, Laboratory Supervisor Data Validator	Precision	RPD ≤20%
MS	One per 20 samples or less	75-125%	Narrate. Flag associated samples.	Analyst, Laboratory Supervisor Data Validator	Precision / Accuracy / Bias	75-125%

%R – Percent Recovery EICP – Extracted Ion Current Profile
MS/MSD – Matrix Spike/Matrix Spike Duplicate
Relative Percent Difference

GC – Gas chromatograph
QC – Quality Control
SDG – Sample Delivery Group

IDL – Instrument Detection Limit
QL – Quantitation Limit

LCS – Laboratory Control Sample
RL – Reporting Limit RPD –

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

Document	Where Maintained
<p><u>Field Documents</u> Field Logbook Field Sample Forms COC Records Air bills Sampling Instrument Calibration Logs Sampling Notes Drilling Logs Photographs Field Task Modification Forms This SAP Health and Safety Plan</p>	<p>Field documents will be maintained in the project file located in the TtNUS King of Prussia office.</p>
<p><u>Laboratory Documents</u> Sample receipt, custody, and tracking record Standards traceability logs Equipment calibration logs Sample preparation logs Analysis Run logs Equipment maintenance, testing, and inspection logs Corrective action forms Reported field sample results Reported results for standards, QC checks, and QC samples Sample storage and disposal records Telephone logs Extraction/clean-up records Raw data Data Completeness checklist</p>	<p>Laboratory documents will be included in the hardcopy and PDF deliverables from the laboratory. Laboratory data deliverables will be maintained in the TtNUS King of Prussia project file and in long-term data package storage at a third-party professional document storage firm.</p> <p>Electronic data results will be maintained in a database on a password protected SQL server.</p>
<p><u>Assessment Findings</u> Field Sampling Audit Checklist (if conducted) Analytical Audit Checklist (if conducted) Data Validation Memoranda (includes tabulated data summary forms)</p>	<p>All assessment documents will be maintained in the TtNUS King of Prussia project file.</p>
<p><u>Reports</u> Site 3 Landfill Delineation Report</p>	<p>All reports for the Site 3 Landfill Delineation will be stored in hardcopy in the TtNUS King of Prussia project file and electronically in the server library.</p>

Project-Specific SAP

Site Name/Project Name: NAS JRB Willow Grove

Site Location: Willow Grove, Pennsylvania

Title: SAP for Landfill Delineation at Site 3 – Ninth Street Landfill

Revision Number: 0

Revision Date: November 2008

COC – Chain of Custody

QC – Quality Control

SAP – Sampling and Analysis Plan

SQL – Structured Query Language

TtNUS – Tetra Tech NUS

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

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization¹ (name and address, contact person and telephone number)	Backup Laboratory / Organization¹ (name and address, contact person and telephone number)
Soil and Aqueous (Blank)	Volatiles	See worksheet 18	SW-846 5035/8260B	21 days	CompuChem	NA
Soil and Aqueous (Blank)	SVOCs	See worksheet 18	SW-846 3540/8270C	21 days		NA
Soil and Aqueous (Blank)	Pesticides	See worksheet 18	SW-846 3540/8081A	21 days		NA
Soil and Aqueous (Blank)	PCBs	See worksheet 18	SW-846 3540/8082	21 days		NA
Soil and Aqueous (Blank)	Metals	See worksheet 18	SW-846 3050/ 6010B	21 days		NA
Soil and Aqueous (Blank)	Mercury	See worksheet 18	SW-846 7471A	21 days		NA
Soil and Aqueous (Blank)	Cyanide	See worksheet 18	SW-846 9012A	21 days		NA
Soil and Aqueous (Blank)	Dioxins/Furans	See worksheet 18	SW-846 8290	21 days	SGS	NA

¹ If the laboratory is not known at time of SAP submission, put "TBD" in the column as a placeholder. A backup laboratory is not expected for this project. If circumstances arise where the contracted laboratories cannot perform the analysis, other laboratories will be procured at that time.

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)
Health and Safety	1 per contract year	Internal	Tetra Tech	TBD	PM	Auditor and HSM	HSM Matt Soltis
Laboratory Systems Audit	Every 18 months	External	NFESC	TBD	Laboratory QA Manager	Laboratory QA Manager	Laboratory QA Manager
Field Sampling Systems Audit	1 per contract year	Internal	Tetra Tech	TBD	PM	Auditor and QAM	QAM Tom Johnston

HSM – Health and Safety Manager
 NFESC – Naval Facilities Engineering Service Center
 PM – Project Manager
 QA – Quality Assurance
 QAM – Quality Assurance Manager
 TBD – To Be Determined

