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FINAL SAMPLING AND ANALYSIS PLAN FOR PRE DESIGN INVESTIGATION FOR SOILS
NS NEWPORT RI
7/1/2013
TETRA TECH

Sampling and Analysis Plan

Pre-Design Investigation for Soil

Naval Undersea Systems Center (NUSC) Disposal Area – Site 8

Naval Station Newport Middletown, Rhode Island

Naval Facilities Engineering Command Mid-Atlantic

Contract Number N62470-08-D-1001
Contract Task Order WE75

July 2013

Title and Approval Page
(UFP-QAPP Manual Section 2.1)

FINAL
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
July 2013

Pre-Design Investigation for Soil
Site 8 – Naval Undersea Systems Center Disposal Area
Naval Station Newport
Middletown, Rhode Island

Prepared for:
Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic Division
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Norfolk, Virginia 23511-3095

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Prepared under:
Contract Number N62470-08-D-1001
CLEAN Contract Task Order No. WE75

Review Signature: T. E. Johnston 7-11-13
Tom Johnston — Date
Quality Assurance Manager
Tetra Tech

Approval Signature: see next page
Quality Assurance Officer (QAO)/Chemist — Date
Naval Facilities Engineering Command

Other Approval Signature: J. Ropp 7.11.13
James Ropp — Date
Project Manager
Tetra Tech

Title and Approval Page
(UFP-QAPP Manual Section 2.1)

DRAFT
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
April 2013

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Approval Signature: NIXON.MONIQUE.L.1272150628 — Digitally signed by NIXON.MONIQUE.L.1272150628 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=NIXON.MONIQUE.L.1272150628 Date: 2013.04.02 07:21:15 -04'00'
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Naval Facilities Engineering Command

Other Approval Signature: J. Ropp 4/1/13
James Ropp — Date
Project Manager
Tetra Tech

EXECUTIVE SUMMARY

Tetra Tech, Inc. (Tetra Tech) has prepared this Sampling and Analysis Plan (SAP) to conduct pre-design investigation (PDI) activities for soil at Site 8, the Naval Undersea Systems Center (NUSC) Disposal Area, located at the Naval Station Newport (NAVSTA Newport), Rhode Island. The objective of the proposed activities is to provide the additional soil quality data needed to support the Remedial Design (RD) for Site 8 soils. The work is being performed under the U.S. Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic's Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62470-08-D-1001, Contract Task Order (CTO) WE75. This SAP was prepared in accordance with the Intergovernmental Data Quality Task Force (IDQTF) Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPP), (IDQTF, 2005).

NAVSTA Newport is located on Aquidneck Island, approximately 25 miles south of Providence, Rhode Island. The facility occupies approximately 1,000 acres, with portions of the facility located in the City of Newport and in the Towns of Middletown, Portsmouth, and Jamestown, Rhode Island. The facility layout follows the western shoreline of Aquidneck Island for nearly six miles, facing the east passage of Narragansett Bay. The primary activities at NAVSTA Newport include research, development, and training operations. The major Navy commands currently located at NAVSTA Newport include the Naval Education and Training Center (NETC), the Surface Warfare Officers School Command, the Naval Undersea Warfare Center (NUWC), and the Naval War College. Site 8 is located within the NUWC portion of NAVSTA Newport, in the Town of Middletown, Rhode Island.

As shown on Figure 1, Site 8 occupies approximately 12.4 acres along the northern boundary of the NUWC grounds, and includes the Building 179 Area (research facilities), the Building 185 Complex (a paved, equipment storage area), as well as undeveloped open fields and wooded areas, two shallow streams bounded by steep slopes, wetlands, and Deerfield Pond (also known as NUWC Pond). A low, concrete dam is present at the northern end of the 2-acre pond. Site details and associated features are depicted on Figure 2. During previous environmental investigations at Site 8, the Navy identified various semi-volatile organic compounds (SVOCs) and inorganics (metals) as the contaminants of concern (COCs) for Site 8 soil.

In September 2012, the Navy completed a Record of Decision (ROD) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) which selected the following Remedial Action (RA) for Site 8:

- Excavation and offsite disposal of selected soil volumes and debris from the following areas: portions of the paved storage area where geophysical anomalies have been identified; in the South Meadow where buried drum fragments remain; soil containing COC concentrations exceeding RIDEM Leachability Criteria; the Buried Container Area where buried canisters remain; and isolated soil

locations outside of the soil cover where COC concentrations exceed RIDEM Direct Exposure Criteria (DEC);

- Construction of a 2-foot soil cover over the remaining area of unpaved soils where COC concentrations exceed industrial cleanup goals;
- Maintenance of the existing paved storage area as a Waste Management Area (WMA);
- Treatment of the most contaminated areas of groundwater using either in-situ enhanced bioremediation or in-situ chemical oxidation (ISCO), followed by monitored natural attenuation (MNA) of the residual groundwater plume;
- Excavation and offsite disposal of contaminated sediment in Deerfield Pond and portions of Deerfield Creek;
- Implementation of land use controls (LUCs) to limit future use of the property to industrial activities;
- Long-term monitoring.

The investigations covered by this SAP will provide the data needed to support the portion of the Site 8 RD which addresses Site 8 soil. Additional data are necessary to facilitate the proposed soil remedy, including:

- Soil sampling and analysis to verify that concentrations of inorganics in soil do not exceed RIDEM's promulgated leachability criteria;
- Soil sampling and analysis in the North Meadow to verify that soil by MW-03B is not acting as a continuing source of volatile organic compound (VOC) COCs for groundwater in that area;
- Soil sampling and analysis to determine whether soil on the steep slopes alongside the planned soil cover area contains COC concentrations that warrant inclusion in the RA (i.e., determine whether the slopes areas can be excluded from the soil cover area as presented in the ROD); and
- A topographic survey to provide baseline topography for the design of the soil cover.

The Navy will prepare separate SAPs to support the PDI efforts for Site 8 sediment, groundwater, and other components of the RA, such as performance monitoring of the implemented actions and the long-term groundwater monitoring program.

TABLE OF CONTENTS

Title and Approval Page 1
1.0 Project Organizational Chart 7
2.0 Communication Pathways 8
3.0 Project Planning Session Participants Sheet 11
4.0 Conceptual Site Model 15
5.0 Data Quality Objectives/Systematic Planning Process Statements 21
6.0 Field Quality Control Samples 26
7.0 Sampling Design and Rationale 27
8.0 Field Project Implementation 29
9.0 Reference Limits and Evaluation Tables 45
10.0 Analytical SOP References Table 48
11.0 Laboratory QC Samples Table 50
12.0 Data Verification and Validation (Steps I and IIa/IIb) Process Table 58

LIST OF FIGURES

1 Site Location Map
2 Site Detail Map
3 Conceptual Site Model
4 Geologic Cross-Section A-A'
5 Geologic Cross-Section B-B'
6 Potentiometric Groundwater Surface Elevation Contours
7 Surface Soil Contamination
8 Subsurface Soil Contamination
9 Soil Sampling and Survey Locations
10 Comparison of Conceptual Soil Cover Layouts

LIST OF TABLES

1 Summary of Site 8 Contaminants of Concern in Soil
2 Summary of RI Sample Results for Site 8 COCs in Soil

REFERENCES

APPENDICES

A Standard Operating Procedures
B Field Documentation Forms
C Analytical Laboratory Certifications

ACRONYMS AND ABBREVIATIONS

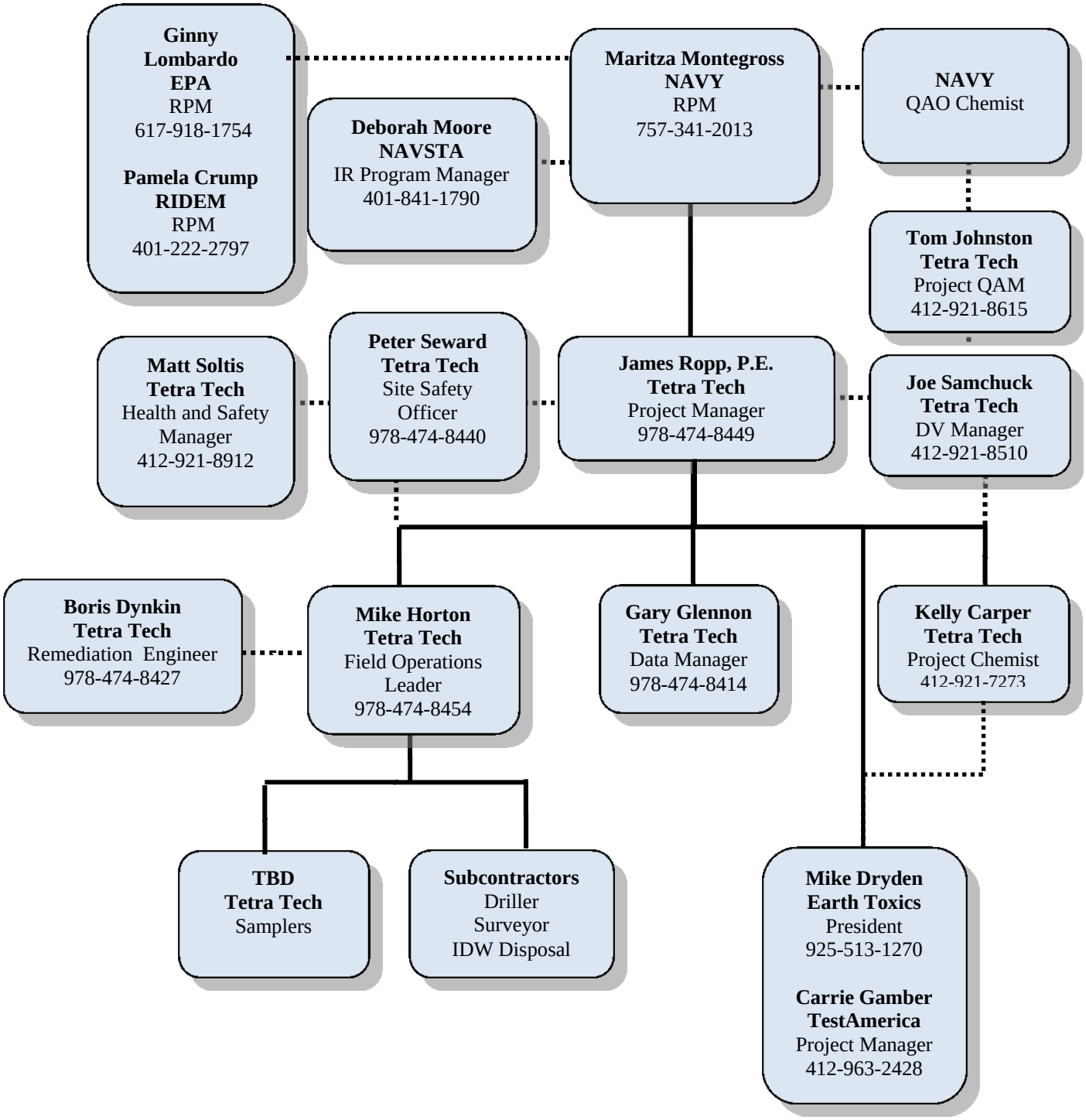
°C	Celsius
°F	Fahrenheit
A-N	alpha-numeric
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Standards and Materials
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Contaminant of Concern
CSM	Conceptual Site Model
CTO	Contract Task Order
DEC	Direct Exposure Criteria
DL	Detection Limit
DPT	Direct-push technology
DQO	Data Quality Objective
EPA	(United States) Environmental Protection Agency
eV	electron volt
FOL	Field Operations Leader
FS	Feasibility Study
GC	Gas Chromatograph
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
ID	inside diameter
IDW	Investigation-derived waste
IDQTF	Intergovernmental Data Quality Task Force
IR	Installation Restoration
ISCO	In-situ chemical oxidation
LCS	Laboratory Control Sample
LOD	Limit of Detection
LOQ	Limit of Quantification
LUC	Land Use Control
MNA	Monitored Natural Attenuation
MPC	Measurement Performance Criteria
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAVD	North American Vertical Datum
NAVFAC	Naval Facilities Engineering Command
NAVSTA	Naval Station
NETC	Naval Education and Training Center
NUSC	Naval Undersea Systems Center
NUWC	Naval Undersea Warfare Center
OSHA	Occupational Safety and Health Administration
oz	ounce
PAH	Polycyclic aromatic hydrocarbon
PAL	Project Action Level
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PGDN	Propylene glycol dinitrate
PID	Photo-ionization detector

PM	Project Manager
PPE	Personal Protective Equipment
PQO	Project Quality Objective
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RA	Remedial Action
RD	Remedial Design
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
ROD	Record of Decision
RPD	Relative Percent Difference
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SSO	Site Safety Officer
SVOC	Semi-volatile Organic Compound
TA	TestAmerica Laboratories
TBD	To be determined
TCE	Trichloroethene
Tetra Tech	Tetra Tech, Inc.
UFP	Uniform Federal Policy
USCS	Unified Soil Classification System
UST	Underground storage tank
VOC	Volatile Organic Compound
WMA	Waste Management Area

1.0 Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1 – Worksheet #5)

Lines of Authority ——— Lines of Communication - - - -



2.0 Communication Pathways

(UFP-QAPP Manual Section 2.4.2 – Worksheet #6)

The communication pathways for the Sampling and Analysis Plan (SAP) are described below.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
SAP amendments	Navy Remedial Project Manager (RPM)	Maritza Montegross	757-341-2013	RPM sends scope change, within 1 week of recognizing need for SAP amendment, to Tetra Tech Program Office, prior to implementing any change in scope.
Mobilization	Tetra Tech Inc. (Tetra Tech) Project Manager (PM) Tetra Tech Field Operations Leader (FOL)	Jim Ropp Mike Horton	978-474-8449 978-474-8454	PM notifies Naval Facilities Engineering Command (NAVFAC) RPM, Naval Station (NAVSTA) Installation Restoration (IR) PM (Deb Moore), and Naval Undersea Warfare Center (NUWC) environmental manager (Rob Davis, 401-832-5844), via e-mail or phone, of planned sampling event 2 weeks prior to mobilizing to the site. FOL checks with Rob Davis regarding any potential operational/access restrictions (e.g., "HERO" conditions). PM/FOL faxes security clearance request to NUWC security office (Robin Spradling/Visitor Control, fax: 401-832-4396) at least 5 days prior to mobilizing to site. PM/FOL ensure that one sampling team member has "escort" clearance, per NUWC requirements. The PM will notify EPA and RIDEM via email 2 weeks before the start of mobilization.
Need to arrange utility clearance and dig permits	Tetra Tech FOL	Mike Horton	978-474-8454	FOL pre-marks drilling locations and contacts DigSafe (1-888-DIG-SAFE) at least 72 hours prior to drilling/soil boring operations. FOL also coordinates with NAVSTA's Public Works Department prior to drilling/soil boring activities to review available NAVSTA utility drawings and to submit a utility clearance request.
Changes in schedule	Tetra Tech FOL Tetra Tech PM Navy RPM	Mike Horton James Ropp Maritza Montegross	978-474-8454 978-474-8449 757-341-2013	FOL informs PM verbally, within the same day that the need for a change is identified; PM informs NAVFAC RPM via e-mail, within 24 hours and, if deemed necessary by the NAVFAC RPM and PM, prepares schedule concurrence letter within 7 calendar days from date of notification.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Issues in the field that result in changes in scope of field work	Tetra Tech FOL Tetra Tech PM Navy RPM	Mike Horton James Ropp Maritza Montegross	978-474-8454 978-474-8449 757-341-2013	FOL informs PM verbally, within same day of identifying need for change; PM informs NAVFAC RPM via e-mail within 24 hours, and sends a Field Modification Record (minor changes) and/or a concurrence letter (major changes) within 7 calendar days to the RPM, if warranted. RPM signs the Field Modification Record within 1 business day (or concurrence letter within 7 calendar days). Scope change is to be approved before the work is executed. EPA and RIDEM will be notified and consulted with for any major changes in scope.
Field Progress Reports	Tetra Tech FOL Tetra Tech PM Navy RPM	Mike Horton James Ropp Maritza Montegross	978-474-8454 978-474-8449 757-341-2013	FOL provides daily progress updates to the PM by phone; PM informs NAVFAC RPM by e-mail weekly of field progress and prepares written monthly status reports for the NAVFAC RPM. EPA and RIDEM will be copied on weekly field progress reports.
Recommendations to stop work and initiate work upon corrective action	Tetra Tech FOL Tetra Tech PM Tetra Tech Quality Assurance Manager (QAM) Tetra Tech Site Safety Officer (SSO) Navy RPM	Mike Horton James Ropp Tom Johnston Peter Seward Maritza Montegross	978-474-8454 978-474-8449 412-921-8615 978-474-8440 757-341-2013	Responsible party verbally informs the PM, FOL, and subcontractors within 1 hour, regarding a recommendation to stop work, and within 24 hours, regarding a recommendation to restart work. Responsible party follows verbal notification with an email to the Project Team within 24 hours.

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Analytical data quality issues	Laboratory PM Tetra Tech Chemist Navy RPM	Carrie Gamber Kelly Carper Maritza Montegross	412-963-2428 412-921-7273 757-341-2013	The Laboratory PM will notify the Tetra Tech Project Chemist by phone or e-mail within 1 business day of when an issue related to laboratory data quality is discovered. The Project Chemist will then notify the data validation manager and the PM by phone or e-mail within 1 business day. The Project Chemist notifies the PM verbally or via e-mail within 48 hours of validation completion that a non-routine and significant laboratory quality deficiency has been detected that could affect this project and/or other projects. The PM advises the NAVFAC RPM by phone or e-mail within 1 business day of notification from the Project Chemist. The NAVFAC RPM takes corrective action that is appropriate for the identified deficiency. Examples of significant laboratory deficiencies include data reported that has a corresponding failed tune or initial calibration verification. Corrective actions may include a consult with the NAVFAC QAO/Chemist within 5 business days.

FOL = Field Operations Leader
PM = Project Manager
QAM = Quality Assurance Manager
QAO = Quality Assurance Officer
RPM = Remedial Project Manager
SSO = Site Safety Officer

3.0 Project Planning Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1 – Worksheet #9)

Project Name:	Pre-Design Investigation (PDI)	**Site Name:**	Site 8 (NUSC Disposal Area)
Projected Date(s) of Sampling:	July 2013	**Site Location:**	NAVSTA Newport, Middletown, Rhode Island
Project Manager:	Jim Ropp		
Date of Session:	November 9, 2012		
Scoping Session Purpose:	Data Quality Objective (DQO) Development and Conceptual Remedial Design (RD) Discussion		

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Tom Johnston	Chemist/DQO Specialist	Tetra Tech	(412) 921-8615	tom.johnston@tetratech.com	QAM
Alex Mikszewski	Remediation Engineer	Woodard & Curran	(800) 446-5518	amikszewski@woodardcurran.com	Rhode Island Dept. of Environmental Management (RIDEM) consultant
Pamela Crump	RPM	RIDEM	(401) 222-2797 x 7020	pamela.crump@DEM.RI.GOV	RIDEM RPM
Jim Ropp	Environmental Engineer	Tetra Tech	(978) 474-8449	Jim.ropp@tetratech.com	PM
Boris Dynkin	Remediation Engineer	Tetra Tech	(978) 474-8427	boris.dynkin@tetratech.com	Senior Engineer
Ginny Lombardo	RPM	EPA	(617) 918-1754	lombardo.ginny@epa.gov	EPA RPM
Maritza Montegross	RPM	NAVFAC	(757) 341-2013	maritza.montegross@navy.mil	Navy RPM
Bill Brandon	Hydrogeologist	EPA	(617) 918-1391	brandon.bill@epamail.epa.gov	EPA Hydrogeo.

Comments/Decisions (pertaining to the soil PDI/RD):

- The Navy and Tetra Tech held the meeting to develop DQOs for this SAP. Tetra Tech also presented the conceptual design for Site 8 because agency agreement on the planned RD/Remedial Action (RD/RA) is needed early in the process in order to develop an appropriate

PDI SAP that will support the RD. The results are presented in the various Sections of this SAP. Related discussions and agreements that pertained to the soil PDI and RD are summarized below.

- The conceptual RD for soil includes selective excavation (less than 600 cubic yards) at 10 specified target areas (as described on page 59 of the ROD), construction of a 2-foot-thick soil cover (approximately 4 acres), and implementation of a Waste Management Area (WMA) in the Paved Storage Area. The preference is to end the soil cover at the top of the steep slopes by NUWC Pond, so that the existing vegetation and ecological habitat along the slopes can be retained (this would be a change to the extent of the soil cover as presented in the ROD).
- During the RA, the U.S. Environmental Protection Agency (EPA) strongly recommends that the Navy remove as much of the buried waste debris from under the Paved Storage Area as possible. M. Montegross agreed that the potential contaminant source would be removed as much as possible, without disrupting the active operations in that area. The disturbed area would be repaved after the debris removal is completed.

Action Items (pertaining to the soil PDI/RD):

- M. Montegross will contact the Government Chemists to determine whether a Tier II SAP can be used for this project. Result: The Government Chemist approved the use of the Tier II SAP format on November 28, 2012.
- J. Ropp will provide copies of the DQO notes and presentation slides to the group. Result: Completed on November 13 and 26, 2012.
- J. Ropp will check the historical information regarding soil samples collected by the stormwater culverts on the west side of the pond, with respect to their potential to re-contaminate the pond. Result: During the Site 8 Remedial Investigation (RI), surface soil sample locations DA-SB142, DA-SB145, and DA-SB146 were collected by storm water outfalls B, C, and D (Figure 2) to evaluate whether the outfalls were contributing to NUWC Pond impacts (Tetra Tech, 2007). Outfalls B, C, and D are associated with storm water catch basins located along Cunningham Street as part of the NUWC complex located to the west/southwest of the pond. A comparison of the sampling data to the soil RGs is presented in the table below. Elevated concentrations of polycyclic aromatic hydrocarbons (PAHs) were detected in surface soil at these locations. Although no RG was identified for polychlorinated biphenyls (PCBs) in soil, the RG for PCBs in pond sediment is 150 µg/kg. Samples DA-SB142, DA-SB145, and DA-SB146 contained 250 J, 350 J, and 140 µg/kg of total PCBs, respectively. The RI concluded that sediment contamination in the pond is likely the result of a combination of contributing factors, not just the storm water outfalls. Sample locations DA-SB142, DA-SB145, and DA-SB146 are planned for selective excavation as part of the Site 8 RA.

SOIL LOCATION ID	Residential RG	Industrial RG	DA-SB142	DA-SB145	DA-SB146
INTERVAL			0-1 ft	0-1 ft	0-1 ft
SAMPLE DATE			01/17/08	01/17/08	01/17/08
SEMIVOLATILES (UG/KG)					
1,1-BIPHENYL	800	--	380 U	430 U	400 U
ACENAPHTHENE	43000	--	48	90	21 J
ANTHRACENE	35000	--	110	400 J	50
BENZO(A)ANTHRACENE	150	2100	310	2400	210
BENZO(A)PYRENE	157	210	270	1800	230
BENZO(B)FLUORANTHENE	150	2100	300	2600	200
BENZO(G,H,I)PERYLENE	800	--	160	1200 J	140
BENZO(K)FLUORANTHENE	900	21000	270	2000	190
CHRYSENE	400	780000	350	2500	290
DIBENZO(A,H)ANTHRACENE	15	210	95	320	64
FLUORANTHENE	20000	--	700	5900	390
FLUORENE	28000	--	40	100	17 J
INDENO(1,2,3-CD)PYRENE	150	2100	180	1500	160
NAPHTHALENE	800	800	15 J	16 J	13 J
PHENANTHRENE	40000	--	520	2000	260
PYRENE	13000	--	490	4000	400
METALS (MG/KG)					
ARSENIC	18	18	14.5	18.6	10
BERYLLIUM	1.5	1.5	0.54 J	0.49 J	0.43 J
LEAD	150	500	33.6	112	46.9
MANGANESE	390	--	354	444	487
ZINC	6000	--	59.1	171	158

Light and dark shading indicate exceedences of residential and industrial soil RGs, respectively.

- P. Crump will check how many Synthetic Precipitation Leaching Procedure (SPLP) samples will be required by RIDEM for the PDI. Result: Determined through review and approval of this SAP.

Consensus Decisions (pertaining to the soil PDI/RD):

- The team agreed that the conceptual RD presented during this meeting was a good approach for Site 8 and that the Navy could proceed with the PDI SAP and RD accordingly.

4.0 Conceptual Site Model
(UFP-QAPP Manual Section 2.5.2 – Worksheet #10)

Figure 3 presents the Site 8 conceptual site model (CSM), which identifies contaminant sources, contaminant release mechanisms, transport routes, and receptors under current and future land use scenarios. Further details are provided below.

4.1 SITE LOCATION AND BACKGROUND

NAVSTA Newport is located approximately 25 miles south of Providence, Rhode Island on Aquidneck Island. The facility layout follows the western shoreline of Aquidneck Island for approximately six miles, facing the eastern passage of Narragansett Bay. The facility occupies approximately 1,000 acres, with portions of the facility located in the City of Newport and in the Towns of Middletown, Portsmouth, and Jamestown, Rhode Island. The primary current activities at NAVSTA Newport include research, development, and training operations. The major Navy commands currently located at NAVSTA Newport include the Naval Education and Training Center (NETC), the Surface Warfare Officers School Command, the NUWC, and the Naval War College. Site 8 is located within the NUWC portion of NAVSTA Newport, in the Town of Middletown, Rhode Island.

Site 8 occupies approximately 12.4 acres along the northern boundary of the NUWC grounds as shown on Figure 1, and includes the Building 179 Area (research facilities), the Building 185 Complex (a paved, equipment storage area), as well as undeveloped open fields and wooded areas, two shallow streams bounded by steep slopes, wetlands, and Deerfield Pond (also known as NUWC Pond). A low, concrete dam is present at the northern end of the 2-acre pond. Site details are shown on Figure 2.

During previous environmental investigations at Site 8, the Navy has identified elevated concentrations of PAHs, PCBs, and metals in soil and sediment, as well as volatile organic compounds (VOCs) and metals in groundwater. The Navy has determined that unacceptable risks to human health and the environment are associated with these contaminants in soil, sediment, and groundwater. The nature and extent of contamination in soil is described in Section 4.3. In September 2012, the Navy completed a Record of Decision (ROD) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) which selected the following RA for Site 8 (NAVFAC, 2012):

- Excavation and offsite disposal of selected soil volumes and debris from the following areas: portions of the paved storage area where geophysical anomalies have been identified; in the South Meadow where buried drum fragments remain; soil containing COC concentrations exceeding RIDEM Leachability Criteria; the Buried Container Area where buried canisters remain; and isolated soil locations outside of the soil cover where COC concentrations exceed RIDEM DEC;
- Construction of a 2-foot soil cover over the remaining area of unpaved soils where COC concentrations exceed industrial cleanup goals;

- Maintenance of the existing Paved Storage Area as a WMA;
- Treatment of the most contaminated areas of groundwater using either in-situ enhanced bioremediation or in-situ chemical oxidation (ISCO), followed by monitored natural attenuation (MNA) of the residual groundwater plume;
- Excavation and offsite disposal of contaminated sediment in Deerfield Pond and portions of Deerfield Creek;
- Implementation of land use controls (LUCs) to limit future use of the property to industrial activities;
- Long-term monitoring for as long as site conditions do not allow for unrestricted use and unlimited exposure.

The activities conducted under this SAP will provide the additional sampling and analytical data needed to support the RD for the soil portion of this Selected Remedy (i.e., the first two bullets above).

4.2 PHYSICAL CHARACTERISTICS

Geologic and hydrogeologic conditions described below are based on data from published maps as well as data collected during the Navy's past field investigations at Site 8. Geologic cross-sections are presented on Figure 4 and Figure 5.

Geology

The site overburden consists of approximately 0.5 to 19.5 feet of unconsolidated materials that overlie bedrock. The overburden thickness is greatest at the western corner of the Paved Storage Area and is thinnest in the North Meadow. Three overburden units consisting of debris fill, non-debris fill, and non-fill materials have been identified at Site 8.

Overburden at Site 8 is predominantly comprised of debris fill materials in the area of the South Meadow, where past disposal operations filled low-lying areas, or grading operations reworked the upper few feet of soil. Fill materials primarily consist of construction debris and/or natural soil or rock (silt, sand, gravel, and weathered bedrock fragments). Debris fill ranging in thickness from 4 to 18 feet was encountered throughout the South Meadow and the area between the Paved Storage Area and Deerfield Creek. Previous surface geophysical surveys and test pitting activities revealed significant metallic content in the debris fill of these areas. Debris was observed only sporadically in the North Meadow, the Paved Storage Area, and the Building 179 Area. The non-debris fill consists of road base materials and reworked native deposits. The non-fill (native) overburden materials are generally grey to brown sand and silt with various quantities of gravel. The gravel is generally platy, angular or sub-angular, and appears to be derived from in-place weathering of bedrock. The large grain characteristics of the fill support migration of site contaminants under the influence of recharging precipitation and groundwater flow dynamics.

Bedrock at the site consists of metamorphosed sedimentary rock, predominantly as phyllite. Metaconglomerate, schist, and quartzite were encountered at a few discrete depths in several locations. The hardness and degree of foliation of the bedrock varies with location, and the color of the rock varies from light to dark grey. The upper portion of the bedrock is significantly weathered and degraded and contains evidence of groundwater flow through the fractures (e.g., iron staining in water-bearing fractures).

The depth to bedrock ranges from approximately 0.5 to 19.5 feet below ground surface (bgs) across the site. Beneath the Paved Storage Area and the Building 185 Complex, the depth to bedrock ranges from 3 feet bgs in the east to 17 feet bgs in the west. In the South Meadow, bedrock depths are between 5 and 16.5 feet bgs, increasing from east to west through the South Meadow. Bedrock is very shallow (about 0.5 feet bgs) in the valley through which Deerfield Creek flows. Bedrock is also very shallow (within 5 feet of ground surface) in the North Meadow. At the north end of the site, the depth to bedrock increases to between 8.5 and 17 feet bgs. Overall, the site topography tends to mimic the bedrock surface.

Deerfield Creek and NUWC Pond are present in a bedrock valley. This valley, and the valley associated with the unnamed stream which separates the North and South Meadows, were likely formed by weathering and erosion of softer bedrock. At the southern portion of the site (the Building 179 Area), Deerfield Creek has not weathered the bedrock to form a deep valley, but rather, appears to be situated on competent bedrock, based upon its rocky bottom and the shallow depth to bedrock.

Borehole geophysics revealed that the strike and dip directions of the bedrock planar features vary. These planar features consist of fractures, bedding planes, cleavage, or contacts. Overall, the most common strike direction is north-south, with a dip direction to the east or west. Possible or likely transmissive fractures were also identified in the bedrock cores. During bedrock drilling operations, evidence of water-bearing fractures (iron staining) was observed in core holes. The number and frequency of fractures generally decreased with depth.

Hydrogeology

The depth to groundwater has been observed to range from approximately 0.5 to 24 feet bgs across the site, as shown on Figure 4 and Figure 5. Groundwater at the site generally flows west toward NUWC Pond and Deerfield Creek, as shown on Figure 6. In the Building 179 Area, groundwater in bedrock flows northward and appears to be influenced by Deerfield Creek, which flows north into NUWC Pond. Deerfield Creek appears to be a discharge zone for shallow bedrock groundwater in this area. In the area of the Paved Storage Area and the South Meadow, groundwater generally flows in a west-northwesterly direction. In the northern portion of the site, groundwater flows in a west-northwesterly and a west-southwesterly direction (towards NUWC Pond and associated wetlands). The intermittent, unnamed stream flowing from the east appears to have little influence on the direction of groundwater flow.

Groundwater flow in the northern part of the site is expected to follow the ground surface topography, which drops steeply towards NUWC Pond.

From the area of the North Meadow and northward, the static groundwater elevation is located within the shallow bedrock zone. South of that, groundwater is encountered near the bedrock/overburden interface.

Surface water is present at the site in Deerfield Creek, flowing from the south, the unnamed stream, flowing from the golf course to the east, and NUWC Pond.

4.3 NATURE, EXTENT, FATE AND TRANSPORT OF CONTAMINATION

A summary of the Site 8 COCs in soil is presented in Table 1. A summary of the RI sample results for the Site 8 soil COCs is presented in Table 2. For surface soil and subsurface soil, the extent of COCs exceeding the Remedial Goals established in the ROD is presented on Figure 7 and Figure 8, respectively.

The upland portion of Site 8 was used for materials/equipment disposal and storage since the Navy began operations there in the early 1950s. The South Meadow area was reportedly used for the disposal of scrap lumber, tires, wire, cable, and empty paint cans. In 2005-2006, the Navy conducted soil/debris removal actions at the “Buried Drum Area” and the “Buried Canister Area” in the South Meadow. Other historical operations at Site 8 also had the potential to generate hazardous materials, including former industrial plating, anodizing, and chemical cleaning within Building 1170 (formerly located approximately 200 feet southwest of the site) and PCB storage at an unknown location. However, the available information does not indicate that materials associated with these operations were disposed at Site 8.

The Building 185 Complex is another possible source of contaminants at Site 8. This complex consists of four, one-story sheds that were used for storage of flammable materials. Otto Fuel, a highly flammable material composed largely of propylene glycol dinitrate (PGDN) and used for fueling torpedoes, is also stored in this area. During the RI, it was determined that a release of Otto Fuel had occurred in the Building 185 Complex and that a subsequent soil removal action had been completed in 2004. In the late 1980s, Building 185 was also reportedly used as a less-than-90-day accumulation area for drummed hazardous wastes that consisted primarily of Otto-Fuel-contaminated solids (rags, Tyvek® protective suits, and cleaning absorbents).

The Building 179 Area is a research facility and formerly had a 2,000-gallon concrete underground storage tank (UST) that stored byproducts generated from the torpedo propulsion system tests. This UST also received wastewater mixed with engine oil, solvent-based cleaners, Otto Fuel, and combustion byproducts. In 1995, it was discovered that the UST had leaked, contaminating soil and groundwater in this area and necessitating cleanup. A follow-up soil removal action associated with this release was completed in 1998.