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
Health and Safety Audit	Audit checklist and written audit finding summary	Tetra Tech PM, FOL, and Program Manager	Dependant on findings, if major a stop work maybe issued immediately, however if minor within 1 week of audit	Written memo	Tetra Tech HSM, Auditor, and Program Manager	Within 48 hours of notification
Field sampling system audit	Audit checklist and written audit finding summary	Tetra Tech PM, FOL, and Program Manager	Dependant on findings, if major a stop work maybe issued immediately, however if minor within 1 week of audit	Written memo	Tetra Tech QAM, Auditor, and Program Manager	Within 48 hours of notification
Laboratory systems Audit	Written audit report	Laboratory QA Manager	Not specified by NFESC	Letter	NFESC	Specified by NFESC

FOL – Field Operations Leader
 HSM – Health and Safety Manager
 NFESC – Naval Facilities Engineering Service Center
 PM – Project Manager
 QA – Quality Assurance

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	Within two weeks after receiving the data from the laboratory	Tetra Tech DVM or designee	Tetra Tech PM, project file
Major analysis problem identification (Internal Memorandum)	When persistent analysis problems are detected	Immediately	Tetra Tech QAM	Tetra Tech PM, QAM, Program Manager, project file
Project monthly progress report	Monthly for duration of the project	Monthly	Tetra Tech PM	Navy, project file
Field progress reports	Daily, oral, during the course of sampling	Everyday that field sampling is occurring	Tetra Tech FOL	Tetra Tech PM
Laboratory QA Report	When significant plan deviations result from unanticipated circumstances	Immediately	Subcontracted laboratories will contact the TtNUS QAM or project chemist. The project chemist and TtNUS PM will discuss a solution. If necessary, the Navy RPM will be included in the decision process.	TtNUS PM, QAM, project chemist, project file

DVM – Data Validation Manager
FOL – Field Operations Leader
PM – Project Manager
QAM – Quality Assurance Manager
SDG – Sample Delivery Group

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)
Sample Tables	Proposed samples verified to have been collected	Internal	Tetra Tech FOL or designee
Chain of custody	Chain of custody records will be reviewed internally by the Project Manager or designee and compared against sample tables listing the proposed samples to verify that all planned samples have been collected.	Internal	Tetra Tech PM or designee
Sample Coordinates	Sample locations have been verified to be correct and in accordance with the SAP (overlay maps proposed locations against actual locations)	Internal	Tetra Tech FOL, PM, or designee
Electronic Data	Verify that all sample results are included in the Electronic Data Deliverable from the laboratory. Verify the samples against the Chain-of-Custody. Upload the data into the SQL database for the data validators.	Internal	Laboratory Project Managers and TtNUS Sample Management Coordinator
Analytical Data Package	The analytical data will be verified for completeness by the laboratory performing the work. The laboratory shall complete an appropriate form documenting the organization and complete contents of each data package.	External	Valgena Respass, CompuChem Chris Cornwell, SGS
Data package	Verify that the data package contains all the elements required by NFESC and the scope of work, this occurs as part of the data validation process.	Internal	Tetra Tech Data validator
Sample log sheets	Log sheets completed as samples are collected in the field are verified for completeness and are maintained at the project office.	Internal	Tetra Tech PM or designee
EM Study data	Log sheets completed as samples are collected in the field are verified for completeness and are maintained at the project office.	External	EM Contractor, TBD

EM - Electromagnetic
FOL – Field Operations Leader
PM – Project Manager
TBD – To Be Determined

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 ¹	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Field SOPs	Ensure that the sampling SOPs were followed.	Tetra Tech FOL
IIa	Analytical SOPs	Ensure that all laboratory analytical SOPs were followed.	Valgena Respass, CompuChem Chris Cornwell, SGS
IIa	Data package	Validator will verify that elements of the data package that are required for validation are present and if not the lab will be contacted and the missing info will be requested. Validation will be performed as per worksheet 36.	Tetra Tech Data Validator
IIa	Field logs/sample coordinates	Verify that the sampling plan was implemented and carried out as written and any deviations are documented	Tetra Tech PM
IIa	Electronic Data	Verify all data have been transferred correctly and completely to the final SQL data base	Tetra Tech PM, Data Validator, or designee
IIa / IIb	SAP Worksheet 12, Field SOPs/Field Logs, COCs	Verify that deviations have been documented and MPCs have been achieved for field QC samples.	Tetra Tech FOL, PM, Data Validator or designee
IIa / IIb	SAP Worksheet 28, Laboratory SOPs, Data Package	Verify that deviations have been documented and MPCs have been achieved for laboratory data including environmental sample results and laboratory QC.	Tetra Tech Data Validator

¹ IIa=compliance with methods, procedures, and contracts [see Table 10, page 117, UFP-QAPP manual, V.1, March 2005.]

IIb=comparison with measurement performance criteria in the SAP [see Table 11, page 118, UFP-QAPP manual, V.1, March 2005]

FOL – Field Operations Leader
MPC – Measurement Performance Criteria
PM – Project Manager
SOP – Standard Operating Procedure
SQL – Structured Query Language

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 (title and organizational affiliation)
IIa and IIb	Soil	Volatiles	TtNUS SOP DV-02 and SAP Worksheets 12 and 28.	Tetra Tech Data Validator
IIa and IIb	Soil	Metals/Mercury	TtNUS SOP DV-04 and SAP Worksheets 12 and 28.	Tetra Tech Data Validator
IIa and IIb	Soil	Cyanide	TtNUS SOP DV-04 and SAP Worksheets 12 and 28.	Tetra Tech Data Validator
IIa and IIb	Soil	Semivolatiles	TtNUS SOP DV-02 and SAP Worksheets 12 and 28.	Tetra Tech Data Validator
IIa and IIb	Soil	Pesticides	TtNUS SOP DV-02 and SAP Worksheets 12 and 28.	Tetra Tech Data Validator
IIa and IIb	Soil	PCBs	TtNUS SOP DV-02 and SAP Worksheets 12 and 28.	Tetra Tech Data Validator
IIa and IIb	Soil	Dioxin/Furan	TtNUS SOP DV-06 and SAP Worksheets 12 and 28.	Tetra Tech Data Validator

SAP Worksheet #37 -- Usability Assessment

[\(UFP-QAPP Manual Section 5.2.3\)](#)

A data usability assessment will be conducted by the planning team, including the TtNUS PM, project chemist, and technical staff. If significant data usability limitations are encountered the planning team will be expanded to include the Navy RPM and Navy technical staff.

The data validation procedure (Worksheets 35 and 36) will be used to help determine which data are usable. Qualifiers will be applied to each value based on the results of the data validation. Rejected values (qualified with “R”) and blank qualified values (“B”) will be eliminated from further consideration. Estimated and biased values (J [estimated], K [biased high], and L [biased low]) will be used as the reported value. The quantitation limits from the data will be evaluated for sensitivity to the project action levels. Limitations on the use of the data due to lack of project-required sensitivity will be discussed. In addition, the data will be reviewed to evaluate if samples were collected from the intended locations and are representative of site conditions.

After data validation and an overall review of data quality indicators, the data will be reconciled with measurement performance criteria (MPCs) to determine whether sufficient data of acceptable quality are available for decision making. A series of checks will be performed to estimate several of the data set characteristics. Simple summary statistics for target analytes may be presented, such as the maximum concentration, minimum concentration, number of samples exhibiting no detectable analyte, the number of samples exhibiting detectable analytes, and the proportion of samples with detectable and undetectable analytes. Rejected values and significant deviations from planning documents, if any, will be identified so the planning team can assess their impacts to the attainment of project objectives. Project assumptions will also be evaluated to determine their validity. If assumptions are shown to be invalid the team will assess the impact of the invalid assumption and take actions necessary to mitigate the impact. In extreme cases, a revision of DQOs may be necessary.

The quantitative bias and precision data quality indicators will be reviewed to determine whether any significant bias or significant imprecision exist in the data. A significant bias is a bias greater than +/- 30 percent for aqueous samples and +/- 50 percent for solid samples (corresponding to consistent analyte recoveries of 70 to 130 percent in LCSs, MSs, or surrogate compound concentrations). Laboratory precision and field precision (based on RPD values from duplicate samples) will be compared to ensure that laboratory precision is not significantly worse (i.e., exhibits greater RPD values) than field precision. At the discretion of the project manager correlations may also be assessed among various parameters as a cross-check to ensure that results appear to be reasonable. Although bias and precision indicators can be assessed quantitatively, evaluations will involve professional judgment which will consider site conditions, the normal analytical performance for the analytes in question, and other factors that affect the precision and agreements among analyte concentrations. The intent will be to identify any deviations or anomalies that adversely affect the ability to attain project objectives and to document how these characteristics were handled by the team to complete the project.

RPD and Percent Recovery values will be computed as follows:

$$RPD = \frac{|\text{Amount in Sample 1} - \text{Amount in Sample 2}|}{0.5 (\text{Amount in Sample 1} + \text{Amount in Sample 2})} \times 100$$

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

The %R for a spiked sample will be calculated by using the following formula:

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \times 100 \%$$

The %R calculation for LCSs and surrogate spikes will be as follows:

$$\%R = \frac{\text{Experimental Concentration}}{\text{Certified or Known Concentration}} \times 100 \%$$

Potential data outliers will also be investigated to determine whether they represent unanticipated site conditions or they are true outliers. No statistical outlier will be removed from a data set unless a physical reason can be assigned to the datum to demonstrate that it is not representative of the intended population.

The comparability among data sets will be evaluated to ensure it is satisfactory. For example, if comparability problems are anticipated because of poor analyte precision or bias, this will be noted so that subsequent data generators or project planners can take these potential data deficiencies into account. Comparability and representativeness assessments will be based on professional judgment with consideration of the quantitative quality indicators such as precision, accuracy, and completeness of data sets.

Data Limitations and Actions from Usability Assessment

After all data evaluations are completed, any limitations on the use of data will be known to the planning team and the limitations will be considered during decision making. If necessary, investigation objectives may be revised in anticipation of additional data collection in order to meet project quality objectives for the site. The data usability assessments for each stage of the bioremediation pilot study will be summarized in the final report for that phase.

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