In the North Meadow, it appears that a historical release(s) of VOCs, primarily trichloroethene (TCE), to the ground surface occurred in the vicinity of monitoring well MW-03B (central/western edge of the North Meadow). Following the original release(s) of solvents, it is likely that some of the solvents volatilized into the air and the remainder migrated through the unsaturated zone into the groundwater within the fractured bedrock. After reaching groundwater, the solvents would have migrated by advective transport and molecular dispersion toward NUWC Pond.

Semi-volatile organic compounds (SVOCs), primarily PAHs, have been detected in soil and sediment, with only low concentrations identified in groundwater. The presence of PAHs in the subsurface soils, where the maximum PAH concentrations were detected, is likely due to the fact that much of the area consists of fill material, with and without anthropogenic materials incorporated. The greater concentrations of PAHs in the surface soil are located in the vicinity of the Buried Drum Area, the Buried Canister Area (also called the Paint Can Area), the northern portion of the Paved Storage Area, and within the wetland soils. PAHs were also detected in the sediments of Deerfield Creek and NUWC Pond. These site features are depicted on Figure 2. The absence of PAHs in surface water and in nearly all groundwater samples is attributable to the relative insolubility of these compounds and their strong sorption potential to soil/sediment. The only SVOCs detected in groundwater included trace amounts of benzo(k)fluoranthene, 1,4-dioxane, and the Otto Fuel components PGDN and dibutyl sebacate. The transport of benzo(k)fluoranthene and Otto Fuel components is predominantly related to soil erosion, and it is expected that the PAHs would migrate to, and accumulate in, the deeper sediments over time, if left unchecked. The presence of 1,4-dioxane in groundwater is associated with the chlorinated ethane plume originating from the Building 179 area, and is being addressed separately from this SAP.

Surface and subsurface soil contained the greatest number of individual detections of pesticides, but no detection in soil exceeded the applicable screening levels. Pesticides were detected mainly in sediment and are consistent with manufactured chemicals that were historically widely used in the United States and are persistent in the environment. Based on the low concentrations of pesticides detected in site soil and groundwater, it appears that the presence of pesticides is not due to a specific release or disposal associated with past Site 8 operations. Instead, the detected pesticides are likely associated with the borrow material placed at the site, the general historic use of pesticides, and/or background and upgradient sources migrating to the site via sorption to particles entrained in the water column of local streams, and depositing in low-flow-velocity areas along the streams and within NUWC Pond.

Metals were detected in surface soil, subsurface soil, groundwater, surface water, and sediment. The most predominant metals detected in these environmental media at concentrations greater than screening levels include arsenic, chromium, cobalt, iron, manganese, and lead. The locations with most of the maximum detected metals concentrations varied, although in surface soils, the maximum concentrations were located in the wetland area, south of NUWC Pond. The maximum concentrations of metals in subsurface soil were detected in the vicinity of the Buried Canister Area.

Many metals, including arsenic, chromium, cobalt, manganese, iron, and lead, occur naturally in soils at varying concentrations. These naturally occurring metals are related to the bedrock composition, which is generally the original source material. The oxidation-reduction (redox) state of the subsurface environment will affect the valence state of metals such as arsenic and manganese and will influence how much of each metal remains bound to soil and rock surfaces and how much is dissolved in groundwater. Under oxidizing conditions, naturally-occurring arsenic and manganese will remain bound in soil and rock or sorbed to suspended particles. Under reducing conditions such as those induced by the presence of chlorinated VOCs, the concentrations of dissolved metals such as arsenic and manganese tend to increase, as the metals on soil and rock surfaces reduce to a more soluble form. It is expected that such concentrations of dissolved metals will decrease and return to background levels, once the chlorinated VOC plumes have been remediated.

5.0 Data Quality Objectives/Systematic Planning Process Statements
(UFP-QAPP Manual Section 2.6.1 – Worksheet #11)

The primary data users of this investigation will be NAVFAC and its environmental contractor, Tetra Tech, in consultation with the other members of the Project Team, which includes EPA, RIDEM, and NAVSTA Newport. The following text describes the development of the project quality objectives (PQOs) using EPA's DQO (Systematic Planning) process.

5.1 PROBLEM STATEMENT

Unacceptable risks to human health and the environment associated with the presence of various COCs in soil have been identified at Site 8, as summarized in Table 1. The Navy has signed a ROD under CERCLA and is currently in the RD/RA phase to mitigate the identified risks at Site 8. The cleanup goals for the soil COCs are based on calculated, risk-based criteria as well as regulatory standards (e.g., Rhode Island's Remediation Regulations). In order to fully develop the RD for Site 8, additional sampling data are required to support the engineering evaluation and calculations.

Soil characterization to support the RD is addressed by this SAP. The Navy needs to design a soil cover system that will render the site suitable for continued industrial use while minimizing damage to the ecological habitat adjacent to the upland soils. Additional data are needed to confirm the extent of the RA which was developed during the Feasibility Study (FS) (Tetra Tech, 2012a). These data must address the following:

- whether additional volumes of soil need to be excavated in the North Meadow;
- whether additional volumes of soil exceed RIDEM's leachability criteria and need to be excavated;
- whether the planned soil cover will need to extend down the steep slopes alongside surface water bodies at the site, as presented in the ROD;
- providing current surface topographic information needed to support the soil cover design.

5.2 IDENTIFY INPUTS NECESSARY TO RESOLVE THE PROBLEM

Data and information that will be required to resolve the problem statement identified in Section 5.1 include site feature information, field measurements and observations, laboratory chemical data, and decision criteria, including Project Action Levels (PALs) for making the determinations to resolve the problem statements. Field tasks to be performed to collect these data inputs are described in Section 8, and include the following:

Historical Sampling Data

- Historical analytical data from Site 8, which were considered during the selection process for new sampling locations included in this SAP.
- Existing geologic and hydrogeologic information.
- Historical findings from various studies that were used to develop the CSM.

Site Feature Information

- Location of underground utilities – Prior to site mobilization and subsurface activities, utility clearance activities must be performed, as described in Section 8.

Field Measurements and Observations

- During soil boring advancements, photo-ionization detector (PID) readings are required to screen samples for VOCs, to complete soil boring logs, and for health and safety purposes.
- During soil boring activities, field observations are required to complete boring logs.

Land Survey

- A topographic land survey by a Rhode Island registered professional land surveyor is needed for the area to be included under the new soil cover. Elevations must be tied into the existing site datum (North American Vertical Datum [NAVD] 1988).

Soil COC Data:

- In order to satisfy RIDEM regulations which were identified as Applicable or Relevant and Appropriate Requirements (ARARs) for the Site 8 RA, soil COC (metals) concentrations and SPLP-metals (including total cyanide) data are needed to verify whether metal or cyanide concentrations in soil are exceeding RIDEM's soil leachability criteria. Exceedences of RIDEM's leachability criteria may warrant additional soil excavations during the RA. Soil samples for SPLP-metals and SPLP-cyanide analyses need to be collected from selected locations where previous metals data indicate the potential for a SPLP exceedence (e.g., based on the "20x Rule"). Soil sampling methods and analytical methods are presented in Section 8. Specific analyte lists are provided in Section 9.
- As requested by RIDEM, additional soil VOC concentration data are needed in the North Meadow by MW-03B to verify that soil in that area is not acting as a continuing source of VOC COCs to groundwater in that area. Soil sampling methods and analytical methods are presented in Section 8.
- Soil data are needed from the steep slopes alongside the areas planned for the constructed soil cover (as presented in the ROD) to determine whether these slopes contain COC concentrations that warrant inclusion in the RA (i.e., determine whether the sloped areas can be excluded from the soil cover area, as presented in the draft RD; see Figure 10). No soil samples were collected from these

slopes during past investigations. Soil sampling methods and analytical methods are presented in Section 8. Specific analyte lists are included in Section 9.

Decision Criteria (see note below)

- To aid in the evaluations of the COC nature and extent, COC concentrations in soil must be compared to the PALs (Section 9), which are based on the Remedial Goals established in the Site 8 ROD.
- To conduct comparisons of COC concentrations to PALs, the selected laboratory must be able to achieve Limits of Quantitation (LOQs) and Limitations of Detection (LODs) that are lower than the PALs for soil. Any data limitations due to unmet sensitivity targets must be documented in the Sampling Report (Section 8). In the event the LOD for a non-detected result is greater than the PAL, the non-detected result will be considered as a non-exceedence for the purpose of making the decisions identified in Section 9. The limitations on data use in this event must be evaluated by the Project Team as described in Section 9 prior to making site decisions based on those data.

Note: Table 1 contains a list of identified COCs as well as potential COCs. The potential COC concentrations in the SPLP leachate will be compared to the leachability criteria presented in Section 9 and, if any criterion is exceeded, then the associated potential COC will be classified as a COC. RIDEM's leachability criteria for soil were identified as an ARAR for the Site 8 RA.

5.3 STUDY BOUNDARIES

The study area geographical boundaries have been defined based on the observed COC concentrations that exceed the Remedial Goals established in the ROD, as measured during previous investigations at Site 8. For the soil investigation, the primary populations of interest are depicted on Figure 9 and include:

- The subsurface soil in the North Meadow by MW-03B, where VOC concentrations in groundwater are highest and may suggest a residual VOC source in soil.
- The overburden soil in the North Meadow and South Meadow where metals concentrations (particularly lead, as recommended by EPA) are highest and suggest the possibility of an exceedence of the SPLP-metals criteria. Based on past sampling data, this includes a previous sampling location in the North Meadow near monitoring well MW-03B and in the South Meadow near monitoring well MW-110B (where the highest lead concentrations were detected).
- The shallow soils (0 to 2 feet bgs) along the vegetated, steep slopes adjacent to the planned areas for the new soil covers, per the ROD.
- The topography of the North and South Meadows, where the soil cap will be placed as part of the RA and where a topographic survey must be completed.

Surface soil is identified as soil in the depth interval from 0 to 2 feet bgs. Subsurface soil is identified as soil from a depth of 2 feet bgs to the top of bedrock.

Temporal Considerations

In accordance with CERCLA, the Navy's RA must be started within 450 days of signature of the September 2012 ROD (i.e., before the end of December 2013). The startup of the RA is preceded by the development and implementation of this SAP, completion of the RD, and completion of RA planning documents by the Navy's Remedial Action Contractor (e.g., Remedial Action Work Plan). As discussed with EPA, conducting the groundwater pilot study and implementing LUCs (addressed under separate cover) may also count toward the 450-day RA milestone.

5.4 ANALYTIC APPROACH

The following decision rules will be used to govern data use for this project:

1. If the specified data have been collected and the amount and quality of the data are judged to be sufficient to support a cost-effective and protective RD, then proceed with the RD; otherwise, convene the Project Team to revise the DQOs.
2. If the data specified have been collected within the constraints and boundaries identified in the SAP (i.e., the procedures and requirements outlined in this SAP), and the data quality reviews (and any associated reviews such as groundwater modeling) do not identify any data quality or quantity deficiencies that cannot be accommodated, then proceed to the RD; otherwise, reconvene the Project Team to evaluate the current knowledge of the site and determine an appropriate course of action. An appropriate course of action may include, but is not limited to, additional data collection, selecting another potential design approach[1], or other actions that cost-effectively move the project toward an effective and protective RD, at the Project Team's discretion.

The suitability of the data will be assessed using quantitative and qualitative characteristics of the data. The quantitative characteristics are the quantitative quality criteria presented in this SAP (i.e., an overall data quality review of the sample results). The qualitative characteristics are the combinations of conditions that interact to either support or not support the RD, as determined by the Navy's Remediation Engineer (i.e., evaluating the effect of the sample results on the RD, in the professional judgment of the design engineers). The intent is to obtain Project Team agreement that the salient characteristics of the site are represented sufficiently well to support a cost-effective and protective RD. The Project Team includes the Navy (NAVFAC and NAVSTA Newport), EPA, and RIDEM.

[1] Any significant or fundamental changes to the design approach may require completion of an Explanation of Significant Differences or a ROD Amendment, as to be determined by the Project Team.

5.5 PERFORMANCE CRITERIA

The sampling locations were selected based on the need to address soil data gaps needed for soil capping and selective excavation design. The data collected under this SAP are anticipated to be sufficient to achieve these goals and support future RD/RA decisions. Measured COC concentrations will be compared directly to the PALs without adjustment. Data quality will be evaluated as part of the verification, validation, and data usability assessment processes described in detail in Section 12.

The Project Team's evaluation will include consideration of the limitations on data usability if LOQs are greater than PALs. The tendency will be to declare the data set to be sufficient if all intended data have been collected and no significant quality issues are identified. If any significant data gaps (i.e., quality deficiencies) are identified, then the Project Team will document the deficiencies and determine the next appropriate step.

5.6 SAMPLING DESIGN AND RATIONALE

The sampling design and rationale are described in Section 7 along with details of the SAP. Section 8 lists the samples to be collected.

6.0 Field Quality Control Samples

(UFP-QAPP Manual Section 2.6.2 – Worksheet #12)

Measurement Performance Criteria Table – Soil Field Quality Control Samples

QC Sample[1]	Analytical Group[2]	Frequency	Data Quality Indicators	Measurement Performance Criteria
Equipment Rinsate Blanks	COCs	1 per 20 field samples per type of non-dedicated sampling equipment, if any[3].	Accuracy/ Bias/ Contamination	No target analytes ≥ ½ LOQ (or > LOQ for common laboratory contaminants).
Trip Blanks	COCs	1 per cooler containing VOC samples.	Accuracy/Bias/ Contamination	No target analytes ≥ ½ LOQ (or > LOQ for common laboratory contaminants).
Field Duplicates	COCs	1 per 10 field samples collected.	Precision	Relative percent difference (RPD) ≤ 30%. If sample results are < 2x LOQ, professional judgment is used.
Cooler Temperature Indicator	COCs	1 per cooler.	Representativeness	Temperature ≤ 6 Celsius (°C).
See above	Physical parameters (moisture content)	None required.	N/A	N/A

Notes:
1. Laboratory Quality Control (QC) samples, including matrix spike/matrix spike duplicate (MS/MSD) samples, are addressed in Section 11.
2. The target COCs to be analyzed by the laboratory are listed in Section 9.
3. Rinsate blanks will be collected only if non-dedicated equipment is used.

QC - Quality Control

7.0 Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1 - Worksheet #17)

Sampling of soil from Site 8 is needed to support the development of the RD. The COCs identified in soil include PAHs and metals, as shown in Table 1 and Section 9. The descriptions below provide an overview of the sampling strategies and rationales.

7.1 SAMPLING DESIGN, LOCATIONS AND RATIONALE

The sampling design for this project is based on a need to support the RD for Site 8. Soil samples need to be collected: (1) by MW-03B, to verify that soil in that area is not acting as a VOC source for groundwater COCs; (2) in the area of high metals concentrations in soil, in order to evaluate whether RIDEM's leachability criteria for metals are being exceeded; and (3) along the steep slopes adjacent to areas planned for soil cover construction, in order to determine whether elevated COC concentrations are present in those areas. The samples along the steep slopes will be used to determine whether it is acceptable to reduce the limits of the planned soil cover, as described in the ROD, to exclude the slopes from the cover area, as proposed in the draft RD. A comparison of the differences in the soil cover area between the ROD and the draft RD is presented in Figure 10. As shown on Figure 10, samples along the sloped areas will be collected at approximate 100-ft intervals.

The Project Team chose a judgmental, non-statistical approach as the basis for decision making; however, it will become clear after data quality review whether the collected data are sufficient to support a RD in the judgment of the Navy's Remediation Engineer and Project Team. Therefore, if the collected data are judged to be sufficient, the team may move forward to the RD.

7.2 SAMPLING AND ANALYSIS PLAN

Locations	See Section 8 and Figure 9.
Matrix	Soil
Analytical Group	VOCs (selected) SVOCs (selected) Metals (selected) SPLP-metals and cyanide. See Section 9 for analyte lists.
Analytical Method/Standard Operating Procedure (SOPs)	See Section 10.

Sampling Frequency	One PDI event
Anticipated Sampling Date	July 2013
Sampling Method	See Section 8 and Section 10.
# Field Samples (Section 8.3)	8 soil samples plus field QC (metals) 3 soil samples, plus field QC (VOCs) 2 soil samples, plus field QC (SPLP-metals) 12 soil samples, plus field QC (PAH and metals)
# Field QC Samples:	See Section 6.

Each site worker will be required to have completed appropriate Hazardous Waste Operations and Emergency Response (HAZWOPER) training specified in Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(e). Project-specific safety requirements are addressed in greater detail in the site-specific Health and Safety Plan (HASP).

8.0 Field Project Implementation (Field Project Instructions)

This section provides project-specific content to be used by the field team as Field Project Instructions. Field program standard operating procedures (SOPs) are presented in Appendix A. Field documentation forms are presented in Appendix B. The laboratory's certifications are presented in Appendix C.

8.1 FIELD PROJECT TASKS
(UFP-QAPP Manual Section 2.8.1 – Worksheet #14)

The following project tasks are summarized below:

- Field Tasks
- Analytical Tasks
- Data Management and Review
- Project Report

8.1.1 Field Tasks

The project field tasks are summarized in this section.

Mobilization/Demobilization – Mobilization includes: procurement of field equipment and supplies; a site walkover; mobilization of field staff, equipment, and supplies to the site; and site set-up. Communication requirements associated with mobilization are summarized in Section 2.

A field team orientation meeting will be held prior to the start of fieldwork in order to familiarize the personnel with the site's health and safety requirements, the objectives and scope of the field activities presented in this SAP, and the chain-of-command. This meeting will be attended by the field staff, FOL, the PM, and the SSO.

A site walkover will be conducted prior to mobilization. The field team will identify/mark sample locations and will identify related field support areas and requirements.

Demobilization includes removing field equipment and supplies from the site, returning rented equipment, managing investigation-derived waste (IDW), performing general site cleanup, organizing and finalizing field paperwork, and entering field records/data into the site database.

Utility Clearance – As described in Section 2, the available NAVSTA Newport utility drawings will be reviewed, a DIGSAFE number will be obtained, and a Utility Clearance request will be submitted to the NAVSTA public works office, prior to mobilizing drilling equipment.

Topographic Survey – A survey of the existing site topography in the area of the proposed soil cover, as shown on Figure 9, will be conducted by a professional land surveyor licensed in the State of Rhode

Island. Vertical measurements will be taken to the nearest 0.1 foot for natural features. The number of measurement transects across the work area will be determined by the FOL in consultation with the surveyor based on field conditions. Topographical information will be provided by the surveyor to Tetra Tech in electronic format for use in the RD.

The surveyor will also obtain horizontal and vertical coordinates from the top of the concrete dam at the northern end of NUWC Pond so that it can be used as a datum for a future bathymetric survey (addressed under separate cover). The datum will be from a readily identifiable point on the dam (e.g., the top corner by the weir), to be determined by the FOL based on field conditions. This datum will be measured to the nearest 0.01 foot vertically and the nearest 0.1 foot horizontally.

Soil sampling locations will be surveyed in the field by the sampling team, using Global Positioning System (GPS).

Subsurface Soil Sampling (VOCs and SPLP metals study) – Soil borings will be advanced from the ground surface to the top of bedrock using a direct push technology (DPT) rig in the North and South Meadows. Based on previous borings at Site 8, the depth to bedrock is approximately 10 feet bgs in the South Meadow and 5 feet bgs in the North Meadow. Soil cores will be collected continuously using a 1.5-inch, inside diameter (ID), dual-tube sampler equipped with a 4-foot-long disposable acetate liner. The boreholes will be logged according to SOP GH-1.5. The soil will be visually classified using the Unified Soil Classification System (USCS) following American Society for Testing and Materials (ASTM) Method D-2488-98.

For the planned VOC soil samples in the North Meadow, three soil borings will be conducted near MW-03B. Jar-headspace screening procedures will be used to obtain PID readings for each recovered soil interval (the jar headspace screening procedure is described below). These screening results will be used to select the depth interval from each boring for collection of soil samples for fixed-based laboratory analysis of VOCs. The soil samples will be collected from the soil interval with the highest jar-headspace screening reading. If there are no elevated PID screening readings from a particular boring, then the soil sample will be collected based on the greatest olfactory or visual evidence of contamination; otherwise, the sample will be collected immediately above the top of the saturated zone (or from immediately above the top of refusal, if the water table is not encountered). Previous investigations have determined that bedrock in this area is encountered at a depth of approximately 4 feet bgs. MW-03B is screened from 4 to 24 feet bgs within the weathered bedrock. Soil borings advanced in this area will penetrate weathered bedrock until refusal, and samples may be collected from the weathered bedrock interval where appropriate. The proposed locations of the three North Meadow soil borings (SB201, SB202, and SB203) are presented on Figure 9.

For the planned SPLP-metals analysis, two soil borings will be installed in the areas where elevated metals concentrations were previously detected. One boring (SB202) will be advanced in the North

Meadow by MW-03B and the other boring (SB204) will be advanced in the South Meadow by MW-110B, as shown on Figure 9[2]. Duplicate soil samples will be collected at 2-foot continuous intervals from both borings. One set of samples from each boring will be submitted for fixed-based laboratory analysis for total metals. Based on the total metals concentrations, the laboratory will be instructed to analyze the corresponding duplicate sample with the highest total metals concentrations in each boring for SPLP-metals analysis. The remaining duplicate samples will be discarded as IDW. If insufficient soil volume is obtained from a single boring to allow for split (duplicate) samples, then a second boring will be drilled directly adjacent to the initial boring and the extra soil volume will be obtained from the same target depth interval.

The Tetra Tech field geologist will be responsible for the following activities during soil sampling:

- Identifying the sample depth interval and recording it on the Boring Log Form (Appendix B).
- Determining the amount of soil sloughed into the top of the sampler.
- Estimating the soil moisture content (i.e., dry, moist, wet). Dry or moist soils will be designated as being in the unsaturated zone; wet soils will be designated as being in the saturated zone.
- Screening soil cores using a PID equipped with a 10.6 electron volt (eV) bulb. Observations will be recorded on the Boring Log Form.
- Collecting separate soil samples for jar headspace and laboratory analyses as described above.
- Classifying soil samples according to the USCS, noting the depth of change in each stratum and any other pertinent visual observations (i.e., discolorations, odors, residual product, moisture content). This information will be recorded on the Boring Log Form, which will also serve as the sample log sheet for soil samples collected from soil borings.
- Decontaminating soil sampling equipment prior to each new sampling location.

[2] SB204 is in an area of high lead concentrations in site soil (e.g., 4,540 mg/kg in sample DA-B110B-1012). SB202 is in an area where nickel and/or chromium concentrations in soil exceeded the “20x rule” for identifying potential leachability concerns (based on past soil results for adjacent sample locations DA-SB135, DA-MW114B, and DA-TP-11). SPLP samples are being collected from different mapped soil types (SB204 is from an area of soil type “Se” and SB202 is from an area of soil type “PmB”).

The drilling equipment will be decontaminated in accordance with Tetra Tech SOP SA-7.1 (Appendix A) before each new sampling location (see decontamination task below). Upon completion, soil borings will be backfilled with bentonite to within 1 foot bgs, and then capped with silica sand and native material.

Jar Headspace Screening for Organic Vapors in Soil

An aliquot of soil will be collected from each 2-foot soil interval for jar headspace screening with a PID. The procedure for the jar headspace screening is as follows:

1. Collect sufficient soil representative of the sample interval to half-fill one clean 8-ounce (oz.) glass jar. Quickly cover the jar with clean aluminum foil and apply the screw cap to tightly seal the jar. Appropriate analytical sampling procedures should be followed to maintain this sample matrix as representative and to avoid cross-contamination.
2. Vigorously shake the jar for at least 15 seconds. Allow headspace development for at least 10 minutes. Where ambient temperatures are below 32 degrees Fahrenheit (°F) (0°C), headspace development should be performed within a heated vehicle or building, though not at conditions above 80 °F (27 °C).
3. Remove the screw lid holding the foil seal in place to avoid losses of headspace and expose the aluminum foil. Quickly puncture the foil seal with the PID instrument probe and advance the probe tip to about one half of the headspace depth. Exercise care to avoid the uptake of water droplets or soil particles.
4. Record the highest instrument reading as the jar headspace organic vapor concentration. The maximum response should occur between 2 and 5 seconds after inserting the probe into the jar. Erratic meter response may occur with high organic vapor concentrations or high moisture content. If erratic responses are obtained, stop the headspace screening.
5. Operation, maintenance, and calibration of the monitoring instrument will be performed in accordance with the manufacturer's instructions.

Surface Soil Sampling Along Slopes of Planned Soil Cover Area (PAH and Metals Study) – Surface soil grab samples along the sloped areas will be collected in accordance with SOP SA-1.3 (Appendix A) from a depth of 0 to 2 feet bgs using a decontaminated stainless steel trowel or stainless steel hand auger. Plant roots and other non-decomposed organic matter and rocks will be removed from the sampler prior to its collection. Samples will be collected at the twelve locations shown on Figure 9, and will be submitted for fixed-based laboratory analysis for the PAHs and metal COCs at Site 8. Non-disposable equipment will be decontaminated between sample locations (see decontamination task below). Samples results will be compared to the PALs presented in Worksheet 9 in order to help determine the extent of the planned soil cover and land use controls.

Quality Control Tasks – Section 6 presents the field sample summary. Field QC samples for soil sampling will be collected as part of the investigation and will include field duplicates, trip blanks (for shipment coolers containing VOC samples), and equipment rinsate blanks (for non-dedicated sampling equipment). Attempts will be made to collect field duplicate samples from locations estimated to have higher COC concentrations in order to provide sufficient concentrations to allow for good duplicate comparisons.

Decontamination – The decontamination procedures presented in SOP SA-7.1 will be followed. Non-disposable equipment that comes in contact with the sample medium will be decontaminated to prevent cross-contamination between sampling points (e.g., stainless steel bowls, scoops). Heavy equipment such as drill rigs will be decontaminated using a high-pressure steam wash prior to beginning work and between each borehole. Personnel decontamination will be conducted in accordance with the project-specific HASP. Potable water will be used for steam-cleaning.

Investigation-Derived Waste – IDW includes decontamination fluid, used personal protective equipment (PPE), used sampling equipment, excess drill cuttings, and excess soil samples. IDW will be managed in accordance with SOP SA-7.1, as follows:

- Soil cuttings and excess soil samples and decontamination rinse water will be collected and transferred for staging in 55-gallon drums or bulk containers. Separate drums will be used for solid and aqueous IDW. In accordance with NAVSTA requests, drums of IDW will be staged onsite in a shipping container, pending waste disposal. The drums of IDW will be sampled for characterization purposes, transported, and disposed by a licensed contractor at an off-site facility licensed to accept the waste. IDW characterization, transport, and disposal will be performed within 90 days after all IDW collection has been completed and properly containerized. In areas where soil is to be excavated or covered as part of the RA, the FOL may choose to place soil drill cuttings and excess soil samples back into the source boreholes rather than disposing of the material in drums.
- Disposable PPE and disposable sampling equipment/materials will be disposed of as general refuse at the approved disposal location at NAVSTA.

8.1.2 Analytical Tasks

Chemical analysis of soil samples will be performed by a subcontracted fixed-base laboratory, Earth Toxics, Inc., and their subcontractor, TestAmerica, Inc. Tetra Tech will perform the specified field screenings (e.g., PID screening of soil samples from the borings by MW-03B).

The laboratory will perform chemical analyses in accordance with the methods identified in Section 10 and the requirements of the analytical specification for laboratory services, developed by Tetra Tech for this work.

Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment	Activity[1]	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
PID	Visual Inspection Calibration/ Verification	Daily Beginning and end of day	Manufacturer's Guidance	Operator Correction or Replacement	FOL or designee	Manufacturer's Guidance	To be used to determine the location within a boring interval that is most contaminated for collection of soil sample.

(1) Rental equipment and instruments will be used in the field. The rental firms will be responsible for the proper care, maintenance, and repair of these items, and for tracking and documenting equipment and instrument maintenance and repairs. The Field Operations Leader will ensure that the equipment is operational and suitable for its intended use.

PID – Photoionization Detector

SOP – Standard Operating Procedure

8.1.3 Data Management and Review

Sample Designation and Tracking System – Each sample collected will be assigned a unique sample tracking number used to catalog the analytical results and other information about each sample. The sample tracking number will consist of alpha-numeric (A-N) characters identifying the site, sample medium, location, and depth or date. Any other pertinent information regarding sample identification will be recorded on the sample log sheets or in the field logbooks. The A-N coding to be used in the sample system is described below.

AAAA	-	AA	-	AANNN	-	(NNNN or NNNNNN)
(Site ID)	-	(Medium)	-	(Location)	-	(Depth or Date)

Site identifier: Naval Undersea Systems Center (NUSC)
Medium identifier: "SO" for subsurface soil samples, "SS" for surface soil samples.
Sample location identifier: Each sample station will be assigned a soil boring identification as a unique location identifier.
Depth/Date: This portion of the tracking number will represent the depth in feet bgs from which the sample was collected; e.g., for soil samples collected from 2 to 4 feet bgs, this portion of the sampling tracking number will be "0204".
For example: A soil sample collected from a depth of 10 to 12 feet bgs at location SB301 will be identified as: NUSC-SO-SB301-1012.

Quality Control (QC) Samples – QC samples will use the same coding system used for the environmental samples. Field QC designations will conform to the following formats:

- Field Duplicates: Blind field duplicate samples will be designated such that the location designation will be replaced with "DUP", followed by a sequential value (the nth duplicate sample collected during that sampling event) and the date (MMDDYY). The sample log sheet will note which sample location the duplicate was collected from. For example, the first subsurface soil field duplicate sample collected on May 4, 2013 would be labeled NUSC-SO-DUP01-050413 and the second field duplicate collected on May 10, 2013 would be NUSC-SO-DUP02-051013.
- Trip Blanks: Trip blank sample identifiers will consist of the site, the medium of the samples associated with the trip blank, the label "-TB", a sequential value (the nth trip blank collected for that medium during that sampling event) and the date (MMDDYY). For example, the first trip blank for the subsurface soil sampling event to be shipped on May 4, 2013 would be labeled NUSC-SO-TB01-050413.

- Rinsate Blanks: Rinsate blank sample identifiers will consist of the site, the medium, the label "-RB", a sequential value (the nth trip blank collected for that medium during that sampling event), and the date (MMDDYY). Example: NUSC-SO-RB01-050413.
- Laboratory QC Samples: MS/MSD samples have no separate sample identifier codes, but are noted on the chain-of-custody record and sample log sheet.

Sample Collection Documentation – The FOL will maintain a project-specific field logbook to keep daily records of significant events, observations, and measurements during field activities. The field logbook also will be used to document all sampling activities. Logbook entries will be made with indelible ink to provide a permanent record and any errors found in the logbook will be verified, crossed-through with a single line, and initialed by the person discovering the error. Field logbooks will be maintained according to SOP SA-6.3 (Appendix A).

Field sample log sheets will be used to document sample collection details, while other observations and activities will be recorded in the field logbook. Field documentation forms are presented in Appendix B.

Field Sample Handling and Chain-of-Custody Procedures – The custody of samples must be maintained and documented at all times to ensure the integrity of a sample from collection through analysis. An accurate written record is necessary to trace the possession and handling of the sample; this documentation is referred to as the "chain-of-custody" form. Chain-of-custody begins when samples are collected in the field, and is maintained by storing the samples in secure areas until custody can be passed on. All samples will be delivered to the laboratory accompanied by a chain-of-custody form that will describe the sample identifiers, the analytical parameters, and the persons who are responsible for the sample integrity.

Prior to sample collection, sample containers will be labeled with the sample location number, sampler's name, date of collection, sample preservation, and designated analytical fraction.

Following collection, samples will be placed on ice in a secure cooler and attended by Tetra Tech personnel, or placed in locked vehicles or designated storage areas, until analysis or shipment to an off-site laboratory. Chain-of-custody procedures are described in further detail in SOP SA-6.3 (Field Documentation) and SOP SA-6.1 (Non-Radiological Sample Handling) (Appendix A).

The samples will be shipped to the laboratories in coolers packed with ice and bubble wrap or equivalent packing material to cushion the samples to prevent breakage and to maintain the required temperature for the samples. A container filled with water and labeled "temperature blank" will be included in each cooler. The temperature of this blank will be measured by the laboratory upon sample receipt to verify acceptable sample preservation temperature. The coolers will be taped and sealed with a signed custody seal to ensure the chain-of-custody is maintained. Samples will be shipped to the laboratory by an overnight courier to ensure that maximum sample holding times are not exceeded. The maximum

allowable sample holding times for each analysis are presented in Section 8.3, which also lists the sample containers, chemical preservatives, and temperature condition requirements to maintain the integrity of the sample.

Each sample collected will be assigned a unique sampling tracking number, as described above. The sample number, sample collection date and time, person collecting the sample, and a list of the sample analyses to be performed will be recorded on each container, and also on the chain-of-custody form. The chain-of-custody form is a two-part form: the original accompanies the samples to the analytical laboratory, and the copy will be archived in the project files. The following information will be recorded on the chain-of-custody form:

- Project name and number
- Sample matrix
- Sample collector's name
- Dates/times of sample collection
- Sample tracking numbers
- Number and type of containers for each sample analysis
- Type of preservation
- QC sample designation
- Analysis method
- Any special handling instructions
- Destination of samples
- Name, date, time, and signature of each individual releasing/accepting the shipping container

The field crew will attempt to identify any potentially high concentration samples (based on the field screening results) on the chain-of-custody form.

Laboratory Custody Procedures – Chain-of-custody requirements are also documented with instructions contained in each shipment from the laboratory, per the laboratory's SOP. The laboratory sample custodian will inspect the integrity of the cooler custody seals and measure the temperature of the samples received using the "Temperature Blank" container included in each cooler. The samples will be checked against the chain-of-custody form for holding times, sample tracking numbers, and integrity. The samples will be logged into the laboratory management system. Custody of the samples will be maintained and recorded in the laboratory from receipt to analysis, and this record will be included with the data package deliverables.

Data Handling and Management – After the field investigation is completed, the field sampling log sheets will be organized by date and medium, and will be filed in the project files. The field logbooks for this project will be used only for this site, and will also be categorized and maintained in the project files after the completion of the field program. Project personnel completing concurrent field sampling activities may maintain multiple field logbooks. When possible, logbooks will be segregated by sampling activity. The field logbooks will be titled based on date and activity. The data handling procedures to be followed by the laboratories will meet the requirements of the associated subcontract technical specification. The electronic data results will be automatically downloaded into the Tetra Tech database in accordance with the proprietary Tetra Tech processes.

Data Tracking and Control – The Tetra Tech PM (or designee) is responsible for the overall tracking and control of data generated for the project.

- **Data Tracking** – Data is tracked from its generation to its archiving in the Tetra Tech project-specific files. The Project Chemist (or designee) is responsible for tracking the samples collected and shipped to the subcontracted laboratories. Upon receipt of the data packages from the analytical laboratories, the Project Chemist will oversee the data validation effort, which includes verifying that the data packages are complete and results for all samples have been delivered by the analytical laboratory.
- **Data Storage, Archiving, and Retrieval** – The data packages received from the subcontracted laboratories are tracked in the data validation logbook. After the data are validated, the data packages are entered into the Tetra Tech Comprehensive Long-Term Environmental Action Navy (CLEAN) file system and archived in secure files. The field records, including field logbooks, sample log sheets, chain-of-custody records, and field calibration logs, will be submitted by the FOL to be entered into the CLEAN file system prior to archiving in secure project files. The project files are audited for accuracy and completeness. At the completion of the Navy contract, the records will be stored by Tetra Tech.
- **Data Security** – The Tetra Tech project files are restricted to designated personnel only. Records can only be borrowed temporarily from the project file using a sign-out system. The Tetra Tech Data Manager maintains the electronic data files. Access to the data files is restricted to qualified personnel only. File and data backup procedures are routinely performed.

Data Review

- Data verification processes are described in Section 12.
- Data validation processes are described in Section 12.
- Usability assessment processes are described in Section 12.

8.1.4 Project Report

At the conclusion of the sampling program, Tetra Tech will prepare a brief project report which will be presented as an appendix to the Site 8 RD. The report will include a summary of the field screening and fixed-base laboratory analytical results. The report will be prepared in draft format (electronic format) for Navy, EPA, and RIDEM review and then finalized (hardcopy and electronic format) based on the agreed-upon resolution of reviewer comments.

Field Project Implementation (Field Project Instructions), continued

8.2 FIELD SOPs REFERENCE TABLE

(UFP-QAPP Manual Section 3.1.2 – Worksheet #21)

SOP Reference Number	Title/Author	Revision Date or Version Number	Location of SOP (if not included in the SAP)	Any Planned Deviation for Project Work	Comments
HS-1.0	Utility Locating and Excavation Clearance / Tetra Tech	Revision 3	Appendix A.	None planned.	None
GH-1.1	Site Reconnaissance / Tetra Tech	Revision 2	Appendix A.	None planned.	None
GH-1.3	Soil and Rock Drilling Methods / Tetra Tech	Revision 2	Appendix A.	None planned.	None
GH-1.5	Borehole and Sample Logging / Tetra Tech	Revision 2	Appendix A.	None planned.	None
SA-1.3	Soil Sampling / Tetra Tech	Revision 9	Appendix A.	None planned.	None
SA-2.5	DPT (Geoprobe/Hydropunch) / Tetra Tech	Revision 4	Appendix A.	None planned.	None
SA-6.1	Non-Radiological Sample Handling / Tetra Tech	Revision 4	Appendix A.	None planned.	None
SA-6.3	Field Documentation / Tetra Tech	Revision 4	Appendix A.	None planned.	None
SA-7.1	Decontamination of Field Equipment / Tetra Tech	Revision 7	Appendix A.	None planned.	None
CT-04	Sample Nomenclature / Tetra Tech	Revision 3	Appendix A.	None planned.	None
CT-05	Database Records and Quality Assurance (QA)	Revision 3	Appendix A	None planned.	None

Field Project Implementation (Field Project Instructions), continued

8.3 SAMPLE DETAILS TABLE

(UFP-QAPP Manual Sections 3.1.1 and 3.5.2.3 – Worksheets #18, 19, 20 and 30)

Sample Details – Soil

	Analysis Group[1]	VOCs	PAHs	Metals	SPLP-Metals	SPLP-Cyanide
CTO WE75 SITE 8 PDI **JULY 2013**	**Preparation and Analytical Method**	SW-846 5035/8260B	SW-846 SVOCs 8270D	SW-846 6020/6010B/ 7471A	EPA Method 1312	SW-846 9010/9012A
	Analytical Laboratory/ Analytical SOP Reference	TestAmerica/ SOP PT-MS-002	TestAmerica / SOP PT-MS-008	TestAmerica / SOP PT-MT-001, PT-MT-002, PT-MT-007	TestAmerica/ SOP PT-OP-004/PT-MT-001, PT-MT-002, PT-MT-005	TestAmerica/ SOP PT-WC-018
	Data Package Turnaround Time	5 business days				
	Container Type/ Volume required (if different than container volume)	Terra core kit (2 water and 1 methanol vial)	1x4 oz. amber glass	From the PAH jar	1x8 oz. plastic or glass	1x4 oz for soil sample.
Earth Toxics, Inc. 8275 S. Eastern Ave., Suite 200-450, Las Vegas, NV 89123 Mike Dryden (925) 513-1270 TestAmerica 301 Alpha Drive, Pittsburgh PA, 15238 Carrie Gamber (412) 963-2428	**Preservative**	Cool to ≤ 6 °C;				
	Holding Time (Preparation/ Analysis)[2]	Low concentration: 48 hours from collection or frozen at < -7° C and analyzed within 14 days from sample collection. Methanol-preserved: 14 days to analysis	14 days to extraction, 40 days from extraction to analysis	6 months to analysis except mercury which is 28 days to analysis	6 months to leach; 6 months to analysis	14 days to analysis

No.	Matrix	Station ID	Sample ID	Coordinates (optional)		Depth/ Sampling Interval					
				X	Y						
1	Soil	SB201	NUSC-SO-SB201-TBD(3,4)			TBD based on PID readings	X				
2	Soil	SB202	NUSC-SO-SB202-TBD(3,5)			TBD based on PID readings	X				
3	Soil	SB203	NUSC-SO-SB203-TBD(3,6)			TBD based on PID readings	X				
4	Soil	SB202	NUSC-SO-SB202-0002			0-2 feet bgs			X	**One from interval with highest metals concentra-tion (8)**	**One from interval with highest metals concentra-tion (8)**
5	Soil	SB202	NUSC-SO-SB202-0204			2-4 feet bgs			X		
6	Soil	SB202	NUSC-SO-SB202-0406			4-6 feet bgs			X		
7	Soil	SB204(7)	NUSC-SO-SB204-0002			0-2 feet bgs			X	**One from interval with highest metals concentra-tion (8)**	**One from interval with highest metals concentra-tion (8)**
8	Soil	SB204	NUSC-SO-SB204-0204			2-4 feet bgs			X		
9	Soil	SB204	NUSC-SO-SB204-0406			4-6 feet bgs			X		
10	Soil	SB204	NUSC-SO-SB204-0608			6-8 feet bgs			X		
11	Soil	SB204	NUSC-SO-SB204-0810			8-10 feet bgs			X		
12	Soil	SS201	NUSC-SO-SS201			0-2 feet bgs		X	X		
13	Soil	SS202	NUSC-SO-SS202			0-2 feet bgs		X	X		
14	Soil	SS203	NUSC-SO-SS203			0-2 feet bgs		X	X		
15	Soil	SS204	NUSC-SO-SS204			0-2 feet bgs		X	X		

16	Soil	SS205	NUSC-SO-SS205			0-2 feet bgs		**X**	**X**		
17	Soil	SS206	NUSC-SO-SS206			0-2 feet bgs		**X**	**X**		
18	Soil	SS207	NUSC-SO-SS207			0-2 feet bgs		**X**	**X**		
19	Soil	SS208	NUSC-SO-SS208			0-2 feet bgs		**X**	**X**		
20	Soil	SS209	NUSC-SO-SS209			0-2 feet bgs		**X**	**X**		
21	Soil	SS210	NUSC-SO-SS210			0-2 feet bgs		**X**	**X**		
22	Soil	SS211	NUSC-SO-SS211			0-2 feet bgs		**X**	**X**		
23	Soil	SS212	NUSC-SO-SS212			0-2 feet bgs		**X**	**X**		
Field QC Samples(1)											
	Field Duplicate	TBD(3)	TBD(3)			TBD(3)	**X**	**XX**	**XX**		
	Matrix Spike	NA	NA			NA					
	Matrix Spike Duplicate	NA	NA			NA					
	Equipment Blank	TBD(3)	TBD(3)			TBD(3)	**X**	**X**	**X**		
	Trip Blank	TBD(3)	TBD(3)			TBD(3)	**X**				
						Total Number of Samples to the Laboratory	**6**	**15**	**23**	**2**	**2**

Frequency of QA/QC sample collection:

Field Duplicate- One per 10 field samples

MS/MSD- One pair per 20 field samples (including field QC samples)

Equipment Blank- One per week of sampling

Trip Blank- One per cooler to the laboratory containing volatiles

Notes:

[1] See Section 9 for the selected analytes.
[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.
[3] To Be Determined (TBD) in the field by the FOL.
[4] SB201 will be located approximately half-way between MW-03B and MW-117B.
[5] SB202 will be located approximately half-way between MW-03B and MW-114B.
[6] SB203 will be located east of MW-03B.
[7] SB204 will be located by previous soil boring B110B where lead was detected at 4,540 mg/kg at a depth of 10-12 ft bgs.
[8] Lab will coordinate with the Tetra Tech PM to select the appropriate sample interval.

9.0 Reference Limits and Evaluation Tables

(UFP-QAPP Manual Section 2.8.1 – Worksheet # 15)

Matrix: Soil
Analytical Groups: VOCs, SVOCs, Metals

Analyte	CAS No.	PALs[a] (mg/kg)	PQL Goal (mg/kg)	Laboratory-Specific Limits[b] (mg/kg)		
				LOQs[c]	LODs	DLs
VOCs						
1,1-Dichloroethane	75-34-3	--	300	0.005	0.001	0.00058
1,1-Dichloroethene	75-35-4	--	0.07	0.005	0.001	0.00085
Cis-1,2-Dichloroethene	156-59-2	--	0.6	0.005	0.001	0.0007
Trans-1,2-Dichloroethene	156-60-5	--	1.1	0.005	0.001	0.0006
1,1,1-Trichloroethane	71-55-6	--	4	0.005	0.001	0.00049
Carbon Tetrachloride	56-23-5	--	0.15	0.005	0.001	0.00045
Ethylbenzene	100-41-4	--	9	0.005	0.001	0.00064
Tetrachloroethene	127-18-4	--	0.03	0.005	0.001	0.00068
Trichloroethene	79-01-6	--	0.07	0.005	0.001	0.00066
Vinyl Chloride	75-01-4	--	0.007	0.005	0.001	0.00047
SVOCs						
1,1-Biphenyl	92-52-4	0.8	0.3	0.033	0.0033	0.003
Acenaphthene	83-32-9	43	14	0.0067	0.0013	0.00064
Anthracene	120-12-7	35	12	0.0067	0.0013	0.00065
Benzo(a)anthracene	56-55-3	0.15	0.05	0.0067	0.0013	0.00084
Benzo(a)pyrene	50-32-8	0.157	0.05	0.0067	0.0013	0.00067
Benzo(b)fluoranthene	205-99-2	0.15	0.05	0.0067	0.0013	0.00105
Benzo(g,h,i)perylene	191-24-2	0.8	0.3	0.0067	0.0013	0.00066
Benzo(k)fluoranthene	207-08-09	0.9	0.3	0.0067	0.0033	0.00135
Chrysene	218-01-9	0.4	0.1	0.0067	0.0013	0.00079
Dibenzo(a,h)anthracene	53-70-3	0.015	0.005	0.0067	0.0013	0.00074
Fluoranthene	206-44-0	20	7	0.0067	0.0013	0.00071
Fluorene	86-73-7	28	9	0.0067	0.0017	0.00088
Indeno(1,2,3-cd)pyrene	193-39-5	0.15	0.05	0.0067	0.0017	0.00069
Naphthalene	91-20-3	0.8	0.3	0.0067	0.0013	0.00058
Phenanthrene	85-01-8	40	13	0.0067	0.0025	0.00106
Pyrene	129-00-0	13	4	0.0067	0.0013	0.00068
Metals						
Arsenic	7440-38-2	18	6	1	0.6	0.223
Antimony	7440-36-0	--	3	1	0.4	0.164
Barium	7440-39-3	--	1,833	20	0.5	0.233
Beryllium	7440-41-7	1.5	0.5	0.4	0.15	0.073

Analyte	CAS No.	PALs[(a)] (mg/kg)	PQL Goal (mg/kg)	Laboratory-Specific Limits[(b)] (mg/kg)		
				LOQs[(c)]	LODs	DLs
Cadmium	7440-43-9	--	13	0.5	0.08	0.025
Chromium	7440-47-3	--	130	0.5	0.3	0.085
Lead	7439-92-1	150	50	0.3	0.3	0.157
Manganese	7439-96-5	390	130	1.5	0.2	0.048
Mercury	7439-97-6	--	8	0.033	0.0167	0.0109
Nickel	7440-02-0	--	333	4	0.5	0.384
Selenium	7782-49-2	--	130	0.5	0.7	0.33
Thallium	7440-28-0	--	2	1	1	0.62
Zinc	7440-66-6	6000	2000	2	1	0.591

Notes:

(a) PALs are based on the Remedial Goals for a residential exposure scenario, per the Site 8 ROD. For analytes without a PAL, the PQL Goals are based on a value that is approximately one-third of the residential direct exposure criteria promulgated under RIDEM's Remediation Regulations. Soil data will also be compared to Remedial Goals for an industrial exposure scenario per the Site 8 ROD, to help determine the extent of the planned soil cover and land use controls.

(b) Laboratory-specific detection limits (DLs, LODs, and LOQs) are limits that an individual laboratory can achieve when utilizing a specific analytical method.

(c) Shaded cells indicate where an LOQ exceeds the respective PQL Goal. However, this is acceptable because the highlighted LOQ do not exceed the PAL.

Reference Limits and Evaluation Tables (continued)

Matrix: Soil
Analytical Groups: SPLP-Metals

Analyte	CAS No.	PALs[(a)] (mg/L)	PQL Goal (mg/L)	Laboratory-Specific Limits[(b)] (mg/L)		
				LOQs	LODs	DLs
SPLP-Metals and Cyanide						
Antimony	7440-36-0	0.05	0.02	0.01	0.003	0.00134
Barium	7440-39-3	23	7	0.2	0.005	0.00233
Beryllium	7440-41-7	0.03	0.01	0.004	0.001	0.0007
Cadmium	7440-43-9	0.03	0.01	0.005	0.0008	0.00025
Chromium	7440-47-3	1.1	0.4	0.005	0.0025	0.00057
Cyanide	57-12-5	2.4	0.8	0.01	0.004	0.0015
Lead	7439-92-1	0.04	0.01	0.01	0.003	0.00157
Mercury	7439-97-6	0.02	0.007	0.0002	0.000075	0.0000384
Nickel	7440-02-0	1	0.3	0.04	0.003	0.00156
Selenium	7782-49-2	0.6	0.2	0.01	0.006	0.0033
Thallium	7440-28-0	0.005	0.002	0.02	0.012	0.0062

Notes:
(a) PALs are based on the RIDEM Remediation Regulations Class GA Soil Leachability Criteria, which are potential Remedial Goals per the Site 8 ROD.
(b) Laboratory-specific DLs, LODs, and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method.

10.0 Analytical SOP References Table

(UFP-QAPP Manual Section 3.2.1 – Worksheet #23)

Laboratory Name and Address: Test America (TA), 301 Alpha Drive, Pittsburgh PA, 15238
Point of Contact Name: Carrie Gamber
Phone Number: (412) 963-2428

Lab SOP Number	Title, Revision Date, and Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to Quality Systems Manual (QSM)	Modified for Project Work? (Y/N)
PT-MS-002	Volatile Organics by Gas Chromatograph (GC)/MS Based on Methods 8260B, 624, revision 14, 11/12/12	Definitive	Soil (VOCs)	GC/MS	SW846 and TA SOP	N
PT-MS-008	Analysis of Semivolatiles (BNAs) by SW846 Method 8270D, revision 2, 5/15/12	Definitive	Soil (SVOCs)	GC/MS	SW846 and TA SOP	N
PT-MT-001	Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method for Trace Element Analyses, SW-846 Method 6010B, 6010C and EPA Method 200.7, revision 13, 5/8/12	Definitive	Soil (Metals)	ICP Trace	SW846 and TA SOP	N
PT-MT-002	Analysis of Metals by Inductively Coupled Plasma/Mass Spectrometry (ICP/MS) for Methods 200.8, 6020, 6020A, revision 9, 5/8/12	Definitive	Soil (Metals)	ICP/MS	SW846 and TA SOP	N

Lab SOP Number	Title, Revision Date, and Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Variance to Quality Systems Manual (QSM)	Modified for Project Work? (Y/N)
PT-MT-007	Preparation and Analysis of Mercury in Solid Samples by Cold Vapor Atomic Absorption Spectroscopy, SW846 7471A & 7471B, revision 10, 12/10/12	Definitive	Soil (Mercury)	CVAA	SW846 and TA SOP	N
PT-OP-004	Toxicity Characteristic Leaching Procedure and Synthetic Precipitation Leaching Procedure, revision 5, 5/8/12	Definitive	Soil (SPLP)	Tumbler	SW846 and TA SOP	N
SOP PT-WC-018	Cyanide Distillation and Analysis by Semiautomated Colorimetry, revision 15, 09/26/2012	Definitive	Soil (SPLP)	Kone Lab Chemistry Analyzer	SW846 and TA SOP	N

Notes:
Include the specific Lab Accreditation or Certification requirements for the work of this project, verification that these have been met, and the expiration dates, as appropriate.

11.0 Laboratory QC Samples Table

(UFP-QAPP Manual Section 3.4 – Worksheet #28)

NOTE: MS/MSD, MS/laboratory duplicate, laboratory duplicate, post-digestion spike, and ICP serial dilution analyses are not required for rinsate blanks.

Matrix	Soil
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B PT-MS-002

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch of 20 samples or less	No target compounds should be ≥1/2 the LOQ except common lab contaminants, which should be < the LOQ.	Reclean, retest, re-extract, reanalyze, and/or qualify the data.	Analyst, Laboratory Supervisor, and Data Validator	Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
Surrogate	4 per sample	Percent recoveries: 1,2-Dichloroethane-d4 per SOP 4-Bromofluorobenzene per SOP Dibromofluoromethane per SOP Toluene-d8 per SOP	Reprepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Laboratory Control Sample (LCS)	1 per batch of 20 samples or less	Compound specific and control limits as per SOP PT-MS-002	(1) Evaluate and reanalyze if possible. (2) Reanalyze the LCS and all samples in the associated preparatory batch for failed analytes. If the LCS is still outside QC criteria, check instrument, do maintenance,	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil
Analytical Group	VOCs
Analytical Method/ SOP Reference	SW-846 8260B PT-MS-002

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
			recalibrate and/or reprepare and reanalyze if sufficient sample material is available. (3) If the LCS recoveries are high but the sample results are <RL, narrate. Otherwise reprepare and reanalyze the batch.			
Internal Standard	3 per sample - Fluorobenzene Chlorobenzene-d5 1,4-dichlorobezene-d4	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.	Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	1 per sample delivery group (SDG) or every 20 samples.	Compound specific and control limits as per SOP PT-MS-002	Corrective actions 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, reprepare the samples and QC.	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	SVOCs
Analytical Method/ SOP Reference	SW-846 8270D/SOP PT-MS-008

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per batch of 20 samples or less.	No target compounds should be ≥1/2 the LOQ except common lab contaminants, which should be < the LOQ.	Reclean, retest, re-extract, reanalyze, and/or qualify the data.	Analyst, Laboratory Supervisor and Data Validator	Bias/contamination	Same as Method/SOP QC Acceptance Limits.
Surrogates	6 per sample	2,4,6-Tribromophenol per SOP 2-Fluorobiphenyl per SOP 2-Fluorophenol per SOP Nitrobenzene-d5 per SOP Phenol-d5/d6 per SOP Terphenyl-d14 per SOP	Reprepare and reanalyze for confirmation of matrix interference when appropriate.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
LCS	1 per batch of 20 samples or less.	Compound specific and control limits as per SOP PT-MS-008	(1) Evaluate and reanalyze if possible. (2) Reanalyze the LCS and all samples in the associated preparatory batch for failed analytes. If the LCS is still outside QC criteria, check instrument,	Analyst, Laboratory Supervisor, and Data Validator	Precision / Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil
Analytical Group	SVOCs
Analytical Method/ SOP Reference	SW-846 8270D/SOP PT-MS-008

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
			do maintenance, recalibrate and/or reprepare and reanalyze if sufficient sample material is available. (3) If the LCS recoveries are high but the sample results are <RL, narrate. Otherwise reprepare and reanalyze the batch.			
Internal Standards	6 per sample – 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of last calibration verification (12 hours) for each internal standard.	Inspect mass spectrometer or GC for malfunctions; mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
MS/MSD	1 per SDG or every 20 samples.	Compound specific and control limits as per SOP-PT-MS-008	(1) Corrective action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. (2) If both the LCS and MS/MSD are unacceptable, reprepare the samples and QC.	Analyst, Laboratory Supervisor, and Data Validator	Precision/Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.

Laboratory QC Samples Table (continued)

Matrix	Soil/Aqueous
Analytical Group	Metals
Analytical Method / SOP Reference	SW-846 6020 SOP-PT-MT-002

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per digestion batch of 20 or fewer samples.	Contaminants in the method blank must be less than ½ the LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Investigate the source of the contamination. Redigest and reanalyze all associated samples if the sample concentration ≥ the LOQ and <10x the blank concentration.	Analyst, Laboratory Supervisor, and Data Validator	Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
LCS	1 per digestion batch of 20 or fewer samples.	Recovery must be within ± 20% of the true value except Ag 75-120 for soil unless vendor-supplied or statistical limits have been established.	(1) Investigate source of problem. (2) Redigest and reanalyze all associated samples.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
Duplicate Sample	1 per digestion batch of 20 or fewer samples.	The relative percent difference should be within ≤20% for duplicate spikes.	Flag results.	Analyst, Laboratory Supervisor, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.
MS	1 per digestion batch of 20 or fewer samples.	Recovery should be ± 20% of the true value except Ag 75-120 for soil, if sample <4x spike added.	Flag results.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Metals
Analytical Method / SOP Reference	SW-846 6010C/ 7470A/ 7471B SOP-PT-MT-001/PT-MT-005/PT-MT-007

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per digestion batch of 20 or fewer samples.	Contaminants in the method blank must be less than ½ the LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Investigate the source of the contamination. Redigest and reanalyze all associated samples if the sample concentration ≥ the LOQ and <10x the blank concentration.	Analyst, Laboratory Supervisor, and Data Validator	Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
LCS	1 per digestion batch of 20 or fewer samples.	Recovery must be within ± 20% of the true value unless vendor-supplied or statistical limits have been established.	(1) Investigate source of problem. (2) Redigest and reanalyze all associated samples.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
Duplicate Sample	1 per digestion batch of 20 or fewer samples.	The relative percent difference should be within ≤20% for duplicate spikes.	Flag results.	Analyst, Laboratory Supervisor, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.
MS	1 per digestion batch of 20 or fewer samples.	Recovery must be within ± 20% of the true value unless vendor-supplied or statistical limits have been established, if sample < 4x spike added.	Flag results.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
ICP Serial Dilution	1 per digestion batch.	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ± 10% of the original result.	Flag result or dilute and reanalyze sample to eliminate interference.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Metals
Analytical Method/ SOP Reference	SW-846 6010C/ 7470A/ 7471B SOP-PT-MT-001/ PT-MT-005/ PT-MT-007

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per digestion batch of 20 or fewer samples.	Contaminants in the method blank must be less than ½ LOQ. For common laboratory contaminants, no analytes detected > LOQ.	Investigate the source of the contamination. Redigest and reanalyze all associated samples if the sample concentration ≥ the LOQ and <10x the blank concentration.	Analyst, Laboratory Supervisor, and Data Validator	Bias/Contamination	Same as Method/SOP QC Acceptance Limits.
LCS	1 per digestion batch of 20 or fewer samples.	Recovery must be within ± 20% of the true value, unless vendor-supplied or statistical limits have been established.	1) Investigate source of problem. 2) Redigest and reanalyze all associated samples.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
Duplicate Sample	1 per digestion batch of 20 or fewer samples.	The relative percent difference should be within ≤20% for duplicate spikes.	Flag results.	Analyst, Laboratory Supervisor, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.
MS	1 per digestion batch of 20 or fewer samples.	Recovery must be within ± 20% of the true value if sample < 4x spike added.	Flag results.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
ICP Serial Dilution	1 per digestion batch.	If original sample result is at least 50x the instrument detection limit, 5-fold dilution must agree within ±10% of the original result.	Flag result or dilute and reanalyze sample to eliminate interference.	Analyst, Laboratory Supervisor, and Data Validator	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.

Laboratory QC Samples Table (continued)

Matrix	Soil
Analytical Group	Percent moisture
Analytical Method/ SOP Reference	SM 2540G/ PT-WC-020

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Sample Duplicate	1 per SDG or every 20 samples.	RPD ≤20%	If the duplicate results are outside of control limits, check instrument conditions and reanalyze the sample and/or flag data.	Analyst, Laboratory Supervisor, and Data Validator	Precision	Same as Method/SOP QC Acceptance Limits.

12.0 Data Verification and Validation (Steps I and IIa/IIb) Process Table

(UFP-QAPP Manual Section 5.2.1, UFP-QAPP Manual Section 5.2.2, Figure 37 UFP-QAPP Manual, Table 9 UFP-QAPP Manual – Worksheets #34, 35, 36)

Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Chain-of-custody Forms	The Tetra Tech FOL or designee will review and sign each chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and the sample information is accurate. The chain-of-custody forms will be signed by the Sampler and a copy will be retained for the project file, the Tetra Tech PM, and the Tetra Tech Data Validator.	Internal	FOL and Field Crew, Tetra Tech
	The Laboratory Sample Custodian will review the sample shipment for completeness and integrity and will sign accepting the shipment. The Tetra Tech Data Validator will check that the chain-of-custody form was signed and dated by the Tetra Tech FOL or designee relinquishing the samples and also by the Laboratory Sample Custodian receiving the samples for analyses.	External/ Internal	1 - Laboratory Sample Custodian, Earth Toxics/TestAmerica 2 – Project Chemist or Data Validator, Tetra Tech
Field SOPs/Field Logs/SAP/ Analytical Data Packages	Ensure that all sampling SOPs were followed. Verify that deviations have been documented and Measurement Performance Criteria (MPCs) have been achieved. Particular attention should be given to verify that samples were correctly identified, that sampling location coordinates are accurate, and that documentation establishes an unbroken trail of documented chain-of-custody from sample collection to report generation. Verify that the correct sampling and analytical methods/SOPs were applied. Verify that the sampling plan was implemented and carried out as written and that any deviations are documented.	Internal	PM, FOL, or designee, Tetra Tech
SAP/Analytical SOPs	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied.	Internal	Laboratory QAM, Earth Toxics/TestAmerica
SAP/Analytical SOPs/ Raw Data/ Applicable Control Limits Tables	Establish that all method QC samples were analyzed and in control as listed in the analytical SOPs. If method QA is not in control, the Laboratory QAM will contact the Tetra Tech PM for guidance prior to report preparation.	Internal	Laboratory QAM, Earth Toxics/TestAmerica
SAP Sample Tables/ Chain-of-Custody Forms	Verify that all proposed samples listed in the SAP tables have been collected.	Internal	FOL and Field Crew, Tetra Tech
Sample Log Sheets	Verify that information recorded in the log sheets is accurate and complete and are maintained at the project office.	Internal	PM, FOL, or designee, Tetra Tech
Sample Coordinates	Verify that actual sample locations are correct and in accordance with the SAP (compare map of planned locations to map of actual locations).	Internal	PM, FOL, or designee, Tetra Tech
SAP/ Chain-of-custody Forms	Verify that field QC samples listed in Section 6 were collected as required.	Internal	FOL or designee, Tetra Tech

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Analytical Data Packages	All analytical data packages will be verified internally for completeness by the laboratory performing the work. The Laboratory QAM will sign the case narrative for each data package.	Internal	Laboratory QAM, CHEMTECH
	Verify that the data package contains all the elements required by the method and the laboratory scope of work. This occurs as part of the data validation process. Missing information will be requested from the laboratory and validation will be suspended until missing data are received.	External	Project Chemist or Data Validator, Tetra Tech
Electronic Data Deliverables	The electronic data will be compared to the chain-of-custody form and hard copy data package to verify accuracy and completeness. Data package analytical results will be verified and compared to the electronic analytical results for accuracy. Sample results will be evaluated for laboratory contamination and will be qualified for false positives using the laboratory method/ preparation blank summaries. Positive results reported between the MDL and the reporting limit will be qualified as estimated. Extraneous laboratory qualifiers will be removed from the validation qualifier.	External	Project Chemist or Data Validator, Tetra Tech

Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Chain-of-Custody Forms	Custody – Ensure that the custody and integrity of the samples were maintained from collection to analysis and the custody records are complete and any deviations are recorded. Review that the samples were shipped and stored at the required temperature and sample pH for chemically-preserved samples meet the requirements listed in Section 10. Ensure that the analyses were performed within the holding times listed in Section 10.	Project Chemist or Data Validators, Tetra Tech
IIa, IIb	SAP/ Laboratory Data Packages/ EDDs	Check that the laboratory recorded the temperature at sample receipt and the pH of the chemically preserved samples to ensure sample integrity from sample collection to analysis.	Project Chemist or Data Validators, Tetra Tech
		Review the chain-of-custody forms generated in the field to ensure that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. The Tetra Tech Data Validator will verify that elements of the data package required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Validation will be performed as per Analytical Data Validation (Steps IIa and IIb) Summary Table. Check that all data have been transferred correctly and completely to the final Structured Query Language database.	

Step IIa/IIb	Validation Input	Description	**Responsible for Validation** (name, organization)
		Ensure that all field QC and assigned laboratory QC samples specified in Section 9 and Section 11 were collected and analyzed and that the associated results were within prescribed MPCs. Verify that laboratory QC samples and standards prescribed in Section 11 were analyzed and within the prescribed acceptance criteria and MPCs, respectively. If any significant QC deviations occur, the laboratory shall have contacted the Tetra Tech Project Chemist or PM.	
IIb	SAP/ Laboratory Data Packages/ EDDs	Compare values for the non-detected results (sample-specific LODs) with the PALs in Section 9, and identify the analytes for which the non-detected values are above the PALs. Document any LODs that were raised for non-detected target analytes due to sample dilutions that were performed because of the high concentration of one or more other contaminants.	Project Chemist or Data Validators, Tetra Tech
11a, IIb	SAP/ Laboratory Data Packages/ EDDs	Deviations - Summarize deviations from methods, procedures, or contracts in the Data Validation Report. Determine the impact of any deviation from sampling or analytical methods and SOPs requirements and matrix interferences effect on the analytical results. Qualify data results based on method or QC deviation and explain all the data qualifications. Print a copy of the project database qualified data depicting data qualifiers and data qualifiers codes that summarize the reason for data qualifications. Determine if the data met the MPCs and discuss the potential impact of any deviations on the technical usability of the data.	Project Chemist or Data Validators, Tetra Tech

Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	**Data Validator** (title and organizational affiliation)
IIa and IIb	Soil (solid)	VOCs, SVOCs, and Metals (Laboratory)	Tier II[1] data validation. Project-specific criteria for VOCs by SW-846 8260B, SVOCs by 8270D, and Metals by 6010C/6020A/7471A are listed in Sections 6, 9, 8.3, and 11. Region I USEPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, Part II, December 1996 (USEPA, 1996) will be applied using these criteria.	Project Chemist or Data Validator, Tetra Tech
IIa and IIb	Soil (aqueous from SPLP)	SPLP-metals (Laboratory)	Tier II[1] data validation. Project-specific criteria for SPLP-metals by EPA extraction Method 1312 with analyses for metals by 6010C/6020A/7470A/7471A, and Cyanide by 9012A are listed in Sections 6, 9, 8.3, and 11. Region I USEPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, Part II, December 1996 (USEPA, 1996) will be applied using these criteria.	Project Chemist or Data Validator, Tetra Tech

1. As specified in the Region I USEPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, Part I, Attachment B, "Region 1 Tiered Organic and Inorganic Data Validation Guidelines", July 1, 1993, Draft (USEPA, 1993).

TABLES

Table 1

Summary of Site 8 Contaminants of Concern in Soil

Medium	Contaminants of Concern			
	VOCs	SVOCs	Inorganics	Other
Soil	None	1,1-Biphenyl Acenaphthene Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Chrysene Dibenzo(a,h)anthracene Fluoranthene Fluorene Indeno(1,2,3-cd)pyrene Naphthalene Phenanthrene Pyrene	Arsenic Beryllium Cadmium Chromium Lead Manganese Zinc **Potential COCs**[(a)] Antimony Barium Cyanide Mercury Nickel Selenium Thallium	None[(b)]

(a) To be determined based on soil leachability testing. If a potential COC concentration exceeds the leachability criterion, then it will become a COC.

(b) Total Petroleum Hydrocarbons (TPH) which are comingled with the above COCs will also be addressed during the Site 8 Remedial Action, in accordance with state regulations.

Table 2
Summary of RI Sample Results for Site 8 Contaminants of Concern in Soil
Page 1 of 3

COC	Frequency of Detection	Concentration Range
Surface Soil – Exposed (non-paved) Area		
SVOCs (µg/kg)		
1,1-Biphenyl	1/55	660
Acenaphthene	57/74	2.4 - 9,500
Anthracene	62/74	3.6 - 13,000
Benzo(a)anthracene	67/74	15 - 20,000
Benzo(a)pyrene	64/74	18 - 17,000
Benzo(b)fluoranthene	64/74	24.5 - 15,000
Benzo(g,h,i)perylene	62/74	12 - 7,400
Benzo(k)fluoranthene	65/74	13 - 12,000
Chrysene	67/74	13 - 17,000
Dibenzo(a,h)anthracene	48/74	5.4 - 3,500
Fluoranthene	67/74	22 - 45,000
Fluorene	51/74	2.3 - 5,900
Indeno(1,2,3-cd)pyrene	61/74	14 - 9,200
Naphthalene	45/74	2.3 - 11,000
Phenanthrene	67/74	12 - 48,000
Pyrene	67/74	16 - 50,000
Metals (mg/kg)		
Arsenic	72/72	0.29 - 90
Beryllium	72/72	0.21 - 0.74
Lead	72/72	4.2 - 2,870
Manganese	72/72	79.8 - 2,020
Zinc	72/72	13.8 - 663
Subsurface Soil – Exposed (non-paved) Area		
SVOCs (µg/kg)		
1,1-Biphenyl	4/40	170 - 8,300
Acenaphthene	39/65	2.1 - 480,000
Anthracene	44/65	2.9 - 970,000
Benzo(a)anthracene	45/65	3.2 - 1,900,000
Benzo(a)pyrene	43/65	6.2 - 1,500,000
Benzo(b)fluoranthene	44/65	7.2 - 1,300,000
Benzo(g,h,i)perylene	42/65	8.5 - 830,000
Benzo(k)fluoranthene	44/65	7.3 - 1,200,000
Chrysene	45/65	3.3 - 1,700,000
Dibenzo(a,h)anthracene	35/65	4.5 - 330,000
Fluoranthene	46/65	4.8 - 4,600,000
Fluorene	37/65	2.8 - 480,000
Indeno(1,2,3-cd)pyrene	40/65	10 - 850,000
Naphthalene	33/65	8.8 - 220,000
Phenanthrene	43/65	15 - 3,500,000
Pyrene	44/65	18 - 3,600,000
Metals (mg/kg)		
Arsenic	65/65	2.7 - 40
Beryllium	65/65	0.21 - 2.5

Table 2
Summary of RI Sample Results for Site 8 Contaminants of Concern in Soil
Page 2 of 3

COC	Frequency of Detection	Concentration Range
Lead	65/65	6.2 - 4,650
Manganese	65/65	180 - 3,300
Zinc	65/65	30 - 9,840
Surface Soil – Paved Area		
SVOCs (µg/kg)		
1,1-Biphenyl	0/17	Not detected
Acenaphthene	15/27	1.8 - 890
Anthracene	18/27	3.1 - 2,000
Benzo(a)anthracene	24/27	2.6 - 5,600
Benzo(a)pyrene	25/27	7.3 - 4,800
Benzo(b)fluoranthene	23/27	14 - 5,700
Benzo(g,h,i)perylene	21/27	3 - 2,000
Benzo(k)fluoranthene	23/27	6.8 - 3,900
Chrysene	25/27	2.8 - 5,700
Dibenzo(a,h)anthracene	14/27	10 - 760
Fluoranthene	26/27	4.4 - 10,000
Fluorene	13/27	3.8 - 870
Indeno(1,2,3-cd)pyrene	19/27	8.25 - 2,200
Naphthalene	11/27	2.9 - 340
Phenanthrene	25/27	4.6 - 8,500
Pyrene	26/27	3.3 - 13,000
Metals (mg/kg)		
Arsenic	25/25	1.7 - 41
Beryllium	24/25	0.21 - 0.57
Lead	25/25	7.3 - 54.8
Manganese	25/25	150 - 827
Zinc	25/25	27.5 - 94.7
Subsurface Soil – Paved Area		
SVOCs (µg/kg)		
1,1-Biphenyl	1/21	310
Acenaphthene	12/31	2.6 - 65.5
Anthracene	10/31	7.8 - 730
Benzo(a)anthracene	17/31	5.4 - 7,700
Benzo(a)pyrene	15/31	5.6 - 5,700
Benzo(b)fluoranthene	15/31	12.2 - 6,500
Benzo(g,h,i)perylene	16/31	3.4 - 1,350
Benzo(k)fluoranthene	15/31	5.3 - 5,350
Chrysene	18/31	3.3 - 7,550
Dibenzo(a,h)anthracene	7/31	6.9 - 700
Fluoranthene	19/31	5 - 11,500
Fluorene	10/31	2.9 - 170
Indeno(1,2,3-cd)pyrene	14/31	9 - 2,750
Naphthalene	8/30	2.4 - 125
Phenanthrene	18/31	4.8 - 3,100
Pyrene	17/31	11.2 - 11,500

Table 2
Summary of RI Sample Results for Site 8 Contaminants of Concern in Soil

COC	Frequency of Detection	Concentration Range
Metals (mg/kg)		
Arsenic	29/29	2.25 - 122
Beryllium	28/29	0.2 - 0.76
Lead	29/29	6.9 - 159
Manganese	29/29	171 - 2,820
Zinc	29/29	23 - 81.2

mg/kg = milligrams per kilogram (parts per million)
µg/kg = micrograms per kilogram (parts per billion)

FIGURES

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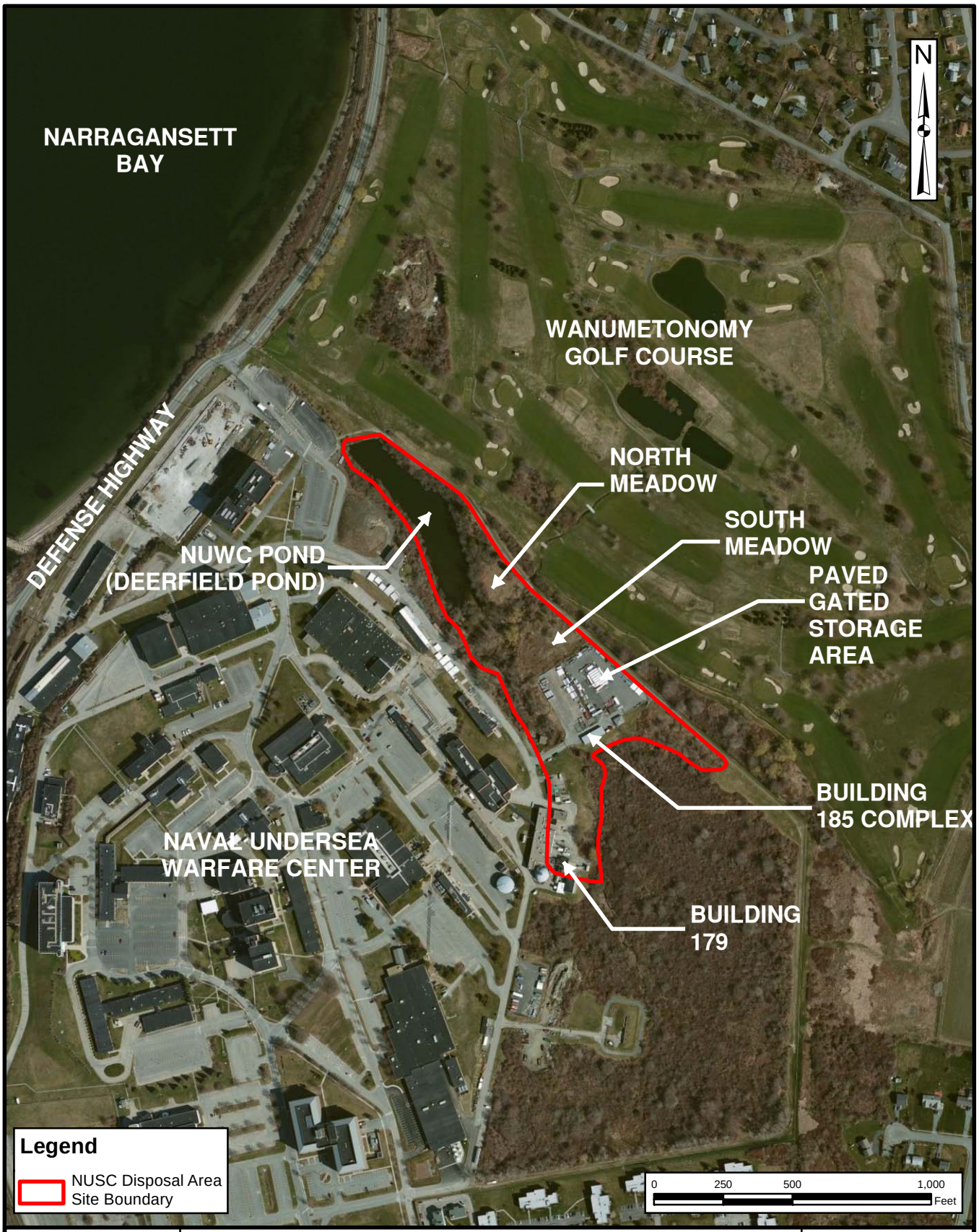


TETRA TECH

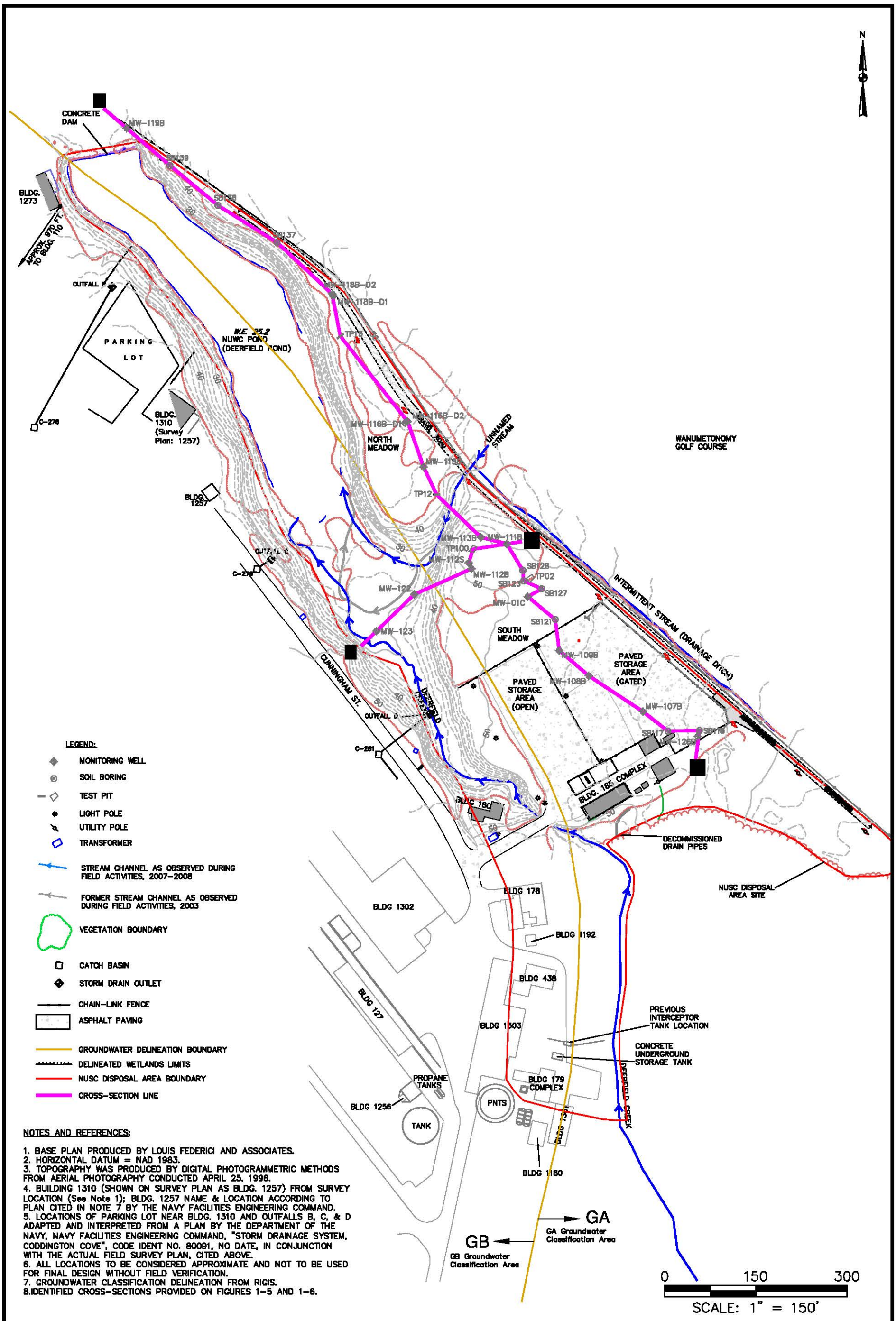
NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

SITE LOCATION MAP

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

SCALE	PERSCALE BAR
FILE	I:\..\NUSC_LOCUS.MXD
REV	0
DATE	02/19/13
FIGURE NUMBER	1

I:\04310\PP.WP\NUSC_SITE_MAP.DWG 2/19/13 DWM



LEGEND:

- MONITORING WELL
- SOIL BORING
- TEST PIT
- LIGHT POLE
- UTILITY POLE
- TRANSFORMER
- STREAM CHANNEL AS OBSERVED DURING FIELD ACTIVITIES, 2007-2008
- FORMER STREAM CHANNEL AS OBSERVED DURING FIELD ACTIVITIES, 2003
- VEGETATION BOUNDARY
- CATCH BASIN
- STORM DRAIN OUTLET
- CHAIN-LINK FENCE
- ASPHALT PAVING
- GROUNDWATER DELINEATION BOUNDARY
- DELINEATED WETLANDS LIMITS
- NUSC DISPOSAL AREA BOUNDARY
- CROSS-SECTION LINE

NOTES AND REFERENCES:

1. BASE PLAN PRODUCED BY LOUIS FEDERICI AND ASSOCIATES.
2. HORIZONTAL DATUM = NAD 1983.
3. TOPOGRAPHY WAS PRODUCED BY DIGITAL PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY CONDUCTED APRIL 25, 1996.
4. BUILDING 1310 (SHOWN ON SURVEY PLAN AS BLDG. 1257) FROM SURVEY LOCATION (See Note 1); BLDG. 1257 NAME & LOCATION ACCORDING TO PLAN CITED IN NOTE 7 BY THE NAVY FACILITIES ENGINEERING COMMAND.
5. LOCATIONS OF PARKING LOT NEAR BLDG. 1310 AND OUTFALLS B, C, & D ADAPTED AND INTERPRETED FROM A PLAN BY THE DEPARTMENT OF THE NAVY, NAVY FACILITIES ENGINEERING COMMAND, "STORM DRAINAGE SYSTEM, CODDINGTON COVE", CODE IDENT NO. 80091, NO DATE, IN CONJUNCTION WITH THE ACTUAL FIELD SURVEY PLAN, CITED ABOVE.
6. ALL LOCATIONS TO BE CONSIDERED APPROXIMATE AND NOT TO BE USED FOR FINAL DESIGN WITHOUT FIELD VERIFICATION.
7. GROUNDWATER CLASSIFICATION DELINEATION FROM RIGIS.
8. IDENTIFIED CROSS-SECTIONS PROVIDED ON FIGURES 1-5 AND 1-6.

TETRA TECH

NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

SITE DETAIL MAP

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

SCALE	
PER SCALE BAR	
FILE	
I:\..\NUSC_SITE_MAP.DWG	
REV	DATE
0	2/19/13
FIGURE NUMBER	
2	

TETRA TECH

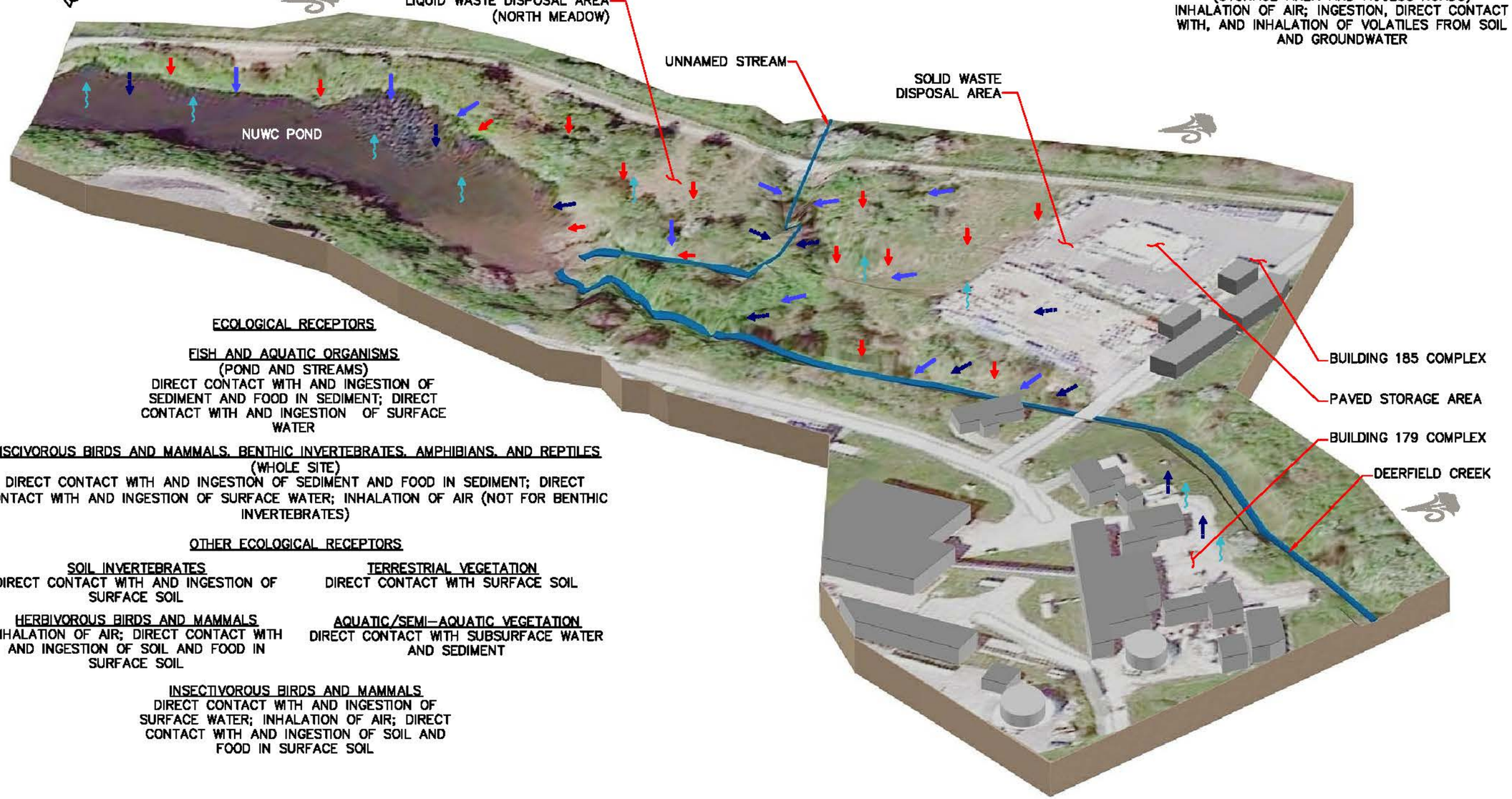
FUTURE RECREATIONAL USER
(WHOLE SITE)
INHALATION OF AIR; DERMAL CONTACT WITH SURFACE WATER AND SEDIMENT; INGESTION OF FISH

FUTURE RESIDENTS
(WHOLE SITE)
INHALATION OF AIR; VAPOR INTRUSION; INGESTION OF, DERMAL CONTACT WITH, AND INHALATION OF SOIL AND GROUNDWATER; INGESTION OF FISH

ADOLESCENT TRESPASSER
(WHOLE SITE)
INHALATION OF AIR; DERMAL CONTACT WITH SURFACE WATER; DERMAL CONTACT WITH AND INGESTION OF SEDIMENT AND SURFACE SOIL

CURRENT/FUTURE INDUSTRIAL WORKER
(STORAGE AREA AND BUILDING COMPLEXES)
INHALATION OF AIR; DIRECT CONTACT WITH AND INCIDENTAL INGESTION OF SOIL; VAPOR INTRUSION

CURRENT/FUTURE CONSTRUCTION WORKER
(STORAGE AREA AND ACCESS ROADS)
INHALATION OF AIR; INGESTION, DIRECT CONTACT WITH, AND INHALATION OF VOLATILES FROM SOIL AND GROUNDWATER



ECOLOGICAL RECEPTORS

FISH AND AQUATIC ORGANISMS
(POND AND STREAMS)
DIRECT CONTACT WITH AND INGESTION OF SEDIMENT AND FOOD IN SEDIMENT; DIRECT CONTACT WITH AND INGESTION OF SURFACE WATER

PISCIVOROUS BIRDS AND MAMMALS, BENTHIC INVERTEBRATES, AMPHIBIANS, AND REPTILES
(WHOLE SITE)
DIRECT CONTACT WITH AND INGESTION OF SEDIMENT AND FOOD IN SEDIMENT; DIRECT CONTACT WITH AND INGESTION OF SURFACE WATER; INHALATION OF AIR (NOT FOR BENTHIC INVERTEBRATES)

OTHER ECOLOGICAL RECEPTORS

SOIL INVERTEBRATES
DIRECT CONTACT WITH AND INGESTION OF SURFACE SOIL

TERRESTRIAL VEGETATION
DIRECT CONTACT WITH SURFACE SOIL

HERBIVOROUS BIRDS AND MAMMALS
INHALATION OF AIR; DIRECT CONTACT WITH AND INGESTION OF SOIL AND FOOD IN SURFACE SOIL

AQUATIC/SEMI-AQUATIC VEGETATION
DIRECT CONTACT WITH SUBSURFACE WATER AND SEDIMENT

INSECTIVOROUS BIRDS AND MAMMALS
DIRECT CONTACT WITH AND INGESTION OF SURFACE WATER; INHALATION OF AIR; DIRECT CONTACT WITH AND INGESTION OF SOIL AND FOOD IN SURFACE SOIL

LEGEND:

- WIND EROSION/DUST MIGRATION
- EMISSION OF VOLATILE COMPOUNDS
- RUNOFF/EROSION MAY HAVE CARRIED CONTAMINATION TO SEDIMENT AND SURFACE WATER
- GROUNDWATER FLOW MAY HAVE CARRIED CONTAMINATION TO SEDIMENT AND SURFACE WATER
- PAST LEACHING OF LEAKS OR SPILLS INFILTRATION MAY HAVE CARRIED CONTAMINATION INTO OVERBURDEN

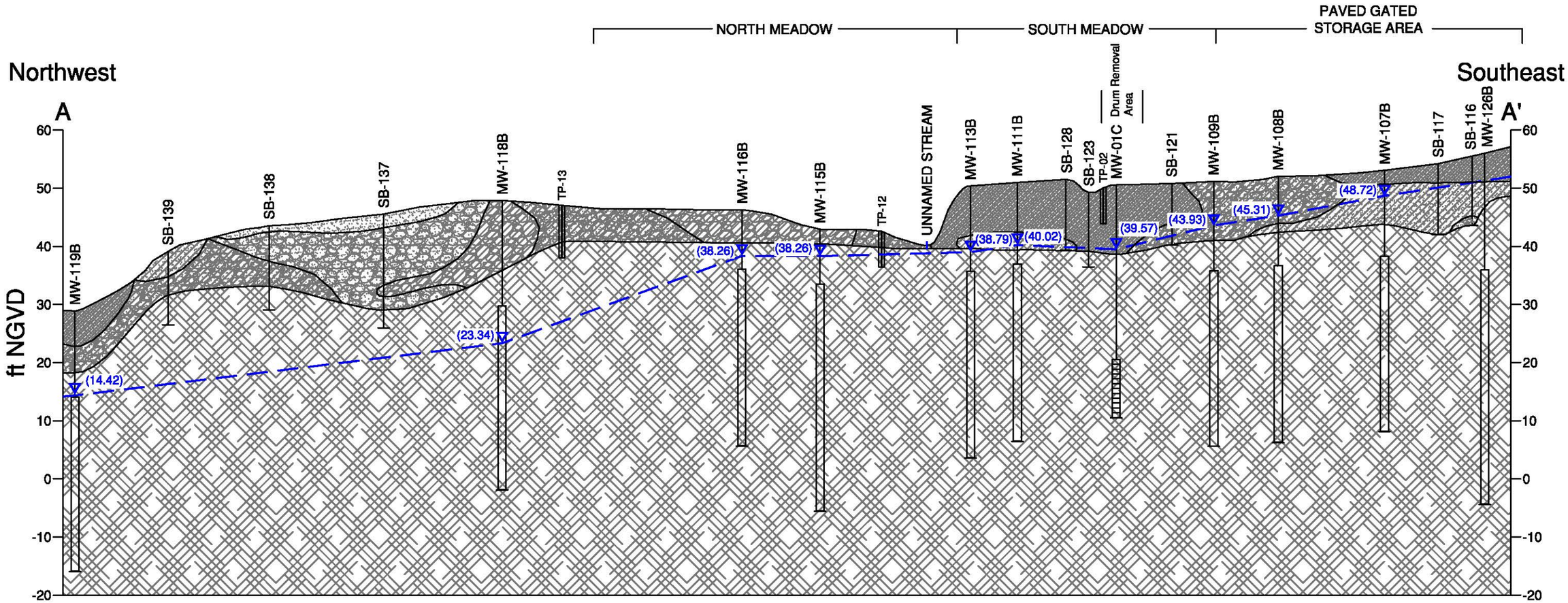
NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

CONCEPTUAL SITE MODEL

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

SCALE NOT TO SCALE
FILE I:\..\NUSC_CSM.DWG
REV 0
DATE 2/19/13
FIGURE NUMBER 3

ACAD:I:\04310\PP.WP\NUSC_X-SECTION_A-A'.DWG 2/19/13 DWM



SAND

GRAVELLY SAND

SILTY GRAVEL

SILTY SAND

SILTY SAND WITH GRAVEL

FILL

BEDROCK

OPEN HOLE WELL OR BORING

MW-112B — SOIL BORING / WELL LOCATION ID

GROUND SURFACE

TOP OF OPEN HOLE

(23.34) WATER ELEVATION MEASURED ON SEPTEMBER 18, 2008

BOTTOM OF OPEN HOLE

BOTTOM OF BORING

SCREENED WELL

MW-112B — SOIL BORING / WELL LOCATION ID

GROUND SURFACE

TOP OF WELL SCREEN

BOTTOM OF WELL SCREEN

BOTTOM OF BORING

TP-100 — TEST PIT ID

GROUND SURFACE

BOTTOM OF TEST PIT

GROUNDWATER ELEVATION (ESTIMATED) (SEPTEMBER 18, 2008)

NOTES:
1. PLAN NOT TO BE USED FOR DESIGN.
2. ALL LOCATIONS AND CONTACTS ARE TO BE CONSIDERED APPROXIMATE.
3. HORIZONTAL DATUM IS BASED ON THE RHODE ISLAND STATE PLANE COORDINATE SYSTEM NAD1983. VERTICAL DATUM IS BASED ON NGVD 1988
4. REFER TO FIGURE 1-4 FOR CROSS-SECTION LOCATION.

HORIZONTAL GRAPHIC SCALE

0' 60'

VERTICAL GRAPHIC SCALE

0' 20'

TETRA TECH

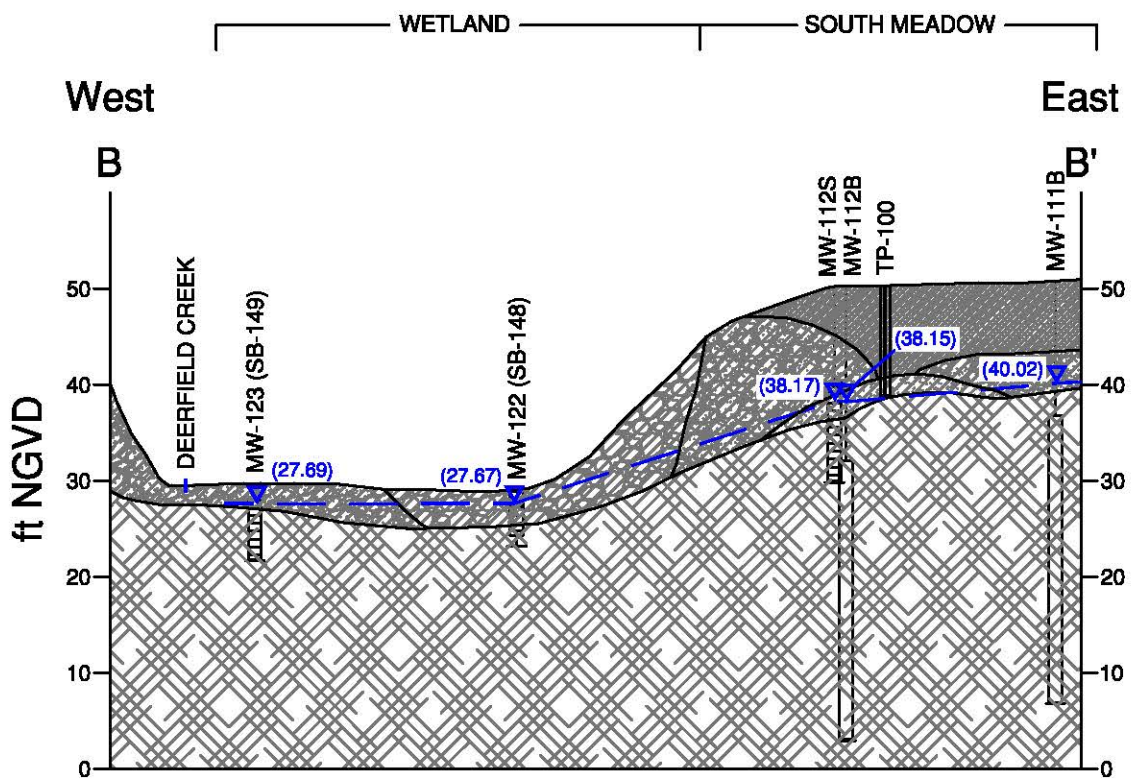
NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

GEOLOGIC CROSS-SECTION A-A'

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

SCALE	
PER BAR SCALE	
FILE	
I:\..\NUSC_X-SECTION_A-A'.DWG	
REV	DATE
0	2/19/13
FIGURE NUMBER	
4	

ACAD:I:\04310\PP.WP\NUSC_X-SECTION_B-B'.DWG 2/19/13 DWM



OPEN HOLE
WELL OR BORING

MW-112B
SOIL BORING / WELL LOCATION ID
GROUND SURFACE
TOP OF OPEN HOLE
(23.34) WATER ELEVATION MEASURED ON SEPTEMBER 18, 2008
BOTTOM OF OPEN HOLE
BOTTOM OF BORING

TP-100
TEST PIT ID
GROUND SURFACE
BOTTOM OF TEST PIT

SCREENED WELL

MW-112B
SOIL BORING / WELL LOCATION ID
GROUND SURFACE
TOP OF WELL SCREEN
BOTTOM OF WELL SCREEN
BOTTOM OF BORING

GRAVELLY SAND
SILTY GRAVEL
SILTY SAND
SILTY SAND WITH GRAVEL
FILL
BEDROCK

HORIZONTAL GRAPHIC SCALE
0' 60'

VERTICAL GRAPHIC SCALE
0' 20'

GROUNDWATER ELEVATION (ESTIMATED) (SEPTEMBER 18, 2008)

NOTES:
1. PLAN NOT TO BE USED FOR DESIGN.
2. ALL LOCATIONS AND CONTACTS ARE TO BE CONSIDERED APPROXIMATE.
3. HORIZONTAL DATUM IS BASED ON THE RHODE ISLAND STATE PLANE COORDINATE SYSTEM NAD1983. VERTICAL DATUM IS BASED ON NGVD 1988.
4.REFER TO FIGURE 1-4 FOR CROSS-SECTION LOCATION.

TETRA TECH

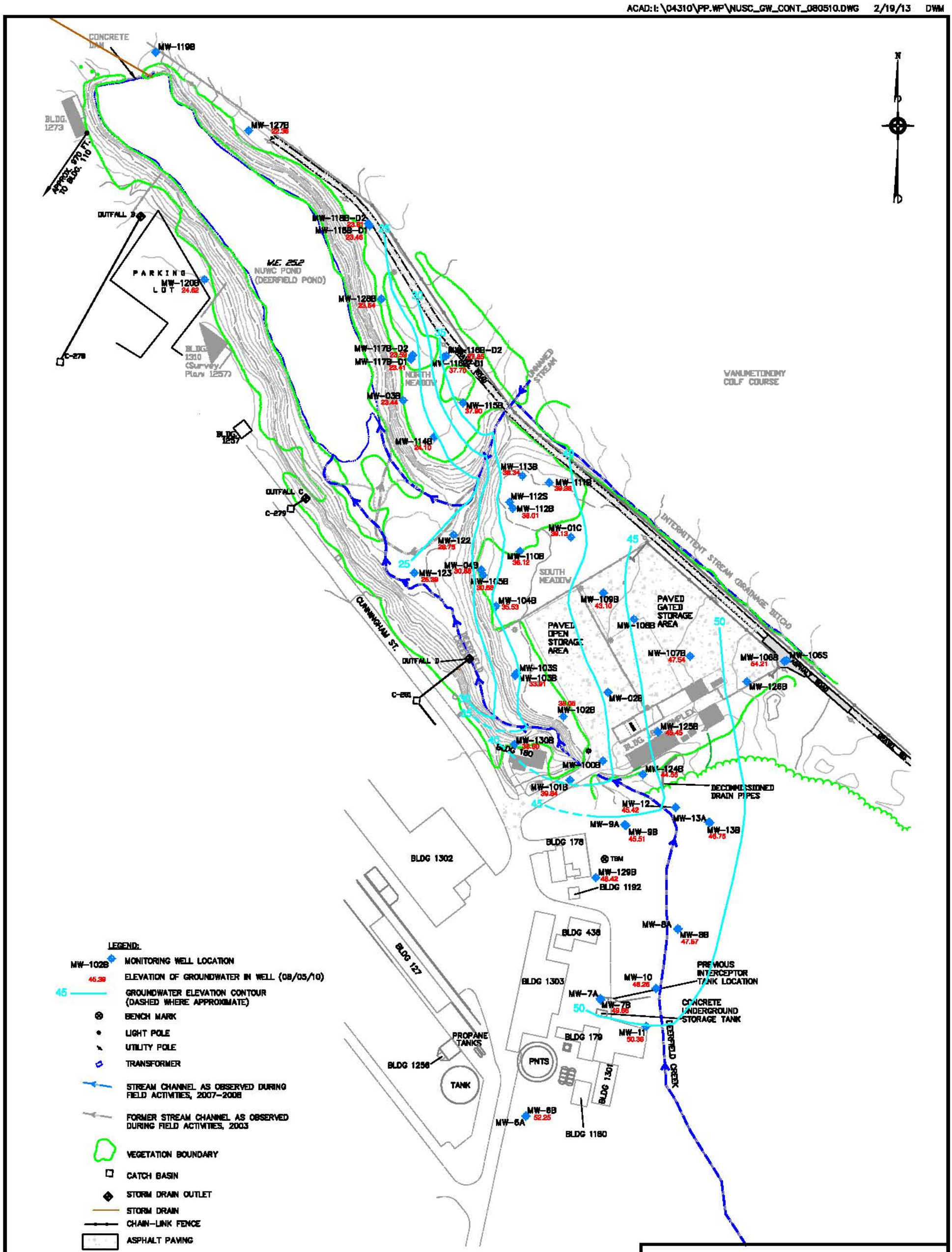
NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

GEOLOGIC CROSS-SECTION B-B'

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

SCALE	
PER BAR SCALE	
FILE	
\..\NUSC_X-SECTION_B-B'.DWG	
REV	DATE
0	2/19/13
FIGURE NUMBER	
5	

ACAD:I:\04310\PP.WP\NUSC_GW_CONT_080510.DWG 2/19/13 DWM



LEGEND:

- MW-102B — MONITORING WELL LOCATION
- 46.39 — ELEVATION OF GROUNDWATER IN WELL (08/05/10)
- 45 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE APPROXIMATE)
- BENCH MARK
- LIGHT POLE
- UTILITY POLE
- TRANSFORMER
- STREAM CHANNEL AS OBSERVED DURING FIELD ACTIVITIES, 2007–2008
- FORMER STREAM CHANNEL AS OBSERVED DURING FIELD ACTIVITIES, 2003
- VEGETATION BOUNDARY
- CATCH BASIN
- STORM DRAIN OUTLET
- STORM DRAIN
- CHAIN-LINK FENCE
- ASPHALT PAVING

NOTES AND REFERENCES

1. BASE PLAN PRODUCED BY LOUIS FEDERICI AND ASSOCIATES.

2. VERTICAL DATUM = NGVD 1929, BEE PLAN PROVIDED BY CLIENT ENTITLED "BUILDING 179 REMEDIAL INVESTIGATION PHASE 2 EXISTING CONDITIONS PLAN", DATED 12/3/08, BY THE NAVAL UNDERSEA WARFARE CENTER DIVISION, PUBLISHED BY NRC, 12/08.

3. BENCH MARK FOUND SE CORNER G.I.S.L. SCRIBED X MARK TOP SE CORNER SLAB ABOVE BURIED OIL WATER SEPARATOR. ELEV. = 57.00, NGVD'29. AS DESCRIBED ABOVE.

4. HORIZONTAL DATUM = NAD 1983.

5. TOPOGRAPHY WAS PRODUCED BY DIGITAL PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY CONDUCTED APRIL 20, 1999 AND FROM A SURVEY CONDUCTED BY LOUIS FEDERICI ASSOCIATES, PROVIDENCE, RI, 08/14/08.

6. BUILDING 1310 (SHOWN ON SURVEY PLAN AS BLDG. 1257) FROM SURVEY LOCATION (See Note 1); BLDG. 1257 NAME & LOCATION ACCORDING TO PLAN CITED IN NOTE 7 BY THE NAVY FACILITIES ENGINEERING COMMAND.

7. LOCATIONS OF PARKING LOT NEAR BLDG. 1310 AND OUTFALLS B, C, & D ADAPTED AND INTERPRETED FROM A PLAN BY THE DEPARTMENT OF THE NAVY, NAVY FACILITIES ENGINEERING COMMAND, "STORM DRAINAGE SYSTEM, COORDINATION CONE", CODE IDENT NO. 80091, NO DATE, IN CONJUNCTION WITH THE ACTUAL FIELD SURVEY PLAN, CITED ABOVE.

8. ALL LOCATIONS TO BE CONSIDERED APPROXIMATE AND NOT TO BE USED FOR FINAL DESIGN WITHOUT FIELD VERIFICATION.

9. MONITORING WELLS THAT HAVE BEEN INSTALLED IN BEDROCK ARE DESIGNATED WITH A "B" AT THE END OF THE WELL NAME. WELLS WITHOUT THE "B" IDENTIFIER WERE INSTALLED IN THE OVERBURDEN OR OVERBURDEN/BEDROCK INTERFACE (EXCEPT FOR MW-01C, WHICH IS IN BEDROCK).

GRAPHIC SCALE

0' 150' 300'

TETRA TECH

NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

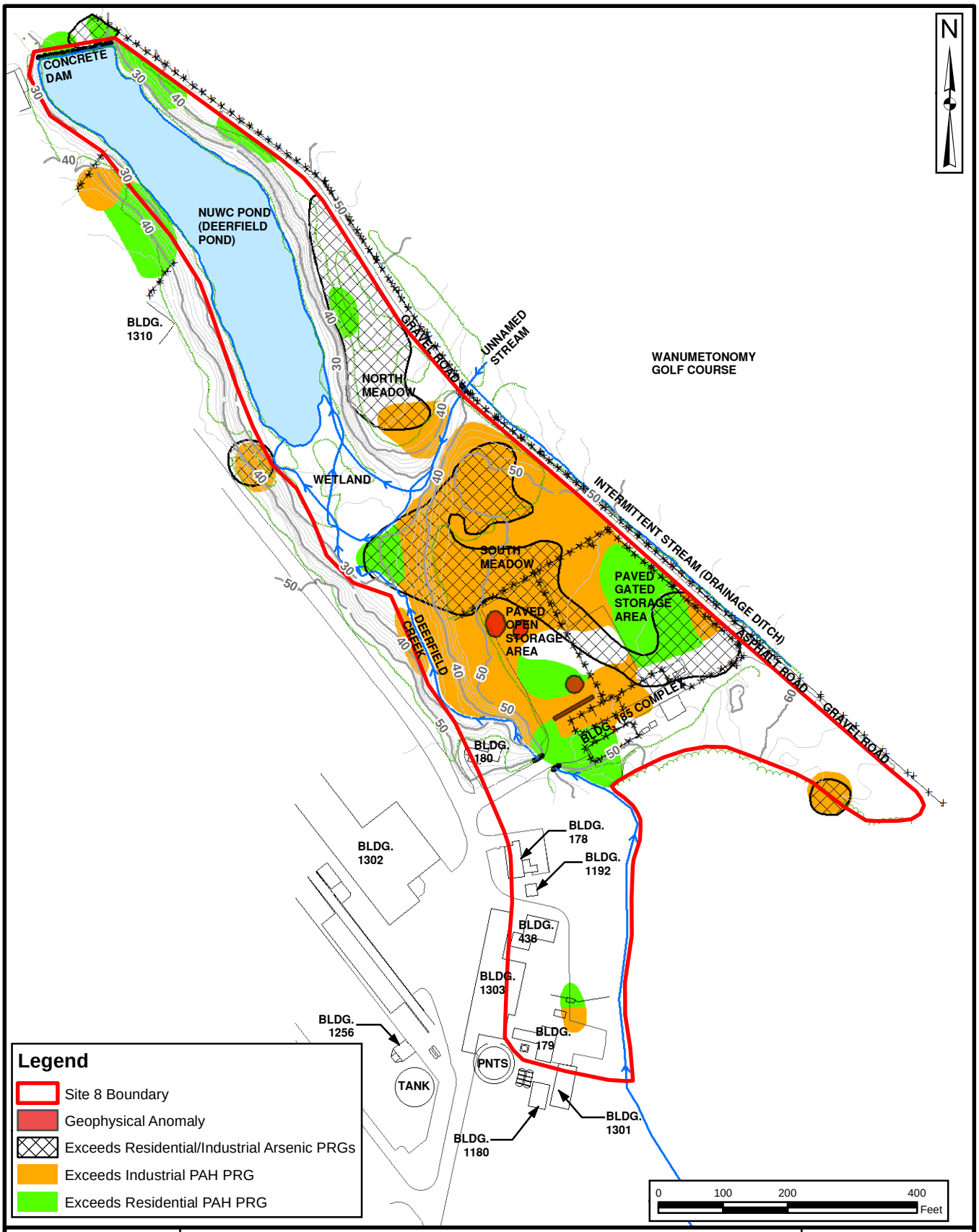
POTENTIOMETRIC GROUNDWATER SURFACE ELEVATION CONTOURS - AUGUST 5, 2010

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

FILE	SCALE
I:\..\NUSC_GW_CONT_080510.DWG	PER SCALE BAR

FIGURE NUMBER	REV	DATE
6	0	2/19/13

I:\04310\PP.WP\NUSC_SURF_SOIL_CONT.MXD DWM 02/19/13



TETRA TECH

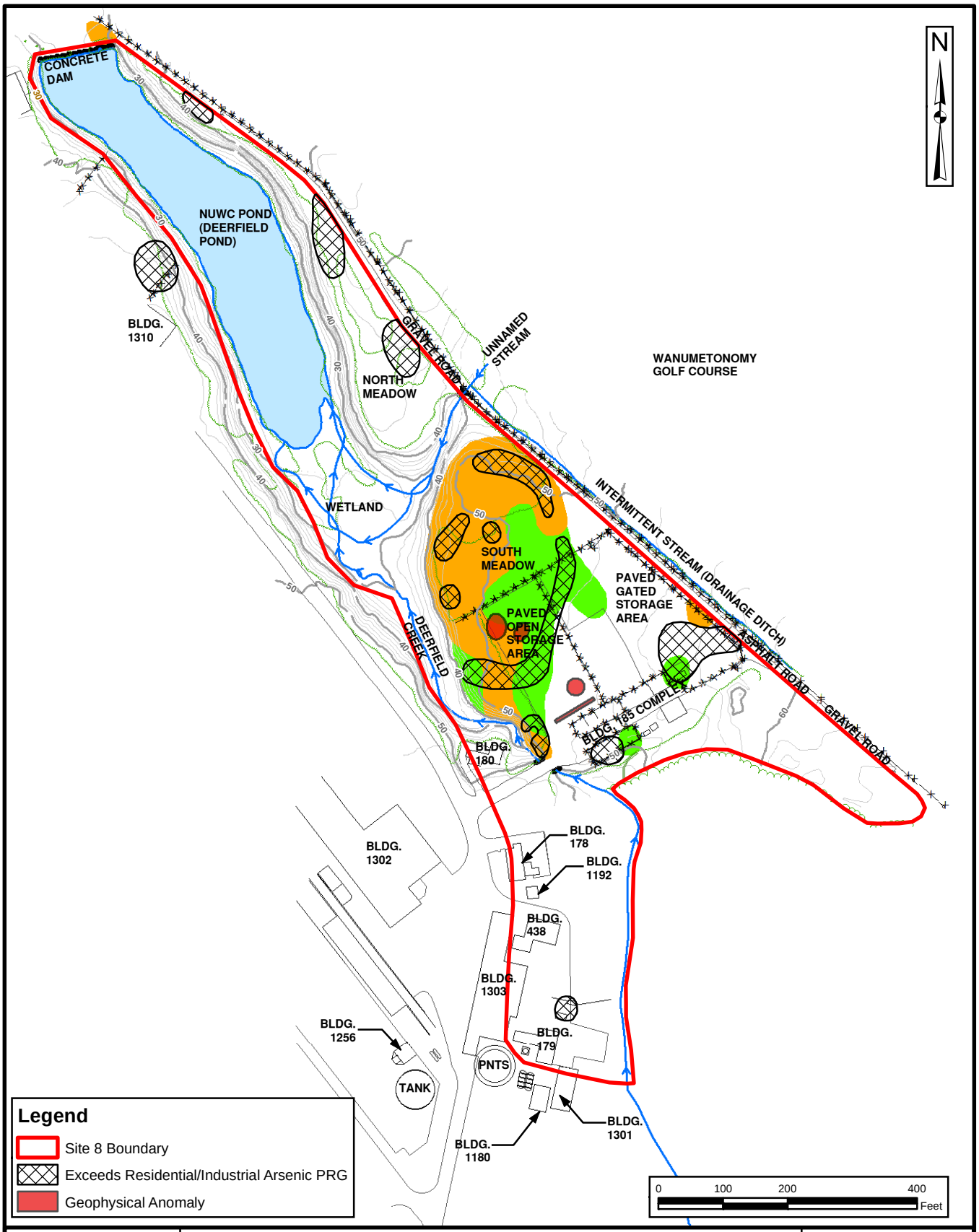
NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

SURFACE SOIL CONTAMINATION

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

SCALE	
PER SCALE BAR	
FILE	
I:\..\NUSC_SURF_SOIL_CONT.MXD	
REV	DATE
0	02/19/13
FIGURE NUMBER	
7	

I:\04310\PP.WP\NUSC_SUB_SOIL_CONT.MXD DWM 02/19/13



TETRA TECH

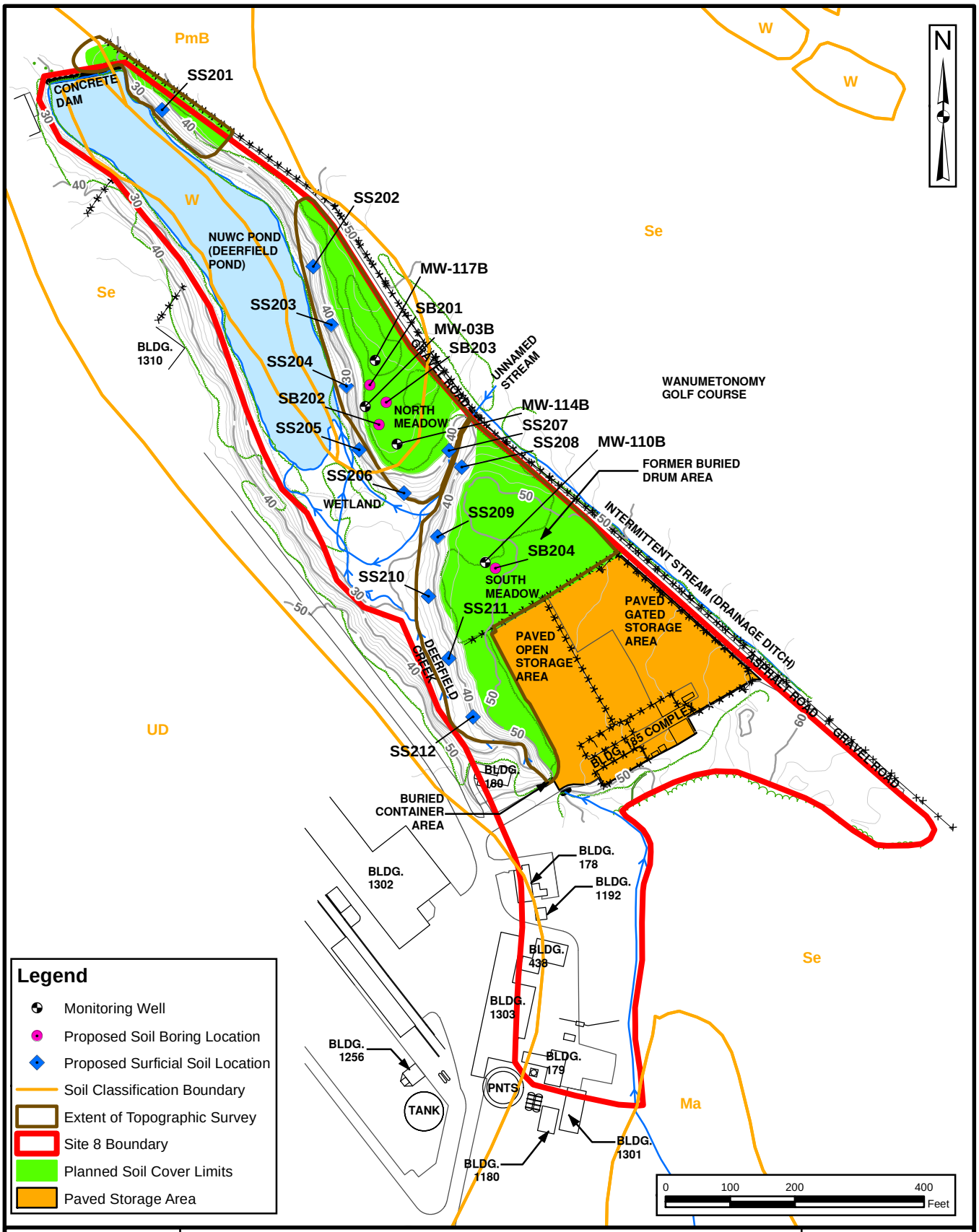
NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

SUBSURFACE SOIL CONTAMINATION

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

SCALE	PER SCALE BAR
FILE	I:\..\NUSC_SURF_SOIL_CONT.MXD
REV	0
DATE	02/19/13
FIGURE NUMBER	8

I:\04310\PP.WP\NUSC_SOIL_SAMP&SURV_LOCS.MXD DWM/NEC 07/08/13



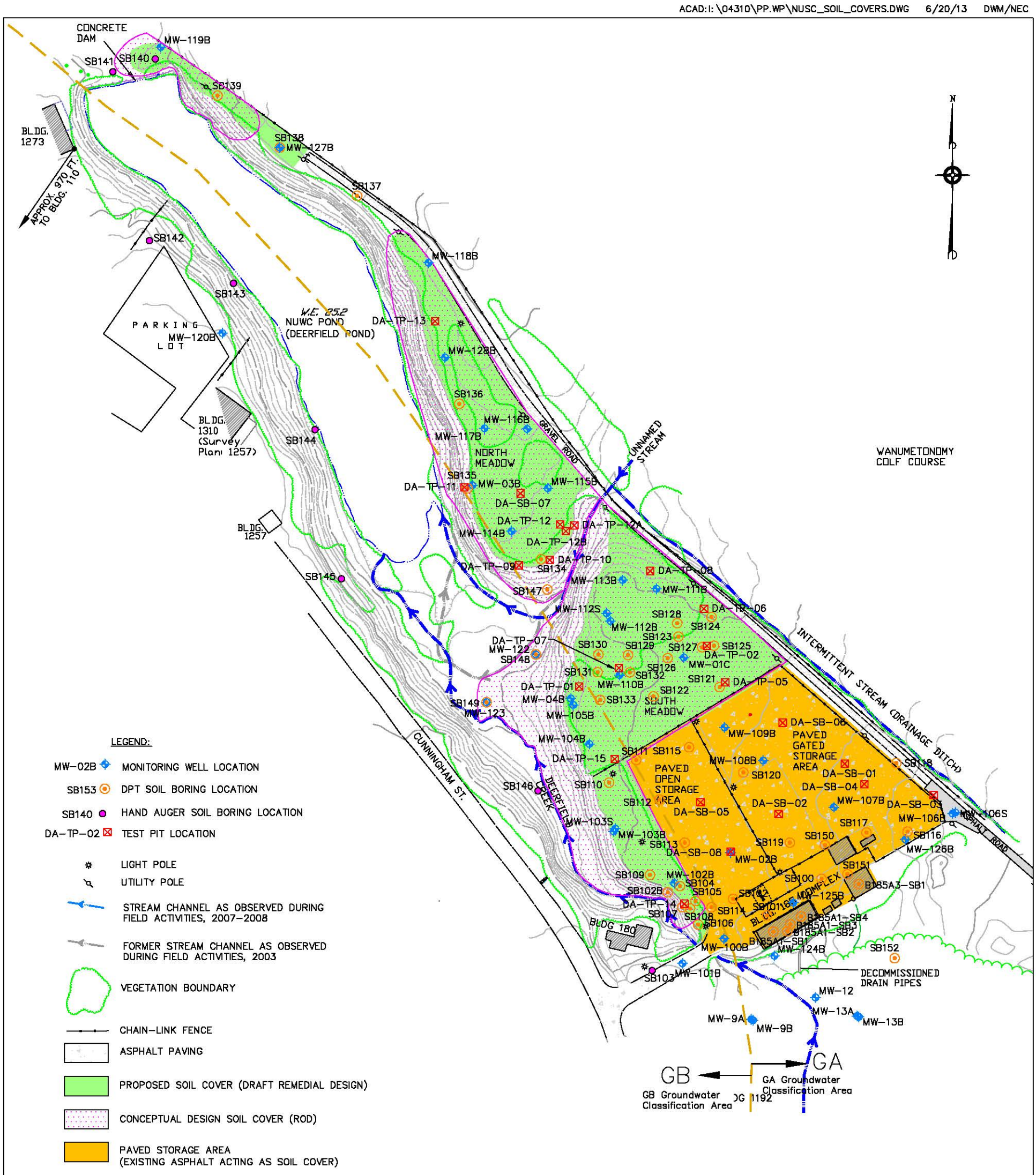
TETRA TECH

NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

SOIL SAMPLING AND SURVEY LOCATIONS

SITE 8 - NUSC DISPOSAL AREA
PRE-DESIGN INVESTIGATION

SCALE	PER SCALE BAR
FILE	I\..\NUSC_SOIL_SAMP &SURV_LOCS.MXD
REV	0
DATE	07/08/13
FIGURE NUMBER	9



NOTES AND REFERENCES

1. BASE PLAN PRODUCED BY LOUIS FEDERICI AND ASSOCIATES.

2. VERTICAL DATUM = NGVD 1929, SEE PLAN PROVIDED BY CLIENT ENTITLED "BUILDING 179 REMEDIAL INVESTIGATION FIGURE 2 EXISTING CONDITIONS PLAN", DATED 12/3/99, BY THE NAVAL UNDERSEA WARFARE CENTER DIVISION, PUBLISHED BY TRC, 12/99.

3. BENCH MARK FOUND SE CORNER O.W.S., SCRIBED X MARK TOP SE CORNER SLAB ABOVE BURIED OIL WATER SEPARATOR, ELEV. = 57.55, NGVD'29, AS DESCRIBED ABOVE.

4. HORIZONTAL DATUM = NAD 1983.

5. TOPOGRAPHY WAS PRODUCED BY DIGITAL PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY CONDUCTED APRIL 25, 1996 AND FROM A SURVEY CONDUCTED BY LOUIS FEDERICI ASSOCIATES, PROVIDENCE, RI, 08/14/08.

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7. LOCATIONS OF PARKING LOT NEAR BLDG. 1310 AND OUTFALLS B, C, & D ADAPTED AND INTERPRETED FROM A PLAN BY THE DEPARTMENT OF THE NAVY, NAVY FACILITIES ENGINEERING COMMAND, "STORM DRAINAGE SYSTEM, CODDINGTON COVE", CODE IDENT NO. 80091, NO DATE, IN CONJUCTION WITH THE ACTUAL FIELD SURVEY PLAN, CITED ABOVE.

8. ALL LOCATIONS TO BE CONSIDERED APPROXIMATE AND NOT TO BE USED FOR FINAL DESIGN WITHOUT FIELD VERIFICATION.

9. SOIL BORING SAMPLES SB-136 TO SB-140 ARE NOT SURVEYED.

GRAPHIC SCALE

0' 130' 260'

TETRA TECH

NAVAL STATION NEWPORT
MIDDLETOWN, RHODE ISLAND

COMPARISON OF CONCEPTUAL SOIL COVER LAYOUTS

SITE 08 – NUSC DISPOSAL AREA
SAMPLING AND ANALYSIS PLAN

FILE	SCALE
I:\..\NUSC_SOIL_COVERS.DWG	PER SCALE BAR
FIGURE NUMBER 10	REV 0 / DATE 6/20/13

REFERENCES

REFERENCES

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APPENDIX A

STANDARD OPERATING PROCEDURES

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES **3**

5.0 PROCEDURES **3**

5.1 BURIED UTILITIES 3
5.2 OVERHEAD POWER LINES 5

6.0 UNDERGROUND LOCATING TECHNIQUES **5**

6.1 GEOPHYSICAL METHODS 5
6.2 PASSIVE DETECTION SURVEYS 6
6.3 INTRUSIVE DETECTION SURVEYS 6

7.0 INTRUSIVE ACTIVITIES SUMMARY **7**

8.0 REFERENCES **8**

ATTACHMENTS

1 Listing of Underground Utility Clearance Resources 9
2 Frost Line Penetration Depths by Geographic Location 11
3 Utility Clearance Form 12
4 OSHA Letter of Interpretation 13

1.0 PURPOSE

Utilities such as electric service lines, natural or propane gas lines, water and sewage lines, telecommunications, and steam lines are very often in the immediate vicinity of work locations. Contact with underground or overhead utilities can have serious consequences including employee injury/fatality, property and equipment damage, substantial financial impacts, and loss of utility service to users.

The purpose of this procedure is to provide minimum requirements and technical guidelines regarding the appropriate procedures to be followed when performing subsurface and overhead utility locating services. It is the policy of Tetra Tech NUS, Inc. (TtNUS) to provide a safe and healthful work environment for the protection of our employees. The purpose of this Standard Operating Procedure (SOP) is to aid in achieving the objectives of this policy, to present the acceptable procedures pertaining to utility locating and excavation clearance activities, and to present requirements and restrictions relevant to these types of activities. This SOP must be reviewed by any employee potentially involved with underground or overhead utility locating and avoidance activities.

2.0 SCOPE

This procedure applies to all TtNUS field activities where there may be potential contact with underground or overhead utilities. This procedure provides a description of the principles of operation, instrumentation, applicability, and implementability of typical methods used to determine the presence and avoidance of contact with utility services. This procedure is intended to assist with work planning and scheduling, resource planning, field implementation, and subcontractor procurement. Utility locating and excavation clearance requires site-specific information prior to the initiation of any such activities on a specific project. This SOP is not intended to provide a detailed description of methodology and instrument operation. Specialized expertise during both planning and execution of several of the methods presented may also be required.

3.0 GLOSSARY

Electromagnetic Induction (EMI) Survey - A geophysical exploration method whereby electromagnetic fields are induced in the ground and the resultant secondary electromagnetic fields are detected as a measure of ground conductivity.

Magnetometer – A device used for precise and sensitive measurements of magnetic fields.

Magnetic Survey – A geophysical survey method that depends on detection of magnetic anomalies caused by the presence of buried ferromagnetic objects.

Metal Detection – A geophysical survey method that is based on electromagnetic coupling caused by underground conductive objects.

Vertical Gradiometer – A magnetometer equipped with two sensors that are vertically separated by a fixed distance. It is best suited to map near surface features and is less susceptible to deep geologic features.

Ground Penetrating Radar – Ground Penetrating Radar (GPR) involves specialized radar equipment whereby a signal is sent into the ground via a transmitter. Some portion of the signal will be reflected from the subsurface material, which is then recorded with a receiver and electronically converted into a graphic picture.

4.0 RESPONSIBILITIES

Project Manager (PM)/Task Order Manager (TOM) - Responsible for ensuring that all field activities are conducted in accordance with this procedure.

Site Manager (SM)/Field Operations Leader (FOL) - Responsible for the onsite verification that all field activities are performed in compliance with approved SOPs or as otherwise directed by the approved project plan(s).

Site Health & Safety Officer (SHSO) – Responsible to provide technical assistance and verify full compliance with this SOP. The SHSO is also responsible for reporting any deficiencies to the Corporate Health and Safety Manager (HSM) and to the PM/TOM.

Health & Safety Manager (HSM) – Responsible for preparing, implementing, and modifying corporate health and safety policy and this SOP.

Site Personnel – Responsible for performing their work activities in accordance with this SOP and the TtNUS Health and Safety Policy.

5.0 PROCEDURES

This procedure addresses the requirements and technical procedures that must be performed to minimize the potential for contact with underground and overhead utility services. These procedures are addressed individually from a buried and overhead standpoint.

5.1 Buried Utilities

Buried utilities present a heightened concern because their location is not typically obvious by visual observation, and it is common that their presence and/or location is unknown or incorrectly known on client properties. This procedure must be followed prior to beginning any subsurface probing or excavation that might potentially be in the vicinity of underground utility services. In addition, the Utility Clearance Form (Attachment 3) must be completed for every location or cluster of locations where intrusive activities will occur.

Where the positive identification and de-energizing of underground utilities cannot be obtained and confirmed using the following steps, the PM/TOM is responsible for arranging for the procurement of a qualified, experienced, utility locating subcontractor who will accomplish the utility location and demarcation duties specified herein.

1. A comprehensive review must be made of any available property maps, blue lines, or as-builts prior to site activities. Interviews with local personnel familiar with the area should be performed to provide additional information concerning the location of potential underground utilities. Information regarding utility locations shall be added to project maps upon completion of this exercise.

2., A visual site inspection must be performed to compare the site plan information to actual field conditions. Any findings must be documented and the site plan/maps revised. The area(s) of proposed excavation or other subsurface activities must be marked at the site in white paint or pin flags to identify those locations of the proposed intrusive activities. The site inspection should focus on locating surface indications of potential underground utilities. Items of interest include the presence of nearby area lights, telephone service, drainage grates, fire hydrants, electrical service vaults/panels, asphalt/concrete scares and patches, and topographical depressions. Note the location of any emergency shut off switches. Any additional information regarding utility

locations shall be added to project maps upon completion of this exercise and returned to the PM/TOM.

3. If the planned work is to be conducted on private property (e.g., military installations, manufacturing facilities, etc.) the FOL must identify and contact appropriate facility personnel (e.g., public works or facility engineering) before any intrusive work begins to inquire about (and comply with) property owner requirements. It is important to note that private property owners may require several days to several weeks advance notice prior to locating utilities.

4. If the work location is on public property, the state agency that performs utility clearances must be notified (see Attachment 1). State “one-call” services must be notified prior to commencing fieldwork per their requirements. Most one-call services require, by law, 48- to 72-hour advance notice prior to beginning any excavation. Such services typically assign a "ticket" number to the particular site. This ticket number must be recorded for future reference and is valid for a specific period of time, but may be extended by contacting the service again. The utility service will notify utility representatives who then mark their respective lines within the specified time frame. It should be noted that most military installations own their own utilities but may lease service and maintenance from area providers. Given this situation, “one call” systems may still be required to provide location services on military installations.

5. Utilities must be identified and their locations plainly marked using pin flags, spray paint, or other accepted means. The location of all utilities must be noted on a field sketch for future inclusion on project maps. Utility locations are to be identified using the following industry-standard color code scheme, unless the property owner or utility locator service uses a different color code:

white	excavation/subsurface investigation location
red	electrical
yellow	gas, oil, steam
orange	telephone, communications
blue	water, irrigation, slurry
green	sewer, drain

6. Where utility locations are not confirmed with a high degree of confidence through drawings, schematics, location services, etc., the work area must be thoroughly investigated prior to beginning the excavation. In these situations, utilities must be identified using safe and effective methods such as passive and intrusive surveys, or the use of non-conductive hand tools. Also, in situations where such hand tools are used, they should always be used in conjunction with suitable detection equipment, such as the items described in Section 6.0 of this SOP. Each method has advantages and disadvantages including complexity, applicability, and price. It also should be noted that in some states, initial excavation is required by hand to a specified depth.

7. At each location where trenching or excavating will occur using a backhoe or other heavy equipment, and where utility identifications and locations cannot be confirmed prior to groundbreaking, the soil must be probed using a device such as a tile probe which is made of non-conductive material such as fiberglass. If these efforts are not successful in clearing the excavation area of suspect utilities, hand shoveling must be performed for the perimeter of the intended excavation.

8. All utilities uncovered or undermined during excavation must be structurally supported to prevent potential damage. Unless necessary as an emergency corrective measure, TtNUS shall not make any repairs or modifications to existing utility lines without prior permission of the utility owner, property owner, and Corporate HSM. All repairs require that the line be locked-out/tagged-out prior to work.

5.2 Overhead Power Lines

If it is necessary to work within the minimum clearance distance of an overhead power line, the overhead line must be de-energized and grounded, or re-routed by the utility company or a registered electrician. If protective measures such as guarding, isolating, or insulating are provided, these precautions must be adequate to prevent employees from contacting such lines directly with any part of their body or indirectly though conductive materials, tools, or equipment.

The following table provides the required minimum clearances for working in proximity to overhead power lines.

Nominal Voltage	Minimum Clearance
0 -50 kV	10 feet, or one mast length; whichever is greater
50+ kV	10 feet plus 4 inches for every 10 kV over 50 kV or 1.5 mast lengths; whichever is greater

6.0 UNDERGROUND LOCATING TECHNIQUES

A variety of supplemental utility locating approaches are available and can be applied when additional assurance is needed. The selection of the appropriate method(s) to employ is site-specific and should be tailored to the anticipated conditions, site and project constraints, and personnel capabilities.

6.1 Geophysical Methods

Geophysical methods include electromagnetic induction, magnetics, and ground penetrating radar. Additional details concerning the design and implementation of electromagnetic induction, magnetics, and ground penetrating radar surveys can be found in one or more of the TtNUS SOPs included in the References (Section 8.0).

Electromagnetic Induction

Electromagnetic Induction (EMI) line locators operate either by locating a background signal or by locating a signal introduced into the utility line using a transmitter. A utility line acts like a radio antenna, producing electrons, which can be picked up with a radiofrequency receiver. Electrical current carrying conductors have a 60HZ signal associated with them. This signal occurs in all power lines regardless of voltage. Utilities in close proximity to power lines or used as grounds may also have a 60HZ signal, which can be picked up with an EM receiver. A typical example of this type of geophysical equipment is an EM-61.

EMI locators specifically designed for utility locating use a special signal that is either indirectly induced onto a utility line by placing the transmitter above the line or directly induced using an induction clamp. The clamp induces a signal on the specific utility and is the preferred method of tracing since there is little chance of the resulting signals being interfered with. A good example of this type of equipment is the Schonstedt® MAC-51B locator. The MAC-51B performs inductively traced surveys, simple magnetic locating, and traced nonmetallic surveys.

When access can be gained inside a conduit to be traced, a flexible insulated trace wire can be used. This is very useful for non-metallic conduits but is limited by the availability of gaining access inside the pipe.

Magnetics

Magnetic locators operate by detecting the relative amounts of buried ferrous metal. They are incapable of locating or identifying nonferrous utility lines but can be very useful for locating underground storage tanks (UST's), steel utility lines, and buried electrical lines. A typical example of this type of equipment is the Schonstedt® GA-52Cx locator. The GA-52Cx is capable of locating 4-inch steel pipe up to 8 feet deep.

Non-ferrous lines are often located by using a typical plumbing tool (snake) fed through the line. A signal is then introduced to the snake that is then traced.

Ground Penetrating Radar

Ground Penetrating Radar (GPR) involves specialized radar equipment whereby a signal is sent into the ground via a transmitter. Some portion of the signal will be reflected from the subsurface material, which is then recorded with a receiver and electronically converted into a graphic picture. In general, an object which is harder than the surrounding soil will reflect a stronger signal. Utilities, tunnels, UST's, and footings will reflect a stronger signal than the surrounding soil. Although this surface detection method may determine the location of a utility, this method does not specifically identify utilities (i.e., water vs. gas, electrical vs. telephone); hence, verification may be necessary using other methods. This method is somewhat limited when used in areas with clay soil types or with a high water table.

6.2 Passive Detection Surveys

Acoustic Surveys

Acoustic location methods are generally most applicable to waterlines or gas lines. A highly sensitive Acoustic Receiver listens for background sounds of water flowing (at joints, leaks, etc.) or to sounds introduced into the water main using a transducer. Acoustics may also be applicable to determine the location of plastic gas lines.

Thermal Imaging

Thermal (i.e., infrared) imaging is a passive method for detecting the heat emitted by an object. Electronics in the infrared camera convert subtle heat differentials into a visual image on the viewfinder or a monitor. The operator does not look for an exact temperature; rather they look for heat anomalies (either elevated or suppressed temperatures) characteristic of a potential utility line.

The thermal fingerprint of underground utilities results from differences in temperature between the atmosphere and the fluid present in a pipe or the heat generated by electrical resistance. In addition, infrared scanners may be capable of detecting differences in the compaction, temperature and moisture content of underground utility trenches. High-performance thermal imagery can detect temperature differences to hundredths of a degree.

6.3 Intrusive Detection Surveys

Vacuum Excavation

Vacuum excavation is used to physically expose utility services. The process involves removing the surface material over approximately a 1' x 1' area at the site location. The air-vacuum process proceeds with the simultaneous action of compressed air-jets to loosen soil and vacuum extraction of the resulting

debris. This process ensures the integrity of the utility line during the excavation process, as no hammers, blades, or heavy mechanical equipment comes into contact with the utility line, eliminating the risk of damage to utilities. The process continues until the utility is uncovered. Vacuum excavation can be used at the proposed site location to excavate below the "utility window" which is usually 8 feet.

Hand Excavation

When the identification and location of underground utilities cannot be positively confirmed through document reviews and/or other methods, borings and excavations may be cleared via the use of non-conductive hand tools. This should always be done in conjunction with the use of detection equipment. This would be required for all locations where there is a potential to impact buried utilities. The minimum hand-excavation depth that must be reached is to be determined considering the geographical location of the work site. This approach recognizes that the placement of buried utilities is influenced by frost line depths that vary by geographical region. Attachment 2 presents frost line depths for the regions of the contiguous United States. At a minimum, hand excavation depths must be at least to the frost line depth (see Attachment 2) plus two (2) feet, but never less than 4 feet below ground surface (bgs). For hand excavation, the hole created must be reamed large enough to be at least the diameter of the drill rig auger or bit prior to drilling. For soil gas surveys, the survey probe shall be placed as close as possible to the cleared hand excavation. It is important to note that a post-hole digger must not be used in this type of hand excavation activity.

Tile Probe Surveys

For some soil types, site conditions, and excavation requirements, non-conductive tile probes may be used. A tile probe is a “T”-handled rod of varying lengths that can be pushed into the soil to determine if any obstructions exist at that location. Tile probes constructed of fiberglass or other nonconductive material are readily-available from numerous vendors. Tile probes must be performed to the same depth requirements as previously specified. As with other types of hand excavating activities, the use of a non-conductive tile probe, should always be in conjunction with suitable utility locating detection equipment.

7.0 INTRUSIVE ACTIVITIES SUMMARY

The following list summarizes the activities that must be performed prior to beginning subsurface activities:

1. Map and mark all subsurface locations and excavation boundaries using white paint or markers specified by the client or property owner.

2. Notify the property owner and/or client that the locations are marked. At this point, drawings of locations or excavation boundaries shall be provided to the property owner and/or client so they may initiate (if applicable) utility clearance.

   Note: Drawings with confirmed locations should be provided to the property owner and/or client as soon as possible to reduce potential time delays.

3. Notify “One Call” service. If possible, arrange for an appointment to show the One Call representative the surface locations or excavation boundaries in person. This will provide a better location designation to the utilities they represent. You should have additional drawings should you need to provide plot plans to the One Call service.

4. Implement supplemental utility detection techniques as necessary and appropriate to conform utility locations or the absence thereof.

5. Complete Attachment 3, Utility Clearance Form. This form should be completed for each excavation location. In situations where multiple subsurface locations exist within the close proximity of one another, one form may be used for multiple locations provided those locations are noted on the Utility Clearance Form. Upon completion, the Utility Clearance Form and revised/annotated utility location map becomes part of the project file.

8.0 REFERENCES

OSHA Letter of Interpretation, Mr. Joseph Caldwell, Attachment 4
OSHA 29 CFR 1926(b)(2)
OSHA 29 CFR 1926(b)(3)
Tt Utility Locating and Clearance Policy
Tt SOP GH-3.1; Resistivity and Electromagnetic Induction
Tt SOP GH-3.2; Magnetic and Metal Detection Surveys
Tt SOP GH-3.4; Ground-penetrating Radar Surveys

ATTACHMENT 1
LISTING OF UNDERGROUND UTILITY CLEARANCE RESOURCES

American Public Works Association
2345 Grand Boulevard, Suite 500, Kansas City, MO 64108-2625
Phone (816) 472-6100 • Fax (816) 472-1610
Web www.apwa.net • E-mail apwa@apwa.net

ONE-CALL SYSTEMS INTERNATIONAL CONDENSED DIRECTORY

Alabama
Alabama One-Call
1-800-292-8525

Alaska
Locate Call Center of Alaska, Inc.
1-800-478-3121

Arizona
Arizona Blue Stake
1-800-782-5348

Arkansas
Arkansas One Call System, Inc.
1-800-482-8998

California
Underground Service Alert North
1-800-227-2600
Underground Service Alert of Southern California
1-800-227-2600

Colorado
Utility Notification Center of Colorado
1-800-922-1987

Connecticut
Call Before You Dig
1-800-922-4455

Delaware
Miss Utility of Delmarva
1-800-282-8555

Florida
Sunshine State One-Call of Florida, Inc.
1-800-432-4770

Georgia
Underground Protection Center, Inc.
1-800-282-7411

Hawaii
Underground Service Alert North
1-800-227-2600

Idaho
Dig Line Inc.
1-800-342-1585
Kootenai County One-Call
1-800-428-4950
Shoshone - Benewah One-Call
1-800-398-3285

Illinois
JULIE, Inc.
1-800-892-0123
Digger (Chicago Utility Alert Network)
312-744-7000

Indiana
Indiana Underground Plant Protection Service
1-800-382-5544

Iowa
Iowa One-Call
1-800-292-8989

Kansas
Kansas One-Call System, Inc.
1-800-344-7233

Kentucky
Kentucky Underground Protection Inc.
1-800-752-6007

Louisiana
Louisiana One Call System, Inc.
1-800-272-3020

Maine
Dig Safe System, Inc.
1-888-344-7233

Maryland
Miss Utility
1-800-257-7777
Miss Utility of Delmarva
1-800-282-8555

Massachusetts
Dig Safe System, Inc.
1-888-344-7233

Michigan
Miss Dig System, Inc.
1-800-482-7171

Minnesota
Gopher State One Call
1-800-252-1166

Mississippi
Mississippi One-Call System, Inc
1-800-227-6477

Missouri
Missouri One-Call System, Inc.
1-800-344-7483

Montana
Utilities Underground Protection Center
1-800-424-5555
Montana One Call Center
1-800-551-8344

Nebraska
Diggers Hotline of Nebraska
1-800-331-5666

Nevada
Underground Service Alert North
1-800-227-2600

New Hampshire
Dig Safe System, Inc.
1-888-344-7233

New Jersey
New Jersey One Call
1-800-272-1000

New Mexico
New Mexico One Call System, Inc.
1-800-321-2537
Las Cruces- Dona Ana Blue Stakes
1-888-526-0400

New York
Dig Safely New York
1-800-962-7962
New York City- Long Island One Call Center
1-800-272-4480

North Carolina
The North Carolina One-Call Center, Inc.
1-800-632-4949

North Dakota
North Dakota One-Call
1-800-795-0555

Ohio
Ohio Utilities Protection Service
1-800-362-2764
Oil & Gas Producers Underground Protect'n Svc
1-800-925-0988

Oklahoma
Call Okie
1-800-522-6543

Oregon
Oregon Utility Notification Center/One Call Concepts
1-800-332-2344

Pennsylvania
Pennsylvania One Call System, Inc.
1-800-242-1776

Rhode Island
Dig Safe System, Inc.
1-888-344-7233

South Carolina
Palmetto Utility Protection Service Inc.
1-888-721-7877

South Dakota
South Dakota One Call
1-800-781-7474

Tennessee
Tennessee One-Call System, Inc.
1-800-351-1111

ATTACHMENT 1 (Continued)

Texas
Texas One Call System
1-800-245-4545
Texas Excavation Safety System, Inc.
1-800-344-8377
Lone Star Notification Center
1-800-669-8344

Utah
Blue Stakes of Utah
1-800-662-4111

Vermont
Dig Safe System, Inc.
1-888-344-7233

Virginia
Miss Utility of Virginia
1-800-552-7001
Miss Utility (Northern Virginia)
1-800-257-7777

Washington
Utilities Underground Location Center
1-800-424-5555
Northwest Utility Notification Center
1-800-553-4344
Inland Empire Utility Coordinating Council
509-456-8000

West Virginia
Miss Utility of West Virginia, Inc.
1-800-245-4848

Wisconsin
Diggers Hotline, Inc.
1-800-242-8511

Wyoming
Wyoming One-Call System, Inc.
1-800-348-1030
Call Before You Dig of Wyoming
1-800-849-2476

District of Columbia
Miss Utility
1-800-257-7777

Alberta
Alberta One-Call Corporation
1-800-242-3447

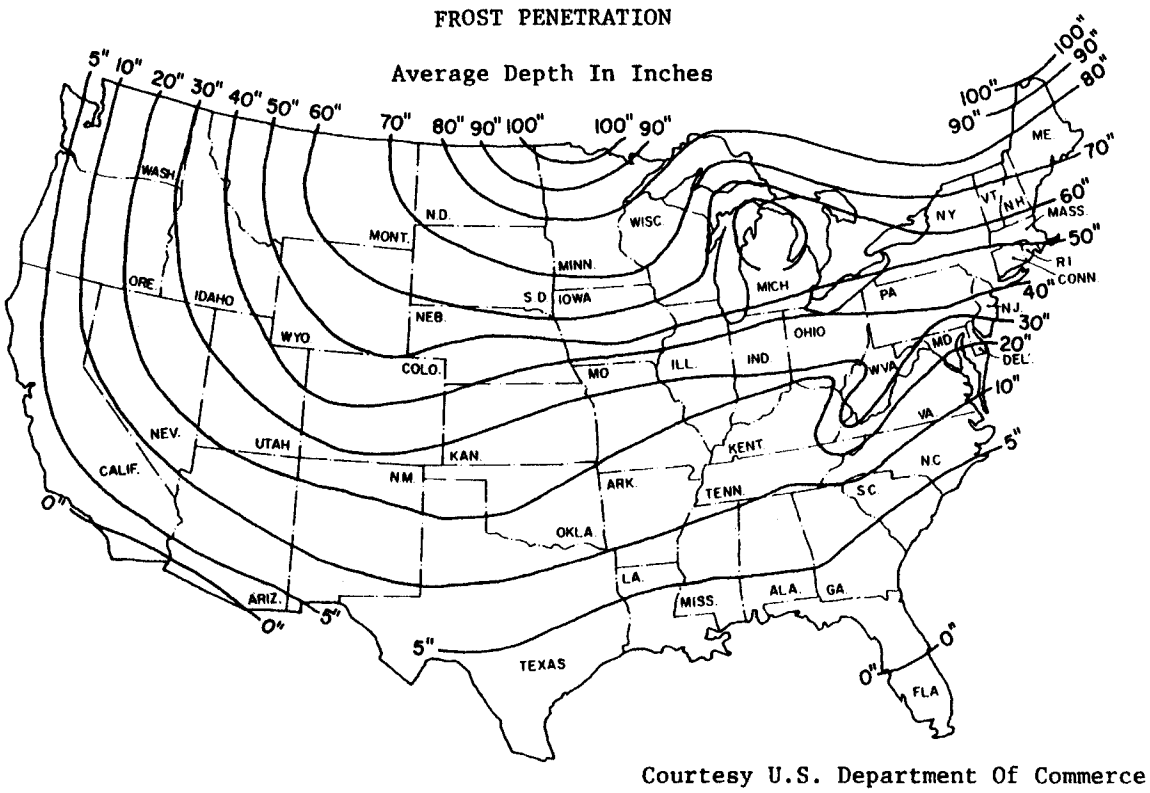
British Columbia
BC One Call
1-800-474-6886

Ontario
Ontario One-Call System
1-800-400-2255

Quebec
Info-Excavation
1-800-663-9228

ATTACHMENT 2

FROST LINE PENETRATION DEPTHS BY GEOGRAPHIC LOCATION



Courtesy U.S. Department Of Commerce

ATTACHMENT 3
UTILITY CLEARANCE FORM

Client: _____ Project Name: _____

Project No.: _____ Completed By: _____

Location Name: _____ Work Date: _____

Excavation Method/Overhead Equipment:_____

1. Underground Utilities — Circle One

a)	Review of existing maps?	yes no N/A
b)	Interview local personnel?	yes no N/A
c)	Site visit and inspection?	yes no N/A
d)	Excavation areas marked in the field?	yes no N/A
e)	Utilities located in the field?	yes no N/A
f)	Located utilities marked/added to site maps?	yes no N/A
g)	Client contact notified Name _____ Telephone: _____ Date: _____	yes no N/A
g)	State One-Call agency called? Caller: _____ Ticket Number: _____ Date: _____	yes no N/A
h)	Geophysical survey performed? Survey performed by:_____ Method: _____ Date: _____	yes no N/A
i)	Hand excavation performed (with concurrent use of utility detection device)? Completed by:_____ Total depth:_____feet Date: _____	yes no N/A
j)	Trench/excavation probed? Probing completed by:_____ Depth/frequency: _____ Date: _____	yes no N/A

2. Overhead Utilities — Present Absent

a)	Determination of nominal voltage	yes no N/A
b)	Marked on site maps	yes no N/A
c)	Necessary to lockout/insulate/re-route	yes no N/A
d)	Document procedures used to lockout/insulate/re-route	yes no N/A
e)	Minimum acceptable clearance (SOP Section 5.2): _____	

3. Notes:

_____

_____

_____

Approval:

_____ _____

Site Manager/Field Operations Leader Date

c: PM/Project File
Program File

ATTACHMENT 4
OSHA LETTER OF INTERPRETATION

Mr. Joseph Caldwell
Consultant
Governmental Liaison
Pipeline Safety Regulations
211 Wilson Boulevard
Suite 700
Arlington, Virginia 22201

Re: Use of hydro-vacuum or non-conductive hand tools to locate underground utilities.

Dear Mr. Caldwell:

In a letter dated July 7, 2003, we responded to your inquiry of September 18, 2002, regarding the use of hydro-vacuum equipment to locate underground utilities by excavation. After our letter to you was posted on the OSHA website, we received numerous inquiries that make it apparent that aspects of our July 7 letter are being misunderstood. In addition, a number of industry stakeholders, including the National Utility Contractors Association (NUCA), have provided new information regarding equipment that is available for this work.

To clarify these issues, we are withdrawing our July 7 letter and issuing this replacement response to your inquiry.

Question: *Section 1926.651 contains several requirements that relate to the safety of employees engaged in excavation work. Specifically, paragraphs (b)(2) and (b)(3) relate in part to the safety of the means used to locate underground utility installations that, if damaged during an uncovering operation, could pose serious hazards to employees.*

Under these provisions, what constitutes an acceptable method of uncovering underground utility lines, and further, would the use of hydro-vacuum excavation be acceptable under the standard?

Answer

Background

Two sections of 29 CFR 1926 Subpart P (Excavations), 1926.651(Specific excavation requirements), govern methods for uncovering underground utility installations. Specifically, paragraph (b)(2) states:

> When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours * * * or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used. (emphasis added).

Paragraph (b)(3) provides:

ATTACHMENT 4 (Continued)

> When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means. (emphasis added).

Therefore, "acceptable means" must be used where the location of the underground utilities have not been identified by the utility companies and detection equipment is not used.

Subpart P does not contain a definition of either "other acceptable means" or "safe and acceptable means." The preambles to both the proposed rule and the final rule discussed the rationale behind the wording at issue. For example, the preamble to the proposed rule, 52 Fed. Reg. 12301 (April 15, 1987), noted that a 1972 version of this standard contained language that specified "careful probing or hand digging" as the means to uncover utilities. The preamble then noted that an amendment to the 1972 standard later deleted that language "to allow other, *equally effective means* of locating such installations." The preamble continued that in the 1987 proposed rule, OSHA again proposed using language in section (b)(3) that would provide another example of an acceptable method of uncovering utilities that could be used *where the utilities have not been marked and detection equipment is not being used* – "probing with hand-held tools." This method was rejected in the final version of 29 CFR 1926. As OSHA explained in the preamble to the final rule, 54 Fed. Reg. 45916 (October 31, 1989):

> OSHA received two comments * * * and input from ACCSH [OSHA's Advisory Committee on Construction Safety and Health] * * * on this provision. All commenters recommended dropping 'such as probing with hand-held tools' from the proposed provision, because this could create a hazard to employees by damaging the installation or its insulation.

In other words, the commenters objected to the use of hand tools being used unless detection equipment was used in conjunction with them. OSHA then concluded its discussion relative to this provision by agreeing with the commentators and ultimately not including any examples of "acceptable means" in the final provision.

Non-conductive hand tools are permitted

This raises the question of whether the standard permits the use of hand tools alone -- without also using detection equipment. NUCA and other industry stakeholders have recently informed us that non-conductive hand tools that are appropriate to be used to locate underground utilities are now commonly available.

Such tools, such as a "shooter" (which has a non-conductive handle and a snub nose) and non-conductive or insulated probes were not discussed in the rulemaking. Since they were not considered at that time, they were not part of the class of equipment that was thought to be unsafe for this purpose. Therefore, we conclude that the use of these types of hand tools, when used with appropriate caution, is an "acceptable means" for locating underground utilities.

ATTACHMENT 4 (Continued)

Hydro-vacuum excavation

It is our understanding that some hydro-vacuum excavation equipment can be adjusted to use a minimum amount of water and suction pressure. When appropriately adjusted so that the equipment will not damage underground utilities (especially utilities that are particularly vulnerable to damage, such as electrical lines), use of such equipment would be considered a "acceptable means" of locating underground utilities. However, if the equipment cannot be sufficiently adjusted, then this method would not be acceptable under the standard.

Other technologies

We are not suggesting that these are the only devices that would be "acceptable means" under the standard. Industry stakeholders have informed us that there are other types of special excavation equipment designed for safely locating utilities as well.

We apologize for any confusion our July 7 letter may have caused. If you have further concerns or questions, please feel free to contact us again by fax at: U.S. Department of Labor, OSHA, Directorate of Construction, Office of Construction Standards and Compliance Assistance, fax # 202-693-1689. You can also contact us by mail at the above office, Room N3468, 200 Constitution Avenue, N.W., Washington, D.C. 20210, although there will be a delay in our receiving correspondence by mail.

Sincerely,

Russell B. Swanson, Director
Directorate of Construction

NOTE: OSHA requirements are set by statute, standards and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA=s interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at http://www.osha.gov.

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES **2**

5.0 PROCEDURES **3**

5.1 EQUIPMENT ITEMS/NEEDED 3

5.2 OBSERVATIONS 3

6.0 RECORDS **5**

ATTACHMENTS

A SITE RECONNAISSANCE CHECKLIST 6

1.0 PURPOSE

The purpose of a site reconnaissance is to collect both general and technical information which will support the scoping, scheduling, implementing project activities, and writing reports for an environmental investigation. This procedure is not intended as a guide for Phase I investigations or for Environmental Baseline Survey activities.

2.0 SCOPE

This procedure is applicable to the performance of a site reconnaissance for initial site characterization. The steps necessary to develop and carry out a site reconnaissance are presented here. These steps include a list of equipment and items which may be needed, areas of special interest during field observations, and methods by which the field observation team can ensure that necessary and appropriate observations have been made.

3.0 GLOSSARY

Site reconnaissance. An onsite inspection program used to identify site-specific conditions that control scheduling, manpower, and affect costs. A site reconnaissance usually consists of visual observations and, often, the use of field monitoring instruments to identify potential health and safety threats and potential sampling locations for site evaluation during subsequent field investigations.

4.0 RESPONSIBILITIES

Field Operations Leader (FOL) is responsible for ensuring that the survey is carried out in sufficient detail. To accomplish this, the FOL must assign the proper personnel and equipment to characterize the site adequately, in accordance with the requirements defined in this procedure and best engineering practices. Other disciplines which may be applicable include (but are not limited to): Geology/Hydrogeology; Health and Safety; Ecological Specialists; and/or Engineering. In addition, the FOL is responsible for supervising equipment preparation, including necessary calibrations, and supervising field data collection and documentation in accordance with the methods described in all referenced standard operation procedures.

Project Manager is responsible for the following:

- Supervising the retrieval and examination of available, applicable information regarding the site.
- Obtaining appropriate program approvals and ensuring the preparation of a site Health and Safety plan for the site reconnaissance.
- Coordinating the field activities with the client and regulatory agencies, as applicable.

Field Personnel are primarily responsible for observing and documenting, either through written documentation or photographic evidence, the site reconnaissance. Field personnel will take direction from the FOL.

5.0 PROCEDURES

5.1 Equipment Items/Needed

Below is a list of items that may be useful when conducting a site reconnaissance. All, or a portion of these items may be required, depending upon the objective of the site reconnaissance.

- Health and Safety equipment and information as required by the Site Safety Officer.
- Maps (U.S.G.S. quadrangle, geologic maps, street and highway maps, and client facility maps).
- Geologic tools (compass, tape measure, hand level, camera, etc.).
- Physical monitoring equipment, if applicable (PID, Immunoassay Test Kits, etc.)
- Regional publications (U.S.G.S reports, water well surveys, U.S.D.A. soil conservation surveys, etc.).
- Site-specific publications by previous investigators (EPA aerial photographic analyses, remedial investigation reports, data on waste disposal practices, boring logs, etc.).
- Marking items (ink markers, surveyor's flagging, spray paint, pin flags, wooden stakes).
- Field notebooks.
- Local telephone book with yellow pages (for obtaining utilities, site trailer, living accommodations, etc.).

Sufficient time will be required in order to obtain some of the aforementioned material. In general, most publications can be obtained in time to be used in the site reconnaissance if ordered approximately 2 weeks before the actual site visit takes place.

5.2 Observations

A site reconnaissance usually requires one to two days, however, additional time may be needed depending upon the objective, site size, etc. The following observations, when applicable, should be documented either on a site map, field notebook, or photographed.

- General Site Access. It should be noted whether site roads provide access to all proposed work locations, or if it will be necessary to prepare access roads with either a backhoe, dozer, chain saws, etc., in order to get drill rigs, excavators, or other work vehicles to specific locations. If temporary driveways must be constructed from existing public roads, regulatory permits may be required. Military facilities may have specific security requirements which require detailed clearance procedures.
- Location of the Command Post or Site Trailer and Sanitary Facilities. The ideal location for the site trailer and sanitary facilities is a level area, within an uncontaminated zone, and centralized in order to provide easy access to work areas on the site. However, certain utility companies may require that the site trailer be placed within a specified radius (usually 100 feet), of the nearest utility pole. Contact the necessary utility companies and inquire about the requirements regarding service before conducting the site reconnaissance. Information that may be required by the utility companies is: type of electric service needed (inquire with trailer vendor for this information); and utility pole number of interest (pole numbers are usually stamped on a brass plate on the pole).
- Potable Water Sources. Local fire departments may allow access to fire hydrants. Private water delivery companies may also be available in the area.
- Sources of Possible Contamination. Drums, tanks, sludge areas, areas of stressed vegetation, fill areas, and leachate seeps may indicate where sources of contamination exist. Filler pipes protruding from the ground surface may indicate the presence of underground storage tanks. Areas where the

original ground surface has been reworked may be contaminated fill areas that have since been buried and covered with natural material. Previous environmental investigations may also identify source areas.

- Location of Decon Areas and Storage/Disposal Areas for Equipment and Wastes Generated by Field Activities.

- Locations of Surface Water Bodies. The locations of surface water bodies, both man-made and natural, and their relation to topographic highs may give an indication of the groundwater flow direction in the area (groundwater flow typically follows topography with the topographic highs serving as groundwater recharge areas, and the surface waters at topographic lows serve as groundwater discharge areas). Visible signs of contamination, the existence of aquatic life, flow rates, and approximate levels should also be observed and noted. Check if the surface water bodies could potentially be impacted by field activities. If so, appropriate sedimentation and erosion controls will be required.

- Existing Wells. Existing monitoring wells, or domestic wells within the site and off site, should be noted on a map, and access checked to see if the wells can be used for data collection.

- Outcrops. Outcrops can be useful in providing hydrogeologic data (lithologic description, strike and dip information, fracture and joint system analysis, identification of moist zones, etc.) Outcrops may occur naturally or be a part of a man-made feature such as a road-cut.

- Lineaments. A lineament is a straight lengthy feature on the earth's surface which is expressed topographically as a line of depression. Stream beds, vegetation patterns or soil characteristics may be aligned or controlled by this feature. Lineaments are due in some cases to the presence of intense jointing or faults beneath the ground surface. Groundwater in the bedrock may follow lineaments. Lineaments should be noted on site maps and described in the field notebooks.

- Bench or Property Markers. Benchmarks or property markers should be marked with paint or surveyor's flagging if encountered during a site reconnaissance. Surveyors may need to use these markers as a reference point when surveying. Benchmarks are typically a brass plate secured in concrete in the ground with numbering on the top. Property markers can range from a stake driven into the ground to a rock protruding from the ground surface. Facility contacts may also be aware of local benchmarks used during the course of other environmental or public work projects.

- Metal Cultural Effects. Overhead power lines, railroad tracks, junk automobiles, fences, etc. will greatly affect certain geophysical surveys. These features should be noted while conducting a site reconnaissance.

6.0 RECORDS

The data collected during a site reconnaissance may have to be compiled into a trip report when returning from the field. This trip report can then be distributed to the project team. A site reconnaissance checklist is located in Attachment A which can be copied and used while conducting the site reconnaissance.

ATTACHMENT A

SITE RECONNAISSANCE CHECKLIST

SITE SKETCH

Include the following as appropriate:

- Site Name
- Site location
- Site Boundaries
- Entrance locations
- Access Roads and Security Requirements
- Disposal locations
- Storage areas
- Office areas
- Well locations
- Treatment facility locations
- Surface drainage, outcrops, general topography descriptions
- Cultural interferences

CHEMICAL STORAGE FACILITIES DESCRIPTION

- Storage tanks - numbers, volumes, condition, contents, etc.
- Drums - number, conditions, labeling, etc.
- Lagoons and surface pits - number, size, use of liner, contents, etc.

TREATMENT SYSTEMS

Note the presence of any treatment systems. These can be difficult to evaluate visually. One should appraise general appearance, maintenance and visual integrity; ask operators for any monitoring records; note presence of odors; and visually characterize any effluents or residues. Describe type of wastes and volumes treated.

- Incinerators
- Flocculation/filtration
- Chemical/physical treatment
- Biological treatment
- Volume reduction
- Waste recycling
- Compositing
- Other

ATTACHMENT A
SITE RECONNAISSANCE CHECKLIST
PAGE TWO

DISPOSAL FACILITIES

Note the presence and use of any of the following operations. Include a description of the size, use of liners, soil type, and the presence of leachate. Provide a description of management practices. Interview site workers if possible. Describe waste types.

- Landfills
- Land forms
- Open dump
- Surface impoundment
- Underground injection
- Incineration

Also, records for disposal of concentrated/containerized waste should be reviewed.

HAZARDOUS SUBSTANCE CHARACTERISTICS

Ask facility contacts for manifests, inventories, or monitoring reports. Note markings on containers.

- Chemical identities
- Quantities
- Hazard characteristics (toxic, explosive, flammable, etc.)
- Container markings
- Monitoring data, other analytical data
- Physical state (liquid, solid, gas, sludge)

CHEMICAL PROCESS INFORMATION

- Manufacturing processes and chemicals
- Off-specification or by-product disposal processes
- Housekeeping practices
- Locations of Plant Operations

ATTACHMENT A
SITE RECONNAISSANCE CHECKLIST
PAGE THREE

HYDROGEOLOGIC ASSESSMENT

Look for situations that promote hazardous substance migration, i.e., porous soils, fractured bedrock formations, shallow water table and karst features.

- Soil type
- Surface water features
- Surface drainage pattern
- Outcrop studies
- Water wells (use, water depth, and construction details)
- Erosion potential
- Flooding potential
- Climatology

IDENTIFICATION OF SENSITIVE RECEPTORS

- Number and locations of private homes
- Public buildings including tenant usage
- Areas of dead or dying vegetation or animals
- Presence of sensitive ecosystems (wetlands, tidal marshes, etc.)
- Other public use areas (roads, parks, etc.)
- Natural areas

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **3**

2.0 SCOPE **3**

3.0 GLOSSARY **3**

4.0 RESPONSIBILITIES **3**

5.0 PROCEDURES **4**

5.1 GENERAL 4
5.2 DRILLING METHODS 4
5.2.1 Continuous-Flight Hollow-Stem Auger Drilling 5
5.2.2 Continuous-Flight Solid-Stem Auger Drilling 6
5.2.3 Rotary Drilling 7
5.2.4 Rotosonic Drilling 9
5.2.5 Reverse Circulation Rotary Drilling 9
5.2.6 Drill-through Casing Driver 10
5.2.7 Cable Tool Drilling 11
5.2.8 Jet Drilling (Washing) 12
5.2.9 Drilling with a Hand Auger 13
5.2.10 Rock Drilling and Coring 13
5.2.11 Drilling & Support Vehicles 14
5.2.12 Equipment Sizes 15
5.2.13 Estimated Drilling Progress 16
5.3 PREVENTION OF CROSS-CONTAMINATION 16
5.4 CLEANOUT OF CASING PRIOR TO SAMPLING 17
5.5 MATERIALS OF CONSTRUCTION 18
5.6 SUBSURFACE SOIL SAMPLES 19
5.7 ROCK SAMPLING (CORING) (ASTM D2113-83) 19
5.7.1 Diamond Core Drilling 23
5.7.2 Rock Sample Preparation and Documentation 23

6.0 REFERENCES **24**

ATTACHMENT

A DRILLING EQUIPMENT SIZES 25

FIGURE

NUMBER **PAGE**

1 STANDARD SIZES OF CORE BARRELS AND CASING 20

1.0 PURPOSE

The purpose of this procedure is to describe the methods and equipment necessary to perform soil and rock borings and identify the equipment, sequence of events, and appropriate methods necessary to obtain soil, both surface and subsurface, and rock samples during field sampling activities.

2.0 SCOPE

This guideline addresses most of the accepted and standard drilling techniques, their benefits, and drawbacks. It should be used generally to determine what type of drilling techniques would be most successful depending on site-specific geologic conditions and the type of sampling required.

The sampling methods described within this procedure are applicable to collecting surface and subsurface soil samples, and obtaining rock core samples for lithologic and hydrogeologic evaluation, excavation/foundation design, remedial alternative design and related civil engineering purposes.

3.0 GLOSSARY

Rock Coring - A method in which a continuous solid cylindrical sample of rock or compact rock-like soil is obtained by the use of a double tube core barrel that is equipped with an appropriate diamond-studded drill bit which is advanced with a hydraulic rotary drilling machine.

Wire-Line Coring - As an alternative to conventional coring, this technique is valuable in deep hole drilling, since this method eliminates trips in and out of the hole with the coring equipment. With this technique, the core barrel becomes an integral part of the drill rod string. The drill rod serves as both a coring device and casing.

4.0 RESPONSIBILITIES

Project Manager - In consultation with the project geologist, the Project Manager is responsible for evaluating the drilling requirements for the site and specifying drilling techniques that will be successful given the study objectives and the known or suspected geologic conditions at the site. The Project Manager also determines the disposal methods for products generated by drilling, such as drill cuttings and well development water, as well as any specialized supplies or logistical support required for the drilling operations.

Field Operations Leader (FOL) - The FOL is responsible for the overall supervision and scheduling of drilling activities, and is strongly supported by the project geologist.

Project Geologist - The project geologist is responsible for ensuring that standard and approved drilling procedures are followed. The geologist will generate a detailed boring log for each test hole. This log shall include a description of materials, samples, method of sampling, blow counts, and other pertinent drilling and testing information that may be obtained during drilling (see SOPs SA-6.3 and GH-1.5). Often this position for inspecting the drilling operations may be filled by other geotechnical personnel, such as soils and foundation engineers, civil engineers, etc.

Determination of the exact location for borings is the responsibility of the site geologist. The final location for drilling must be properly documented on the boring log. The general area in which the borings are to be located will be shown on a site map included in the Work Plan and/or Sampling and Analysis Plan.

Drilling Subcontractor - Operates under the supervision of the FOL. Responsible for obtaining all drilling permits and clearances, and supplying all services (including labor), equipment and material required to

perform the drilling, testing, and well installation program, as well as maintenance and quality control of such required equipment except as stated in signed and approved subcontracts.

The driller must report any major technical or analytical problems encountered in the field to the FOL within 24 hours of determination, and must provide advance written notification of any changes in field procedures, describing and justifying such changes. No such changes shall be made unless requested and authorized in writing by the FOL (with the concurrence of the Project Manager). Depending on the subcontract, the Project Manager may need to obtain written authorization from appropriate administrative personnel before approving any changes.

The drilling subcontractor is responsible for following decontamination procedures specified in the project plan documents. Upon completion of the work, the driller is responsible for demobilizing all equipment, cleaning up any materials deposited on site during drilling operations, and properly backfilling any open borings.

5.0 PROCEDURES

5.1 General

The purpose of drilling boreholes is:

- To determine the type, thickness, and certain physical and chemical properties of the soil, water and rock strata which underlie the site.
- To install monitoring wells or piezometers.

All drilling and sampling equipment will be cleaned between samples and borings using appropriate decontamination procedures as outlined in SOP SA-7.1. Unless otherwise specified, it is generally advisable to drill borings at "clean" locations first, and at the most contaminated locations last, to reduce the risk of spreading contamination between locations. All borings must be logged by the site geologist as they proceed (see SOPs SA-6.3 and GH-1.5). Situations where logging would not be required would include installation of multiple well points within a small area, or a "second attempt" boring adjacent to a boring that could not be continued through resistant material. In the latter case, the boring log can be resumed 5 feet above the depth at which the initial boring was abandoned, although the site geologist should still confirm that the stratigraphy at the redrilled location conforms essentially with that encountered at the original location. If significant differences are seen, each hole should be logged separately.

5.2 Drilling Methods

The selected drilling methods described below apply to drilling in subsurface materials, including, but not limited to, sand, gravel, clay, silt, cobbles, boulders, rock and man-made fill. Drilling methods should be selected after studying the site geology and terrain, the waste conditions at the site, and reviewing the purpose of drilling and the overall subsurface investigation program proposed for the site. The full range of different drilling methods applicable to the proposed program should be identified with final selection based on relative cost, availability, time constraints, and how well each method meets the sampling and testing requirements of the individual drilling program.

5.2.1 Continuous-Flight Hollow-Stem Auger Drilling

This method of drilling consists of rotating augers with a hollow stem into the ground. Cuttings are brought to the surface by the rotating action of the auger. This method is relatively quick and inexpensive. Advantages of this type of drilling include:

- Samples can be obtained without pulling the augers out of the hole. However, this is a poor method for obtaining grab samples from thin, discrete formations because of mixing of soils which occurs as the material is brought to the surface. Sampling of such formations requires the use of split-barrel or thin-wall tube samplers advanced through the hollow core of the auger.
- No drilling fluids are required.
- A well can be installed inside the auger stem and backfilled as the augers are withdrawn.

Disadvantages and limitations of this method of drilling include:

- Augering can only be done in unconsolidated materials.

- The inside diameter of hollow stem augers used for well installation should be at least 4 inches greater than the well casing. Use of such large-diameter hollow-stem augers is more expensive than the use of small-diameter augers in boreholes not used for well installation. Furthermore, the density of unconsolidated materials and depths become more of a limiting factor. More friction is produced with the larger diameter auger and subsequently greater torque is needed to advance the boring.

- The maximum effective depth for drilling is 150 feet or less, depending on site conditions and the size of augers used.

- In augering through clean sand formations below the water table, the sand will tend to flow into the hollow stem when the plug is removed for soil sampling or well installation. If the condition of "running" or "flowing" sands is persistent at a site, an alternative method of drilling is recommended, in particular for wells or boreholes deeper than 25 feet.

Hollow-stem auger drilling is the preferred method of drilling. Most alternative methods require the introduction of water or mud downhole (air rotary is the exception) to maintain the open borehole. With these other methods, great care must be taken to ensure that the method does not interfere with the collection of a representative sample (which may be the prime objective of the borehole construction). With this in mind, the preferred order of choice of drilling method after hollow-stem augering (HSA) is:

- Cable tool
- Casing drive (air)
- Air rotary
- Mud rotary
- Rotosonic
- Drive and wash
- Jetting

However, the use of any method will also depend on efficiency and cost-effectiveness. In many cases, mud rotary is the only feasible alternative to hollow-stem augering. Thus, mud rotary drilling is generally acceptable as a first substitute for HSA.

The procedures for sampling soils through holes drilled by hollow-stem auger shall conform with the applicable ASTM Standards: D1587-83 and D1586-84. The guidelines established in SOP SA-1.3 shall also be followed. The hollow-stem auger may be advanced by any power-operated drilling machine having sufficient torque and ram range to rotate and force the auger to the desired depth. The machine must, however, be equipped with the accessory equipment needed to perform required sampling, or rock coring.

The hollow-stem auger may be used without the plug when boring for geotechnical examination or for well installation. However, when drilling below the water table, specially designed plugs which allow

passage of formation water but not solid material shall be used (see Reference 1 of this guideline). This drilling configuration method also prevents blow back and plugging of the auger when the plug is removed for sampling.

Alternately, it may be necessary to keep the hollow stem full of water, at least to the level of the water table, to prevent blowback and plugging of the auger. If water is added to the hole, it must be sampled and analyzed to determine if it is free from contaminants prior to use. In addition, the amount of water introduced, the amount recovered upon attainment of depth, and the amount of water extracted during well development must be carefully logged in order to ensure that a representative sample of the formation water can be obtained. Well development should occur as soon after well completion as practicable (see SOP GH-2.8 for well development procedures). If gravelly or hard material is encountered which prevents advancing the auger to the desired depth, augering should be halted and either driven casing or hydraulic rotary methods should be attempted. If the depth to the bedrock/soil interface and bedrock lithology must be determined, then a 5-foot confirmatory core run should be conducted (see Section 5.2.9).

At the option of the Field Operations Leader (in communication with the Project Manager), when resistant materials prevent the advancement of the auger, a new boring can be attempted. The original boring must be properly backfilled and the new boring started a short distance away at a location determined by the site geologist. If multiple water bearing strata were encountered, the original boring must be grouted. In some formations, it may be prudent to also grout borings which penetrate only the water table aquifer, since loose soil backfill in the boring may still provide a preferred pathway for surface liquids to reach the water table. Backfilling requirements may also be driven by state or local regulations.

5.2.2 Continuous-Flight Solid-Stem Auger Drilling

This drilling method is similar to hollow-stem augering. Practical application of this method is severely restricted compared to use of hollow-stem augers. Split-barrel (split-spoon) sampling cannot be performed without pulling the augers out, which may allow the hole to collapse. The continuous-flight solid-stem auger drilling method is therefore very time consuming and is not cost effective. Also, augers would have to be withdrawn before installing a monitoring well, which again, may allow the hole to collapse. Furthermore, geologic logging by examining the soils brought to the surface is unreliable, and depth to water may be difficult to determine while drilling.

There would be very few situations where use of a solid-stem auger would be preferable to other drilling methods. The only practical applications of this method would be to drill boreholes for well installation where no lithologic information is desired and the soils are such that the borehole can be expected to remain open after the augers are withdrawn. Alternatively, this technique can be used to find depth to bedrock in an area when no other information is required from drilling.

5.2.3 Rotary Drilling

Direct rotary drilling includes air-rotary and fluid-rotary drilling. For air or fluid-rotary drilling, the rotary drill may be advanced to the desired depth by any power-operated drilling machine having sufficient torque and ram range to rotate and force the bit to the desired depth. The drilling machine must, however, be equipped with any accessory equipment needed to perform required sampling, or coring. Prior to sampling, any settled drill cuttings in the borehole must be removed.

Air-rotary drilling is a method of drilling where the drill rig simultaneously turns and exerts a downward pressure on the drilling rods and bit while circulating compressed air down the inside of the drill rods, around the bit, and out the annulus of the borehole. Air circulation serves to both cool the bit and remove the cuttings from the borehole. Advantages of this method include:

- The drilling rate is high (even in rock).
- The cost per foot of drilling is relatively low.
- Air-rotary rigs are common in most areas.
- No drilling fluid is required (except when water is injected to keep down dust).
- The borehole diameter is large, to allow room for proper well installation procedures.

Disadvantages to using this method include:

- Formations must be logged from the cuttings that are blown to the surface and thus the depths of materials logged are approximate.
- Air blown into the formation during drilling may "bind" the formation and impede well development and natural groundwater flow.
- In-situ samples cannot be taken, unless the hole is cased.
- Casing must generally be used in unconsolidated materials.
- Air-rotary drill rigs are large and heavy.
- Large amounts of Investigation Derived Waste (IDW) may be generated which may require containerization, sampling, and off-site disposal.

A variation of the typical air-rotary drill bit is a down hole hammer which hammers the drill bit down as it drills. This makes drilling in hard rock faster. Air-rotary drills can also be adapted to use for rock coring although they are generally slower than other types of core drills. A major application of the air-rotary drilling method would be to drill holes in rock for well installation.

Fluid-Rotary drilling operates in a similar manner to air-rotary drilling except that a drilling fluid ("mud") or clean water is used in place of air to cool the drill bit and remove cuttings. There are a variety of fluids that can be used with this drilling method, including bentonite slurry and synthetic slurries. If a drilling fluid other than water/cuttings is used, it must be a natural clay (i.e., bentonite) and a "background" sample of the fluid should be taken for analysis of possible organic or inorganic contaminants.

Advantages to the fluid-rotary drilling method include:

- The ability to drill in many types of formations.
- Relatively quick and inexpensive.
- Split-barrel (split-spoon) or thin-wall (Shelby) tube samples can be obtained without removing drill rods if the appropriate size drill rods and bits (i.e., fish-tail or drag bit) are used.
- In some borings temporary casing may not be needed as the drilling fluids may keep the borehole open.
- Drill rigs are readily available in most areas.

Disadvantages to this method include:

- Formation logging is not as accurate as with hollow-stem auger method if split-barrel (split-spoon) samples are not taken (i.e., the depths of materials logged from cuttings delivered to the surface are approximate).

- Drilling fluids reduce permeability of the formation adjacent to the boring to some degree, and require more extensive well development than "dry" techniques (augering, air-rotary).
- No information on depth to water is obtainable while drilling.
- Fluids are needed for drilling, and there is some question about the effects of the drilling fluids on subsequent water samples obtained. For this reason as well, extensive well development may be required.
- In very porous materials (i.e., rubble fill, boulders, coarse gravel) drilling fluids may be continuously lost into the formation. This requires either constant replenishment of the drilling fluid, or the use of casing through this formation.
- Drill rigs are large and heavy, and must be supported with supplied water.
- Groundwater samples can be potentially diluted with drilling fluid.

The procedures for performing direct rotary soil investigations and sampling shall conform with the applicable ASTM standards: D2113-83, D1587-83, and D1586-84.

Soil samples shall be taken as specified by project plan documents, or more frequently, if requested by the project geologist. Any required sampling shall be performed by rotation, pressing, or driving in accordance with the standard or approved method governing use of the particular sampling tool.

When field conditions prevent the advancement of the hole to the desired depth, a new boring may be drilled at the request of the Field Operations Leader. The original boring shall be backfilled using methods and materials appropriate for the given site and a new boring started a short distance away at a location determined by the project geologist.

5.2.4 Rotosonic Drilling

The Rotosonic drilling method employs a high frequency vibrational and low speed rotational motion coupled with down pressure to advance the cutting edge of a drill string. This produces a uniform borehole while providing a continuous, undisturbed core sample of both unconsolidated and most bedrock formations. Rotosonic drilling advances a 4-inch diameter to 12-inch diameter core barrel for sampling and can advance up to a 12-inch diameter outer casing for the construction of standard and telescoped monitoring wells. During drilling, the core barrel is advanced ahead of the outer barrel in increments as determined by the site geologist and depending upon type of material, degree of subsurface contamination and sampling objectives.

The outer casing can be advanced at the same time as the inner drill string and core barrel, or advanced down over the inner drill rods and core barrel, or after the core barrel has moved ahead to collect the undisturbed sample and has been pulled out of the borehole. The outer casing can be advanced dry in most cases, or can be advanced with water or air depending upon the formations being drilled, the depth and diameter of the hole, or requirements of the project.

Advantages of this method include:

- Sampling and well installation are faster as compared to other drilling methods.
- Continuous sampling, with larger sample volume as compared to split-spoon sampling.

- The ability to drill through difficult formations such as cobbles or boulders, hard till and bedrock.
- Reduction of IDW by an average of 70 to 80 percent.
- Well installations are quick and controlled by elimination of potential bridging of annular materials during well installation, due to the ability to vibrate the outer casing during removal.

Disadvantages include:

- The cost for Rotosonic drilling as compared to other methods are generally higher. However, the net result can be a significant savings considering reduced IDW and shortened project duration.
- Rotosonic drill rigs are large and need ample room to drill, however, Rotosonic units can be placed on the ground or placed on an ATV.
- There are a limited number of Rotosonic drilling contractors at the present time.

5.2.5 Reverse Circulation Rotary Drilling

The common reverse-circulation rig is a water or mud-rotary rig with a large-diameter drill pipe which circulates the drilling water down the annulus and up the inside of the drill pipe (reverse flow direction from direct mud-rotary). This type of rig is used for the construction of large-capacity production water wells and is not suited for small, water quality sampling wells because of the use of drilling muds and the large-diameter hole which is created. A few special reverse-circulation rotary rigs are made with double-wall drill pipe. The drilling water or air is circulated down the annulus between the drill pipes and up inside the inner pipe.

Advantages of the latter method include:

- The formation water is not contaminated by the drilling water.
- Formation samples can be obtained, from known depths.
- When drilling with air, immediate information is available regarding the water-bearing properties of formations penetrated.
- Collapsing of the hole in unconsolidated formations is not as great a problem as when drilling with the normal air-rotary rig.

Disadvantages include:

- Double-wall, reverse-circulation drill rigs are rare and expensive to operate.
- Placing cement grout around the outside of the well casing above a well screen often is difficult, especially when the screen and casing are placed down through the inner drill pipe before the drill pipe is pulled out.

5.2.6 Drill-through Casing Driver

The driven-casing method consists of alternately driving casing (fitted with a sharp, hardened casing shoe) into the ground using a hammer lifted and dropped by the drill rig (or an air-hammer) and cleaning out the casing using a rotary chopping bit and air or water to flush out the materials. The casing is driven down in stages (usually 5 feet per stage); a continuous record is kept of the blows per foot in driving the

casing (see SOP GH-1.5). The casing is normally advanced by a 300-pound hammer falling freely through a height of 30 inches. Simultaneous washing and driving of the casing is not recommended. If this procedure is used, the elevations within which wash water is used and in which the casing is driven must be clearly recorded.

The driven casing method is used in unconsolidated formations only. When the boring is to be used for later well installation, the driven casing used should be at least 4 inches larger in diameter than the well casing to be installed. Advantages to this method of drilling include:

- Split-barrel (split-spoon) sampling can be conducted while drilling.
- Well installation is easily accomplished.
- Drill rigs used are relatively small and mobile.
- The use of casing minimizes flow into the hole from upper water-bearing layers; therefore, multiple aquifers can be penetrated and sampled for rough field determinations of some water quality parameters.

Some of the disadvantages include:

- This method can only be used in unconsolidated formations.
- The method is slower than other methods (average drilling progress is 30 to 50 feet per day).
- Maximum depth of the borehole varies with the size of the drill rig and casing diameter used, and the nature of the formations drilled.
- The cost per hour or per foot of drilling may be substantially higher than other drilling methods.
- It is difficult and time consuming to pull back the casing if it has been driven very deep (deeper than 50 feet in many formations).

5.2.7 Cable Tool Drilling

A cable tool rig uses a heavy, solid-steel, chisel-type drill bit ("tool") suspended on a steel cable, which when raised and dropped, chisels or pounds a hole through the soils and rock. Drilling progress may be expedited by the use of "slip-jars" which serve as a cable-activated down hole percussion device to hammer the bit ahead.

When drilling through the unsaturated zone, some water must be added to the hole. The cuttings are suspended in the water and then bailed out periodically. Below the water table, after sufficient ground water enters the borehole to replace the water removed by bailing, no further water needs to be added.
When soft caving formations are encountered, it is usually necessary to drive casing as the hole is advanced to prevent collapse of the hole. Often the drilling can be only a few feet below the bottom of the casing. Because the drill bit is lowered through the casing, the hole created by the bit is smaller than the casing. Therefore, the casing (with a sharp, hardened casing shoe on the bottom) must be driven into the hole (see Section 5.2.5 of this guideline).

Advantages of the cable-tool method include the following:

- Information regarding water-bearing zones is readily available during the drilling. Even relative permeabilities and rough water quality data from different zones penetrated can be obtained by skilled operators.

- The cable-tool rig can operate satisfactorily in all formations, but is best suited for caving, boulder, cobble or coarse gravel type formations (e.g., glacial till) or formations with large cavities above the water table (such as limestones).

- When casing is used, the casing seals formation water out of the hole, preventing down hole contamination and allowing sampling of deeper aquifers for field-measurable water quality parameters.

- Split-barrel (split-spoon) or thin-wall (Shelby) tube samples can be collected through the casing.

Disadvantages include:

- Drilling is slow compared with rotary rigs.

- The necessity of driving the casing in unconsolidated formations requires that the casing be pulled back if exposure of selected water-bearing zones is desired. This process complicates the well completion process and often increases costs. There is also a chance that the casing may become stuck in the hole.

- The relatively large diameters required (minimum of 4-inch casing) plus the cost of steel casing result in higher costs compared to rotary drilling methods where casing is not required (e.g., such use of a hollow-stem auger).

- Cable-tool rigs have largely been replaced by rotary rigs. In some parts of the U.S., availability may be difficult.

5.2.8 Jet Drilling (Washing)

Jet drilling, which should be used only for piezometer or vadose zone sampler installation, consists of pumping water or drilling mud down through a small diameter (1/2- to 2-inch) standard pipe (steel or PVC). The pipe may be fitted with a chisel bit or a special jetting screen. Formation materials dislodged by the bit and jetting action of the water are brought to the surface through the annulus around the pipe. As the pipe is jetted deeper, additional lengths of pipe may be added at the surface.

Jet percussion is a variation of the jetting method, in which the casing is driven with a drive weight. Normally, this method is used to place 2-inch-diameter casing in shallow, unconsolidated sand formations, but this method has also been used to install 3- to 4-inch-diameter casings to a depth of 200 feet.

Jetting is acceptable in very soft formations, usually for shallow sampling, and when introduction of drilling water to the formation is acceptable. Such conditions would occur during rough stratigraphic investigation or installation of piezometers for water level measurement. Advantages of this method include:

- Jetting is fast and inexpensive.

- Because of the small amount of equipment required, jetting can be accomplished in locations where access by a normal drilling rig would be very difficult. For example, it would be possible to jet down a well point in the center of a lagoon at a fraction of the cost of using a drill rig.

- Jetting numerous well points just into a shallow water table is an inexpensive method for determining the water table contours, hence flow direction.

Disadvantages include the following:

- A large amount of foreign water or drilling mud is introduced above and into the formation to be sampled.
- Jetting is usually done in very soft formations which are subject to caving. Because of this caving, it is often not possible to place a grout seal above the screen to assure that water in the well is only from the screened interval.
- The diameter of the casing is usually limited to 2 inches.
- Jetting is only possible in very soft formations that do not contain boulders or coarse gravel, and the depth limitation is shallow (about 30 feet without jet percussion equipment).
- Large quantities of water are often needed.

5.2.9 Drilling with a Hand Auger

This method is applicable wherever the formation, total depth of sampling, and the site and groundwater conditions are such as to allow hand auger drilling. Hand augering can also be considered at locations where drill rig access is not possible. All hand auger borings will be performed according to ASTM D1452-80.

Samples should be taken continuously unless otherwise specified by the project plan documents. Any required sampling is performed by rotation, pressing, or driving in accordance with the standard or approved method governing use of the particular sampling tool. Typical equipment used for sampling and advancing shallow "hand auger" holes are Iwan samplers (which are rotated) or post hole diggers (which are operated like tongs). These techniques are slow but effective where larger pieces of equipment do not have access, and where very shallow holes are desired (less than 15 feet). Surficial soils must be composed of relatively soft and non-cemented formations to allow penetration by the auger.

5.2.10 Rock Drilling and Coring

When soil borings cannot be continued using augers or rotary methods due to the hardness of the soil or when rock or large boulders are encountered, drilling and sampling can be performed using a diamond bit corer in accordance with ASTM D2113.

Drilling is done by rotating and applying downward pressure to the drill rods and drill bit. The drill bit is a circular, hollow, diamond-studded bit attached to the outer core barrel in a double-tube core barrel. The use of single-tube core barrels is not recommended, as the rotation of the barrel erodes the sample and limits its use for detailed geological evaluation. Water or air is circulated down through the drill rods and annular space between the core barrel tubes to cool the bit and remove the cuttings. The bit cuts a core out of the rock which rises into an inner barrel mounted inside the outer barrel. The inner core barrel and rock core are removed by lowering a wire line with a coupling into the drill rods, latching onto the inner barrel and withdrawing the inner barrel. A less efficient variation of this method utilizes a core barrel that cannot be removed without pulling all of the drill rods. This variation is practical only if less than 50 feet of core is required.

Core borings are made through the casing used for the soil borings. The casing must be driven and sealed into the rock formation to prevent seepage from the overburden into the hole to be cored (see

Section 5.3 of this guideline). A double-tube core barrel with a diamond bit and reaming shell or equivalent should be used to recover rock cores of a size specified in the project plans. The most common core barrel diameters are listed in Attachment A.

Soft or decomposed rock should be sampled with a driven split-barrel whenever possible or cored with a Denison or Pitcher sampler.

When coring rock, including shale and claystone, the speed of the drill and the drilling pressure, amount and pressure of water, and length of run can be varied to give the maximum recovery from the rock being drilled. Should any rock formation be so soft or broken that the pieces continually fall into the hole causing unsatisfactory coring, the hole should be reamed and a flush-joint casing installed to a point below the broken formation. The size of the flush-joint casing must permit securing the core size specified. When soft or broken rock is anticipated, the length of core runs should be reduced to less than 5 feet to avoid core loss and minimize core disturbance.

Advantages of core drilling include:

- Undisturbed rock cores can be recovered for examination and/or testing.
- In formations in which the cored hole will remain open without casing, water from the rock fractures may be recovered from the well without the installation of a well screen and gravel pack.
- Formation logging is extremely accurate.
- Drill rigs are relatively small and mobile.

Disadvantages include:

- Water or air is needed for drilling.
- Coring is slower than rotary drilling (and more expensive).
- Depth to water cannot accurately be determined if water is used for drilling.
- The size of the borehole is limited.

This drilling method is useful if accurate determinations of rock lithology are desired or if open wells are to be installed into bedrock. To install larger diameter wells in coreholes, the hole must be reamed out to the proper size after boring, using air or mud rotary drilling methods.

5.2.11 Drilling & Support Vehicles

In addition to the drilling method required to accomplish the objectives of the field program, the type of vehicle carrying the drill rig and/or support equipment and its suitability for the site terrain, will often be an additional deciding factor in planning the drilling program. The types of vehicles available are extensive, and depend upon the particular drilling subcontractor's fleet. Most large drilling subcontractors will have a wide variety of vehicle and drill types suited for most drilling assignments in their particular region, while smaller drilling subcontractors will usually have a fleet of much more limited diversity. The weight, size, and means of locomotion (tires, tracks, etc.) of the drill rig must be selected to be compatible with the site terrain to assure adequate mobility between borehole locations. Such considerations also apply to necessary support vehicles used to transport water and/or drilling materials to the drill rigs at the borehole locations. When the drill rigs or support vehicles do not have adequate mobility to easily traverse the site, provisions must be made for assisting equipment, such as bulldozers, winches, timber planking, etc., to maintain adequate progress during the drilling program.

Some of the typical vehicles which are usually available for drill rigs and support equipment are:

- Totally portable drilling/sampling equipment, where all necessary components (tripods, samplers, hammers, catheads, etc.) may be hand carried to the borehole site. Drilling/sampling methods used with such equipment include:

  - Hand augers and lightweight motorized augers.
  - Retractable plug samplers--driven by hand (hammer).
  - Motorized cathead - a lightweight aluminum tripod with a small gas-engine cathead mounted on one leg, used to install small-diameter cased borings. This rig is sometimes called a "monkey on a stick."

- Skid-mounted drilling equipment containing a rotary drill or engine-driven cathead (to lift hammers and drill string), a pump, and a dismounted tripod. The skid is pushed, dragged, or winched (using the cathead drum) between boring locations.

- Small truck-mounted drilling equipment using a Jeep, stake body or other light truck (4 to 6 wheels), upon which are mounted the drill and/or a cathead, a pump, and a tripod or small drilling derrick. On some rigs, the drill and/or a cathead are driven by a power take-off from the truck, instead of by a separate engine.

- Track-mounted drilling equipment is similar to truck-mounted rigs, except that the vehicle used has wide bulldozer tracks for traversing soft ground. Sometimes a continuous-track "all terrain vehicle" is also modified for this purpose. Some types of tracked drill rigs are called "bombardier" or "weasel" rigs.

- Heavy truck-mounted drilling equipment is mounted on tandem or dual tandem trucks to transport the drill, derrick, winches, and pumps or compressors. The drill may be provided with a separate engine or may use a power take-off from the truck engine. Large augers, hydraulic rotary and reverse circulation rotary drilling equipment are usually mounted on such heavy duty trucks. For soft-ground sites, the drilling equipment is sometimes mounted on vehicles having low pressure, very wide diameter tires and capable of floating; these vehicles are called "swamp buggy" rigs.

- Marine drilling equipment is mounted on various floating equipment for drilling borings in lakes, estuaries and other bodies of water. The floating equipment varies, and is often manufactured or customized by the drilling subcontractor to suit specific drilling requirements. Typically, the range of flotation vehicles include:

  - Barrel-float rigs - a drill rig mounted on a timber platform buoyed by empty 55-gallon drums or similar flotation units.

  - Barge-mounted drill rigs.

  - Jack-up platforms - drilling equipment mounted on a floating platform having retractable legs to support the unit on the sea or lake bed when the platform is jacked up out of the water.

  - Drill ships - for deep ocean drilling.

In addition to the mobility for the drilling equipment, similar consideration must be given for equipment to support the drilling operations. Such vehicles or floating equipment are needed to transport drill water, drilling supplies and equipment, samples, drilling personnel, etc. to and/or from various boring locations.

5.2.12 Equipment Sizes

In planning subsurface exploration programs, care must be taken in specifying the various drilling components, so that they will fit properly in the boring or well.

For drilling open boreholes using rotary drilling equipment, tri-cone drill bits are employed with air, water or drilling mud to remove cuttings and cool the bit. Tri-cone bits are slightly smaller than the holes they drill (i.e., 5-7/8-inch or 7-7/8-inch bits will nominally drill 6-inch and 8-inch holes, respectively).

For obtaining split-barrel samples of a formation, samplers are commonly manufactured in sizes ranging from 2 inches to 3-1/2 inches in outside diameter. However, the most commonly used size is the 2-inch O.D., 1-3/8-inch I.D. split-barrel sampler. When this sampler is used and driven by a 140-pound (∀ 2-pound) hammer dropping 30 inches (∀ 1 inch), the procedure is called a Standard Penetration Test, and the blows per foot required to advance the sampler into the formation can be correlated to the formation's density or strength.

In planning the drilling of boreholes using hollow-stem augers or casing, in which thin-wall tube samples or diamond core drilling will be performed, refer to the various sizes and clearances provided in Attachment A of this guideline. Sizes selected must be stated in the project plan documents.

5.2.13 Estimated Drilling Progress

To estimate the anticipated rates of drilling progress for a site, the following must be considered:

- The speed of the drilling method employed.
- Applicable site conditions (e.g., terrain, mobility between borings, difficult drilling conditions in bouldery soils, rubble fill or broken rock, etc.).
- Project-imposed restrictions (e.g., drilling while wearing personal protective equipment, decontamination of drilling equipment, etc.).

Based on recent experience in drilling average soil conditions (no boulders) and taking samples at 5-foot intervals, for moderate depth (30 feet to 50 feet) boreholes (not including installation or development of wells), the following daily rates of total drilling progress may be anticipated for the following drilling methods:

Drilling Method	Average Daily Progress (linear feet)
Hollow-stem augers	75'
Solid-stem augers	50'
Mud-Rotary Drilling	100' (cuttings samples)
Rotosonic Drilling	100'-160' (continuous core)
Reverse-Circulation Rotary	100' (cuttings samples)
Skid-Rig with driven casing	30'
Rotary with driven casing	50'
Cable Tool	30'
Hand Auger	Varies
Continuous Rock Coring	50'

5.3 Prevention of Cross-Contamination

A telescoping or multiple casing technique minimizes the potential for the migration of contaminated groundwater to lower strata below a confining layer. The telescoping technique consists of drilling to a confining layer utilizing a spun casing method with a diamond cutting or augering shoe (a method similar to the rock coring method described in Section 5.2.10, except that larger casing is used) or by using a driven-casing method (see Section 5.2.6 of this guideline) and installing a specified diameter steel well casing. The operation consists of three separate steps. Initially, a drilling casing (usually of 8-inch diameter) is installed followed by installation of the well casing (6-inch-diameter is common for 2-inch wells). This well casing is driven into the confining layer to ensure a tight seal at the bottom of the hole. The well casing is sealed at the bottom with a bentonite-cement slurry. The remaining depth of the boring is drilled utilizing a narrower diameter spun or driven casing technique within the outer well casing. A smaller diameter well casing with an appropriate length of slotted screen on the lower end, is installed to the surface.

Clean sand is placed in the annulus around and to a point of about 2 feet above the screen prior to withdrawal of the drilling casing. The annular space above the screen and to a point 2 feet above the bottom of the outer well casing is sealed with a tremied cement-bentonite slurry which is pressure-grouted or displacement-grouted into the hole. The remaining casing annulus is backfilled with clean material and grouted at the surface, or it is grouted all the way to the surface.

5.4 Cleanout of Casing Prior to Sampling

The boring hole must be completely cleaned of disturbed soil, segregated coarse material and clay adhering to the inside walls of the casing. The cleaning must extend to the bottom edge of the casing and, if possible, a short distance further (1 or 2 inches) to bypass disturbed soil resulting from the advancement of the casing. Loss of wash water during cleaning should be recorded.

For disturbed samples both above and below the water table and where introduction of relatively large volumes of wash water is permissible, the cleaning operation is usually performed by washing the material out of the casing with water; however, the cleaning should never be accomplished with a strong, downward-directed jet which will disturb the underlying soil. When clean out has reached the bottom of the casing or slightly below (as specified above), the string of tools should be lifted one foot off the bottom with the water still flowing, until the wash water coming out of the casing is clear of granular soil particles. In formations where the cuttings contain gravel and other larger particles, it is often useful to repeatedly raise and lower the drill rods and wash bit while washing out the hole, to surge these large particles upward out of the hole. As a time saver, the drilling contractor may be permitted to use a split-barrel (split-spoon) sampler with the ball check valve removed as the clean-out tool, provided the material below the spoon is not disturbed and the shoe of the spoon is not damaged. However, because the ball check valve has been removed, in some formations it may be necessary to install a flap valve or spring sample retainer in the split-spoon bit, to prevent the sample from falling out as the sampler is withdrawn from the hole. The use of jet-type chopping bits is discouraged except where large boulders and cobbles or hard-cemented soils are encountered. If water markedly softens the soils above the water table, clean out should be performed dry with an auger.

For undisturbed samples below the water table, or where wash water must be minimized, clean out is usually accomplished with an appropriate diameter clean out auger. This auger has cutting blades at the bottom to carry loose material up into the auger, and up-turned water jets just above the cutting blades to carry the removed soil to the surface. In this manner, there is a minimum of disturbance at the top of the material to be sampled. If any gravel material washes down into the casing and cannot be removed by the clean out auger, a split-barrel sample can be taken to remove it; bailers and sandpumps should not

be used. For undisturbed samples above the groundwater table, all operations must be performed in a dry manner.

If all of the cuttings created by drilling through the overlying formations are not cleaned from the borehole prior to sampling, some of the problems which may be encountered during sampling include:

- When sampling is attempted through the cuttings remaining in the borehole, all or part of the sampler may become filled with the cuttings. This limits the amount of sample from the underlying formation which can enter and be retained in the sampler, and also raises questions as to the validity of the sample.

- If the cuttings remaining in the borehole contain coarse gravel and/or other large particles, these may block the bit of the sampler and prevent any materials from the underlying formation from entering the sampler when the sampler is advanced.

- In cased borings, should sampling be attempted through cuttings which remain in the lower portion of the casing, these cuttings could cause the sampler to become bound into the casing, such that it becomes very difficult to either advance or retract the sampler.

- When sampler blow counts are used to estimate the density or strength of the formation being sampled, the presence of cuttings in the borehole will usually give erroneously high sample blow counts.

To confirm that all cuttings have been removed from the borehole prior to attempting sampling, it is important that the site geologist measure the "stickup" of the drill string. This is accomplished by measuring the assembled length of all drill rods and bits or samplers (the drill string) as they are lowered to the bottom of the hole, below some convenient reference point of the drill string, then measuring the height of this reference point above the ground surface. The difference of these measurements is the depth of the drill string (lower end of the bit or sampler) below the ground surface, which must then be compared with the depth of sampling required (installed depth of casing or depth of borehole drilled). If the length of drill string below grade is more than the drilled or casing depth, the borehole has been cleaned too deeply, and this deeper depth of sampling must be recorded on the log. If the length of drill string below grade is less than the drilled or casing depth, the difference represents the thickness of cuttings which remain in the borehole. In most cases, an inch or two of cuttings may be left in the borehole with little or no problem. However, if more than a few inches of cuttings are encountered, the borehole must be recleaned prior to attempting sampling.

5.5 Materials of Construction

The effects of monitoring well construction materials on specific chemical analytical parameters are described and/or referenced in SOP GH-2.8. However, there are several materials used during drilling, particularly drilling fluids and lubricants, which must be used with care to avoid compromising the representativeness of soil and ground water samples.

The use of synthetic or organic polymer slurries is not permitted at any location where soil samples for chemical analysis are to be collected. These slurry materials could be used for installation of long-term monitoring wells, but the early time data in time series collection of ground water data may then be suspect. If synthetic or organic polymer muds are proposed for use at a given site, a complete written justification including methods and procedures for their use must be provided by the site geologist and approved by the Project Manager. The specific slurry composition and the concentration of suspected contaminants for each site must be known.

For many drilling operations, potable water is an adequate lubricant for drill stem and drilling tool connections. However, there are instances, such as drilling in tight clayey formations or in loose gravels, when threaded couplings must be lubricated to avoid binding. In these instances, to be determined in the field by the judgment of the site geologist and noted in the site logbook, and only after approval by the Project Manager, a vegetable oil or silicone-based lubricant should be used. Petroleum based greases, etc. will not be permitted. Samples of lubricants used must be provided and analyzed for chemical parameters appropriate to the given site.

5.6 Subsurface Soil Samples

Subsurface soil samples are used to characterize subsurface stratigraphy. This characterization can indicate the potential for migration of chemical contaminants in the subsurface. In addition, definition of the actual migration of contaminants can be obtained through chemical analysis of the soil samples. Where the remedial activities may include in-situ treatment or excavation and removal of the contaminated soil, the depth and areal extent of contamination must be known as accurately as possible.

Engineering and physical properties of soil may also be of interest should site construction activities be planned. Soil types, grain size distribution, shear strength, compressibility, permeability, plasticity, unit weight, and moisture content are some of the physical characteristics that may be determined for soil samples.

Penetration tests are also described in this procedure. The tests can be used to estimate various physical and engineering parameters such as relative density, unconfined compressive strength, and consolidation characteristics of soils.

Surface protocols for various soil sampling techniques are discussed in SOP SA-1.3. Continuous-core soil sampling and rock coring are discussed below. The procedures described here are representative of a larger number of possible drilling and sampling techniques. The choice of techniques is based on a large number of variables such as cost, local geology, etc. The final choice of methods must be made with the assistance of drilling subcontractors familiar with the local geologic conditions. Alternative techniques must be based upon the underlying principles of quality assurance implicit in the following procedures.

The CME continuous sample tube system provides a method of sampling soil continuously during hollow-stem augering. The 5-foot sample barrel fits within the lead auger of a hollow-auger column. The sampling system can be used with a wide range of I.D. hollow-stem augers (from 3-1/4-inch to 8-1/4-inch I.D.). This method has been used to sample many different materials such as glacial drift, hard clays and shales, mine tailings, etc. This method is particularly used when SPT samples are not required and a large volume of material is needed. Also, this method is useful when a visual description of the subsurface lithology is required. Rotosonic drilling methods also provide a continuous soil sample.

5.7 Rock Sampling (Coring) (ASTM D2113-83)

Rock coring enables a detailed assessment of borehole conditions to be made, showing precisely all lithologic changes and characteristics. Because coring is an expensive drilling method, it is commonly used for shallow studies of 500 feet or less, or for specific intervals in the drill hole that require detailed logging and/or analyzing. Rock coring can, however, proceed for thousands of feet continuously, depending on the size of the drill rig, and yields better quality data than air-rotary drilling, although at a substantially reduced drilling rate. Rate of drilling varies widely, depending on the characteristics of lithologies encountered, drilling methods, depth of drilling, and condition of drilling equipment. Average output in a 10-hour day ranges from 40 to over 200 feet. Down hole geophysical logging or television camera monitoring is sometimes used to complement the data generated by coring.

Borehole diameter can be drilled to various sizes, depending on the information needed. Standard sizes of core barrels (showing core diameter) and casing are shown in Figure 1.

Core drilling is used when formations are too hard to be sampled by soil sampling methods and a continuous solid sample is desired. Usually, soil samples are used for overburden, and coring begins in sound bedrock. Casing is set into bedrock before coring begins to prevent loose material from entering the borehole, to prevent loss of drilling fluid, and to prevent cross-contamination of aquifers.

Drilling through bedrock is initiated by using a diamond-tipped core bit threaded to a drill rod (outer core barrel) with a rate of drilling determined by the downward pressure, rotation speed of drill rods, drilling fluid pressure in the borehole, and the characteristics of the rock (mineralogy, cementation, weathering).

FIGURE 1

STANDARD SIZES OF CORE BARRELS AND CASING

Coring Bit Size	Nominal*		Set Size*	
	O.D.	I.D.	O.D.	I.D.
RWT	1 5/32	3/4	1.160	0.735
EWT	1 1/2	29/32	1.470	0.905
EX, EXL, EWG, EWM	1 1/2	13/16	1.470	0.845
AWT	1 7/8	1 9/32	1.875	1.281
AX, AXL, AWG, AWM	1 7/8	1 3/16	1.875	1.185
BWT	2 3/8	1 3/4	2.345	1.750
BX, BXL, BWG, BWM	2 3/8	1 5/8	2.345	1.655
NWT	3	2 5/16	2.965	2.313
NX, NXL, NWG, NWM	3	2 1/8	2.965	2.155
HWT	3 29/32	3 3/16	3.889	3.187
HWG	3 29/32	3	3.889	3.000
2 3/4 x 3 7/8	3 7/8	2 3/4	3.840	2.690
4 x 5 1/2	5 1/2	4	5.435	3.970
6 x 7 3/4	7 3/4	6	7.655	5.970
AX Wire line ___|___/	1 7/8	1	1.875	1.000
BX Wire line ___|___/	2 3/8	1 7/16	2.345	1.437
NX Wire line ___|___/	3	1 15/16	2.965	1.937

* All dimensions are in inches; to convert to millimeters, multiply by 25.4.
___|___/ Wire line dimensions and designations may vary according to manufacturer.

FIGURE 1
STANDARD SIZES OF CORE BARRELS AND CASING
PAGE TWO

Size Designations		Casing O.D., Inches	Casing Coupling		Casing bit O.D., Inches	Core barrel bit O.D., Inches*	Drill rod O.D., Inches	Approximate Core Diameter	
Casing; Casing coupling; Casing bits; Core barrel bits	Rod; rod couplings		O.D., Inches	I.D., Inches				Normal, Inches	Thinwall, Inches
RX	RW	1.437	1.437	1.188	1.485	1.160	1.094	---	0.735
EX	E	1.812	1.812	1.500	1.875	1.470	1.313	0.845	0.905
AX	A	2.250	2.250	1.906	2.345	1.875	1.625	1.185	1.281
BX	B	2.875	2.875	2.375	2.965	2.345	1.906	1.655	1.750
NX	N	3.500	3.500	3.000	3.615	2.965	2.375	2.155	2.313
HX	HW	4.500	4.500	3.938	4.625	3.890	3.500	3.000	3.187
RW	RW	1.437	Flush Joint	No Coupling	1.485	1.160	1.094	---	0.735
EW	EW	1.812			1.875	1.470	1.375	0.845	0.905
AW	AW	2.250			2.345	1.875	1.750	1.185	1.281
BW	BW	2.875			2.965	2.345	2.125	1.655	1.750
NW	NW	3.500			3.615	2.965	2.625	2.155	2.313
HW	HW	4.500			4.625	3.890	3.500	3.000	3.187
PW	---	5.500			5.650	---	---	---	---
SW	---	6.625			6.790	---	---	---	---
UW	---	7.625			7.800	---	---	---	---
ZW	---	8.625			8.810	---	---	---	---
---	AX __|__\	---	---	---	---	1.875	1.750	1.000	---
---	BX __|__\	---	---	---	---	2.345	2.250	1.437	---
---	NX __|__\	---	---	---	---	2.965	2.813	1.937	---

* All dimensions are in inches; to convert to millimeters, multiply by 25.4.
___|___/ Wire line dimensions and designations may vary according to manufacturer.

NOMINAL DIMENSIONS FOR DRILL CASINGS AND ACCESSORIES. (DIAMOND CORE DRILL MANUFACTURERS ASSOCIATION). 288-D-2889

5.7.1 Diamond Core Drilling

A penetration of typically less than 6 inches per 50 blows using a 140-lb. hammer dropping 30 inches with a 2-inch split-barrel sampler shall be considered an indication that soil sampling methods may not be applicable and that coring may be necessary to obtain samples.

When formations are encountered that are too hard to be sampled by soil sampling methods, the following diamond core drilling procedure may be used:

- Firmly seat a casing into the bedrock or the hard material to prevent loose materials from entering the hole and to prevent the loss of drilling fluid return. Level the surface of the rock or hard material when necessary by the use of a fishtail or other bits. If the drill hole can be retained open without the casing and if cross-contamination of aquifers in the unconsolidated materials is unlikely, leveling may be omitted.

- Begin the core drilling using a double-tube swivel-core barrel of the desired size. After drilling no more than 10 feet (3 m), remove the core barrel from the hole and take out the core. If the core blocks the flow of the drilling fluid during drilling, remove the core barrel immediately. In soft materials, a large starting size may be specified for the coring tools; where local experience indicates satisfactory core recovery or where hard, sound materials are anticipated, a smaller size or the single-tube type may be specified and longer runs may be drilled. NX/NW size coring equipment is the most commonly used size.

- When soft materials are encountered that produce less than 50 percent recovery, stop the core drilling. If soil samples are desired, secure such samples in accordance with the procedures described in ASTM Method D 1586 (Split-barrel Sampling) or in Method D 1587 (Thin-Walled Tube Sampling); sample soils per SOP SA-1.3. Resume diamond core drilling when refusal materials are again encountered.

- Since rock structures and the occurrence of seams, fissures, cavities, and broken areas are among the most important items to be detected and described, take special care to obtain and record these features. If such broken zones or cavities prevent further advance of the boring, one of the following three steps shall be taken: (1) cement the hole; (2) ream and case; or (3) case and advance with the next smaller size core barrel, as conditions warrant.

- In soft, seamy, or otherwise unsound rock, where core recovery may be difficult, M-design core barrels may be used. In hard, sound rock where a high percentage of core recovery is anticipated, the single-tube core barrel may be employed.

5.7.2 Rock Sample Preparation and Documentation

Once the rock coring has been completed and the core recovered, the rock core shall be carefully removed from the barrel, placed in a core tray (previously labeled "top" and "bottom" to avoid confusion), classified, and measured for percentage of recovery as well as the rock quality designation (RQD). Each core shall be described, classified, and logged using a uniform system as presented in SOP GH-1.5. If moisture content will be determined or if it is desirable to prevent drying (e.g., to prevent shrinkage of clay formations) or oxidation of the core, the core shall be wrapped in plastic sleeves immediately after logging. Each plastic sleeve shall be labeled with indelible ink. The boring number, run number, and the footage represented in each sleeve shall be included, as well as designating the top and bottom of the core run.

After sampling, rock cores shall be placed in the sequence of recovery in well-constructed wooden boxes provided by the drilling contractor. Rock cores from two different borings shall not be placed in the same

core box unless accepted by the Project Geologist. The core boxes shall be constructed to accommodate at least 20 linear feet of core in rows of approximately 5 feet each and shall be constructed with hinged tops secured with screws, and a latch (usually a hook and eye) to keep the top securely fastened down. Wood partitions shall be placed at the end of each core run and between rows.

The depth from the surface of the boring to the top and bottom of the drill run and run number shall be marked on the wooden partitions with indelible ink. A wooden partition (wooden block) shall be placed at the end of each run with the depth of the bottom of the run written on the block. These blocks will serve to separate successive core runs and indicate depth intervals for each run. The order of placing cores shall be the same in all core boxes. Rock core shall be placed in the box so that, when the box is open, with the inside of the lid facing the observer, the top of the cored interval contained within the box is in the upper left corner of the box, and the bottom of the cored interval is in the lower right corner of the box. The top and bottom of each core obtained and its true depth shall be clearly and permanently marked on each box. The width of each row must be compatible with the core diameter to prevent lateral movement of the core in the box. Similarly, an empty space in a row shall be filled with an appropriate filler material or spacers to prevent longitudinal movement of the core in the box.

The inside and outside of the core-box lid shall be marked by indelible ink to show all pertinent data on the box's contents. At a minimum, the following information shall be included:

- Project name.
- Project number.
- Boring number.
- Run numbers.
- Footage (depths).
- Recovery.
- RQD (%).
- Box number and total number of boxes for that boring (Example: Box 5 of 7).

For easy retrieval when core boxes are stacked, the sides and ends of the box shall also be labeled and include project number, boring number, top and bottom depths of core and box number.

Prior to final closing of the core box, a photograph of the recovered core and the labeling on the inside cover shall be taken. If moisture content is not critical, the core shall be wetted and wiped clean for the photograph. (This will help to show true colors and bedding features in the cores).

6.0 REFERENCES

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ATTACHMENT A

DRILLING EQUIPMENT SIZES

Drilling Component	Designation or Hole Size (Inches)	O.D. (Inches)	I.D. (Inches)	Coupling I.D. (Inches)
Hollow-stem augers (Ref. 7)	6 1/4	5	2 1/4	
	6 3/4	5 3/4	2 3/4	---
	7 1/4	6 1/4	3 1/4	---
	13 1/4	12	6	---
Thin Wall Tube Samplers (Ref. 7)	---	2	1 7/8	---
	---	2 1/2	2 3/8	---
	---	3	2 7/8	---
	---	3 1/2	3 3/8	---
	---	4 1/2	4 3/8	---
	---	5	4 3/4	---
Drill Rods (Ref. 7)	RW	1 3/32	23/32	13/32
	EW	1 3/8	15/16	7/16
	AW	1 3/4	1 1/4	5/8
	BW	2 1/8	1 3/4	3/4
	NW	2 5/8	2 1/4	1 3/8
	HW	3 1/2	3 1/16	2 3/8
	E	1 5/16	7/8	7/16
	A	1 5/8	1 1/8	9/16
	B	1 7/8	1 1/4	5/8
	N	2 3/8	2	1
				Wall Thickness (Inches)
Driven External Coupled Extra Strong Steel* Casing (Ref. 8)	2 1/2	2.875	2.323	0.276
	3	3.5	2.9	0.300
	3 1/2	4.0	3.364	0.318
	4	4.5	3.826	0.337
	5	5.63	4.813	0.375
	6	6.625	5.761	0.432
	8	8.625	7.625	0.500
	10	10.750	9.750	0.500
	12	12.750	11.750	0.500

* Add twice the casing wall thickness to casing O.D. to obtain the approximate O.D. of the external pipe couplings.

ATTACHMENT A
DRILLING EQUIPMENT SIZES

PAGE TWO

Drilling Component	Designation or Hole Size (Inches)	O.D. (Inches)	I.D. (Inches)	Coupling I.D. (Inches)
Flush Coupled Casing (Ref. 7)	RX	1 7/16	1 3/16	1 3/16
	EX	1 13/16	1 5/8	1 1/2
	AX	2 1/4	2	1 29/32
	BX	2 7/8	2 9/16	2 3/8
	NX	3 1/2	3 3/16	3
	HX	4 1/2	4 1/8	3 15/16
Flush Joint Casing (Ref. 7)	RW	1 7/16	1 3/16	
	EW	1 13/16	1 1/2	
	AW	2 1/4	1 29/32	
	BW	2 7/8	2 3/8	
	NW	3 1/2	3	
	HW	4 1/2	4	
	PW	5 1/2	5	
	SW	6 5/8	6	
	UW	7 5/8	7	
	ZW	8 5/8	8	
Diamond Core Barrels (Ref. 7)	EWM	1 1/2	7/8**	
	AWM	1 7/8	1 1/8**	
	BWM	2 3/8	1 5/8**	
	NWM	3	2 1/8	
	HWG	3 7/8	3	
	2 3/4 x 3 7/8	3 7/8	2 11/16	
	4 x 5 1/2	5 1/2	3 15/16	
	6 x 7 3/4	7 3/4	5 15/16	
	AQ (wireline)	1 57/64	1 1/16**	
	BQ (wireline)	2 23/64	1 7/16**	
	NQ (wireline)	2 63/64	1 7/8	
	HQ (wireline)	3 25/32	2 1/2	

** Because of the fragile nature of the core and the difficulty to identify rock details, use of small-diameter core (1 3/8") is not recommended.

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **3**

2.0 SCOPE **3**

3.0 GLOSSARY **3**

4.0 RESPONSIBILITIES **3**

5.0 PROCEDURES **3**

5.1 MATERIALS NEEDED 3
5.2 CLASSIFICATION OF SOILS 3
5.2.1 USCS Classification 6
5.2.2 Color 6
5.2.3 Relative Density and Consistency 6
5.2.4 Weight Percentages 7
5.2.5 Moisture 10
5.2.6 Stratification 10
5.2.7 Texture/Fabric/Bedding 10
5.2.8 Summary of Soil Classification 10
5.3 CLASSIFICATION OF ROCKS 13
5.3.1 Rock Type 13
5.3.2 Color 16
5.3.3 Bedding Thickness 16
5.3.4 Hardness 16
5.3.5 Fracturing 16
5.3.6 Weathering 17
5.3.7 Other Characteristics 17
5.3.8 Additional Terms Used in the Description of Rock 18
5.4 ABBREVIATIONS 19
5.5 BORING LOGS AND DOCUMENTATION 19
5.5.1 Soil Classification 19
5.5.2 Rock Classification 23
5.5.3 Classification of Soil and Rock from Drill Cuttings 24
5.6 REVIEW 24

6.0 REFERENCES **24**

7.0 RECORDS **25**

TABLE OF CONTENTS (Continued)

FIGURES

NUMBERS **PAGE**

1 BORING LOG (EXAMPLE) 4
2 CONSISTENCY FOR COHESIVE SOILS 8
3 BEDDING THICKNESS CLASSIFICATION 10
4 GRAIN SIZE CLASSIFICATION FOR ROCKS 12
5 COMPLETED BORING LOG (EXAMPLE) 17

1.0 PURPOSE

The purpose of this document is to establish standard procedures and technical guidance on borehole and sample logging.

2.0 SCOPE

These procedures provide descriptions of the standard techniques for borehole and sample logging. These techniques shall be used for each boring logged to provide consistent descriptions of subsurface lithology. While experience is the only method to develop confidence and accuracy in the description of soil and rock, the field geologist/engineer can do a good job of classification by careful, thoughtful observation and by being consistent throughout the classification procedure.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Site Geologist. Responsible for supervising all boring activities and assuring that each borehole is completely logged. If more than one rig is being used on site, the Site Geologist must make sure that each field geologist is properly trained in logging procedures. A brief review or training session may be necessary prior to the start up of the field program and/or upon completion of the first boring.

5.0 PROCEDURES

The classification of soil and rocks is one of the most important jobs of the field geologist/engineer. To maintain a consistent flow of information, it is imperative that the field geologist/engineer understand and accurately use the field classification system described in this SOP. This identification is based on visual examination and manual tests.

5.1 Materials Needed

When logging soil and rock samples, the geologist or engineer may be equipped with the following:

- Rock hammer
- Knife
- Camera
- Dilute hydrochloric acid (HCl)
- Ruler (marked in tenths and hundredths of feet)
- Hand Lens

5.2 Classification of Soils

All data shall be written directly on the boring log (Figure 1) or in a field notebook if more space is needed. Details on filling out the boring log are discussed in Section 5.5.

FIGURE 1

BORING LOG (EXAMPLE)

BORING LOG

Page ___ of ___

PROJECT NAME: _____ BORING NUMBER: _____
PROJECT NUMBER: _____ DATE: _____
DRILLING COMPANY: _____ GEOLOGIST: _____
DRILLING RIG: _____ DRILLER: _____

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	PID/FID Reading (ppm): Sampler BZ	PID/FID Reading (ppm): Borehole**	PID/FID Reading (ppm): Driller BZ**

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): _____

Remarks: _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

FIGURE 1 (CONTINUED)

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE-GRAINED SOILS More Than Half of Material is LARGER Than No. 200 Sieve Size					FINE-GRAINED SOILS More Than Half of Material is SMALLER Than No. 200 Sieve Size					
FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES	FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)				GROUP SYMBOL	TYPICAL NAMES
					Identification Procedures on Fraction Smaller than No. 40 Sieve Size					
						DRY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
GRAVELS (More Than Half of Coarse Fraction Is Larger Than No. 4 Sieve Size)	CLEAN GRAVELS (Less Than 5% Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	SILTS AND CLAYS Liquid Limit Less Than 50	None to Slight	Quick to Slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.		Medium to High	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	GRAVELS WITH FINES (More Than 12% Fines)	Non-plastic fines (for identification procedures, see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.		Slight to Medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
		Plastic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.	SILTS AND CLAYS Liquid Limit Greater Than 50	Slight to Medium	Slow to None	Slight to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
SANDS (More Than Half of Coarse Fraction Is Smaller Than No. 4 Sieve Size)	CLEAN SANDS (Less Than 5% Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	SW	Well graded sand, gravelly sands, little or no fines.		High to Very High	None	High	CH	Inorganic clays of high plasticity, fat clays.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.		Medium to High	None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity.
	SANDS WITH FINES (More Than 12% Fines)	Non-plastic fines (for identification procedures, see ML)	SM	Silty sands, poorly graded sand-silt mixtures.	HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other organic soils
		Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay mixtures.						

Boundary classifications: Soils possessing characteristics of two groups are designated by combining group symbols. For example, GW-GC, well graded gravel-sand mixture with clay binder.
All sieve sizes on this chart are U.S. Standard.

DENSITY OF GRANULAR SOILS	
DESIGNATION	STANDARD PENETRATION RESISTANCE-BLOWS/FOOT
Very Loose	0-4
Loose	5-10
Medium Loose	11-30
Dense	31-50
Very Dense	Over 50

CONSISTENCY OF COHESIVE SOILS			
CONSISTENCY	UNCONFINED STRENGTH (TONS/SQ. FT.)	STANDARD PENETRATION RESISTANCE-BLOWS/FOOT	FIELD IDENTIFICATION METHODS
Very Soft	Less than 0.25	0 to 2	Easily penetrated several inches by fist
Soft	0.25 to 0.50	2 to 4	Easily penetrated several inches by thumb.
Medium Stiff	0.50 to 1.0	4 to 8	Can be penetrated several inches by thumb.
Stiff	1.0 to 2.0	8 to 15	Readily indented by thumb.
Very Stiff	2.0 to 4.0	15 to 30	Readily indented by thumbnail.
Hard	More than 4.0	Over 30	Indented with difficulty by thumbnail.

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)			ROCK BROKENNESS		
Descriptive Terms	Scratcher or Knife Effects	Hammer Effects	Descriptive Terms	Abbreviation	Spacing
Soft	Easily Gouged	Crushes when pressed with hammer	Very Broken	(V.Br.)	0 - 2"
Medium Soft	Can be Gouged	Breaks (one blow); crumbly edges	Broken	(Br.)	2"-1'
Medium Hard	Can be scratched	Breaks (one blow); sharp edges	Blocky	(Bl.)	1'-3'
Hard	Cannot be scratched	Breaks considerably (several blows); sharp edges	Massive	(M)	3'-10'

LEGEND :

SOIL SAMPLES - TYPES	ROCK SAMPLES - TYPES		WATER LEVELS	
1-3" Split Barrel Sample	X-NX (Conventional) Core (2.1-1.8" O.D.)	12/ft		
S 3-5" O.D. Undisturbed Sample	G-NQ (Wireline) Core (2.1-1.8" O.D.)		▼ 12.4'	Initial Level to Water a Depth
O - Other Samples, Specify in Remarks	Z - Other Core Sizes, Specify in Remarks	12/ft		
			▼ 12.4'	Stabilized Level to Water a Depth

5.2.1 USCS Classification

Soils are to be classified according to the Unified Soil Classification System (USCS). This method of classification is detailed in Figure 1 (Continued).
This method of classification identifies soil types on the basis of grain size and cohesiveness.

Fine-grained soils, or fines, are smaller than the No. 200 sieve and are of two types: silt (M) and clay (C). Some classification systems define size ranges for these soil particles, but for field classification purposes, they are identified by their respective behaviors. Organic material (O) is a common component of soil but has no size range; it is recognized by its composition. The careful study of the USCS will aid in developing the competence and consistency necessary for the classification of soils.

Coarse-grained soils shall be divided into rock fragments, sand, or gravel. The terms sand and gravel not only refer to the size of the soil particles but also to their depositional history. To insure accuracy in description, the term rock fragments shall be used to indicate angular granular materials resulting from the breakup of rock. The sharp edges typically observed indicate little or no transport from their source area, and therefore the term provides additional information in reconstructing the depositional environment of the soils encountered. When the term "rock fragments" is used it shall be followed by a size designation such as "(1/4 inchΦ-1/2 inchΦ)" or "coarse-sand size" either immediately after the entry or in the remarks column. The USCS classification would not be affected by this variation in terms.

5.2.2 Color

Soil colors shall be described utilizing a single color descriptor preceded, when necessary, by a modifier to denote variations in shade or color mixtures. A soil could therefore be referred to as "gray" or "light gray" or "blue-gray." Since color can be utilized in correlating units between sampling locations, it is important for color descriptions to be consistent from one boring to another.

Colors must be described while the sample is still moist. Soil samples shall be broken or split vertically to describe colors. Samplers tend to smear the sample surface creating color variations between the sample interior and exterior.

The term "mottled" shall be used to indicate soils irregularly marked with spots of different colors. Mottling in soils usually indicates poor aeration and lack of good drainage.

Soil Color Charts shall not be used unless specified by the project manager.

5.2.3 Relative Density and Consistency

To classify the relative density and/or consistency of a soil, the geologist is to first identify the soil type. Granular soils contain predominantly sands and gravels. They are noncohesive (particles do not adhere well when compressed). Finer-grained soils (silts and clays) are cohesive (particles will adhere together when compressed).

The density of noncohesive, granular soils is classified according to standard penetration resistances obtained from split-barrel sampling performed according to the methods detailed in Standard Operating Procedures GH-1.3 and SA-1.3. Those designations are:

Designation	Standard Penetration Resistance (Blows per Foot)
Very loose	0 to 4

Loose	5 to 10
Medium dense	11 to 30
Dense	31 to 50
Very dense	Over 50

Standard penetration resistance is the number of blows required to drive a split-barrel sampler with a 2-inch outside diameter 12 inches into the material using a 140-pound hammer falling freely through 30 inches. The sampler is driven through an 18-inch sample interval, and the number of blows is recorded for each 6-inch increment. The density designation of granular soils is obtained by adding the number of blows required to penetrate the last 12 inches of each sample interval. It is important to note that if gravel or rock fragments are broken by the sampler or if rock fragments are lodged in the tip, the resulting blow count will be erroneously high, reflecting a higher density than actually exists. This shall be noted on the log and referenced to the sample number. Granular soils are given the USCS classifications GW, GP, GM, SW, SP, SM, GC, or SC (see Figure 1).

The consistency of cohesive soils is determined by performing field tests and identifying the consistency as shown in Figure 2.

Cohesive soils are given the USCS classifications ML, MH, CL, CH, OL, or OH (see Figure 1).

The consistency of cohesive soils is determined either by blow counts, a pocket penetrometer (values listed in the table as Unconfined Compressive Strength), or by hand by determining the resistance to penetration by the thumb. The pocket penetrometer and thumb determination methods are conducted on a selected sample of the soil, preferably the lowest 0.5 foot of the sample in the split-barrel sampler. The sample shall be broken in half and the thumb or penetrometer pushed into the end of the sample to determine the consistency. Do not determine consistency by attempting to penetrate a rock fragment. If the sample is decomposed rock, it is classified as a soft decomposed rock rather than a hard soil. Consistency shall not be determined solely by blow counts. One of the other methods shall be used in conjunction with it. The designations used to describe the consistency of cohesive soils are shown in Figure 2.

5.2.4 Weight Percentages

In nature, soils are comprised of particles of varying size and shape, and are combinations of the various grain types. The following terms are useful in the description of soil:

Terms of Identifying Proportion of the Component	Defining Range of Percentages by Weight
Trace	0 - 10 percent
Some	11 - 30 percent
Adjective form of the soil type (e.g., "sandy")	31 - 50 percent

FIGURE 2

CONSISTENCY FOR COHESIVE SOILS

Consistency	Standard Penetration Resistance (Blows per Foot)	Unconfined Compressive Strength (Tons/Sq. Foot by pocket penetration)	Field Identification
Very soft	0 to 2	Less than 0.25	Easily penetrated several inches by fist
Soft	2 to 4	0.25 to 0.50	Easily penetrated several inches by thumb
Medium stiff	4 to 8	0.50 to 1.0	Can be penetrated several inches by thumb with moderate effort
Stiff	8 to 15	1.0 to 2.0	Readily indented by thumb but penetrated only with great effort
Very stiff	15 to 30	2.0 to 4.0	Readily indented by thumbnail
Hard	Over 30	More than 4.0	Indented with difficulty by thumbnail

Examples:

- Silty fine sand: 50 to 69 percent fine sand, 31 to 50 percent silt.
- Medium to coarse sand, some silt: 70 to 80 percent medium to coarse sand, 11 to 30 percent silt.
- Fine sandy silt, trace clay: 50 to 68 percent silt, 31 to 49 percent fine sand, 1 to 10 percent clay.
- Clayey silt, some coarse sand: 70 to 89 percent clayey silt, 11 to 30 percent coarse sand.

5.2.5 Moisture

Moisture content is estimated in the field according to four categories: dry, moist, wet, and saturated. In dry soil, there appears to be little or no water. Saturated samples obviously have all the water they can hold. Moist and wet classifications are somewhat subjective and often are determined by the individual's judgment. A suggested parameter for this would be calling a soil wet if rolling it in the hand or on a porous surface liberates water, i.e., dirties or muddies the surface. Whatever method is adopted for describing moisture, it is important that the method used by an individual remains consistent throughout an entire drilling job.

Laboratory tests for water content shall be performed if the natural water content is important.

5.2.6 Stratification

Stratification can only be determined after the sample barrel is opened. The stratification or bedding thickness for soil and rock is depending on grain size and composition. The classification to be used for stratification description is shown in Figure 3.

5.2.7 Texture/Fabric/Bedding

The texture/fabric/bedding of the soil shall be described. Texture is described as the relative angularity of the particles: rounded, subrounded, subangular, and angular. Fabric shall be noted as to whether the particles are flat or bulky and whether there is a particular relation between particles (i.e., all the flat particles are parallel or there is some cementation). The bedding or structure shall also be noted (e.g., stratified, lensed, nonstratified, heterogeneous varved).

5.2.8 Summary of Soil Classification

In summary, soils shall be classified in a similar manner by each geologist/engineer at a project site. The hierarchy of classification is as follows:

- Density and/or consistency
- Color
- Plasticity (Optional)
- Soil types
- Moisture content
- Stratification
- Texture, fabric, bedding
- Other distinguishing features

FIGURE 3

BEDDING THICKNESS CLASSIFICATION

Thickness (metric)	Thickness (Approximate English Equivalent)	Classification
> 1.0 meter	> 3.3'	Massive
30 cm - 1 meter	1.0' - 3.3'	Thick Bedded
10 cm - 30 cm	4" - 1.0'	Medium Bedded
3 cm - 10 cm	1" - 4"	Thin Bedded
1 cm - 3 cm	2/5" - 1"	Very Thin Bedded
3 mm - 1 cm	1/8" - 2/5"	Laminated
1 mm - 3 mm	1/32" - 1/8"	Thinly Laminated
< 1 mm	<1/32"	Micro Laminated

(Weir, 1973 and Ingram, 1954)

5.3 Classification of Rocks

Rocks are grouped into three main divisions: sedimentary, igneous and metamorphic. Sedimentary rocks are by far the predominant type exposed at the earth's surface. The following basic names are applied to the types of rocks found in sedimentary sequences:

- Sandstone - Made up predominantly of granular materials ranging between 1/16 to 2 mm in diameter.
- Siltstone - Made up of granular materials less than 1/16 to 1/256 mm in diameter. Fractures irregularly. Medium thick to thick bedded.
- Claystone - Very fine-grained rock made up of clay and silt-size materials. Fractures irregularly. Very smooth to touch. Generally has irregularly spaced pitting on surface of drilled cores.
- Shale - A fissile very fine-grained rock. Fractures along bedding planes.
- Limestone - Rock made up predominantly of calcite ($CaCO_3$). Effervesces strongly upon the application of dilute hydrochloric acid.
- Coal - Rock consisting mainly of organic remains.
- Others - Numerous other sedimentary rock types are present in lesser amounts in the stratigraphic record. The local abundance of any of these rock types is dependent upon the depositional history of the area. Conglomerate, halite, gypsum, dolomite, anhydrite, lignite, etc. are some of the rock types found in lesser amounts.

In classifying a sedimentary rock the following hierarchy shall be noted:

- Rock type
- Color
- Bedding thickness
- Hardness
- Fracturing
- Weathering
- Other characteristics

5.3.1 Rock Type

As described above, there are numerous types of sedimentary rocks. In most cases, a rock will be a combination of several grain types, therefore, a modifier such as a sandy siltstone, or a silty sandstone can be used. The modifier indicates that a significant portion of the rock type is composed of the modifier. Other modifiers can include carbonaceous, calcareous, siliceous, etc.

Grain size is the basis for the classification of clastic sedimentary rocks. Figure 4 is the Udden-Wentworth classification that will be assigned to sedimentary rocks. The individual boundaries are slightly different than the USCS subdivision for soil classification. For field determination of grain sizes, a scale can be used for the coarse grained rocks. For example, the division between siltstone and claystone may not be measurable in the field. The boundary shall be determined by use of a hand lens. If the grains cannot be seen with the naked eye but are distinguishable with a hand lens, the rock is a siltstone. If the grains are not distinguishable with a hand lens, the rock is a claystone.

FIGURE 4

GRAIN SIZE CLASSIFICATION FOR ROCKS

Particle Name	Grain Size Diameter
Cobbles	> 64 mm
Pebbles	4 - 64 mm
Granules	2 - 4 mm
Very Coarse Sand	1 - 2 mm
Coarse Sand	0.5 - 1 mm
Medium Sand	0.25 - 0.5 mm
Fine Sand	0.125 - 0.25 mm
Very Fine Sand	0.0625 - 0.125 mm
Silt	0.0039 - 0.0625 mm

After Wentworth, 1922

5.3.2 Color

The color of a rock can be determined in a similar manner as for soil samples. Rock core samples shall be classified while wet, when possible, and air cored samples shall be scraped clean of cuttings prior to color classifications.

Rock color charts shall not be used unless specified by the Project Manager.

5.3.3 Bedding Thickness

The bedding thickness designations applied to soil classification (see Figure 3) will also be used for rock classification.

5.3.4 Hardness

The hardness of a rock is a function of the compaction, cementation, and mineralogical composition of the rock. A relative scale for sedimentary rock hardness is as follows:

- Soft - Weathered, considerable erosion of core, easily gouged by screwdriver, scratched by fingernail. Soft rock crushes or deforms under pressure of a pressed hammer. This term is always used for the hardness of the saprolite (decomposed rock which occupies the zone between the lowest soil horizon and firm bedrock).

- Medium soft - Slight erosion of core, slightly gouged by screwdriver, or breaks with crumbly edges from single hammer blow.

- Medium hard - No core erosion, easily scratched by screwdriver, or breaks with sharp edges from single hammer blow.

- Hard - Requires several hammer blows to break and has sharp conchoidal breaks. Cannot be scratched with screwdriver.

Note the difference in usage here of the works "scratch" and "gouge." A scratch shall be considered a slight depression in the rock (do not mistake the scraping off of rock flour from drilling with a scratch in the rock itself), while a gouge is much deeper.

5.3.5 Fracturing

The degree of fracturing or brokenness of a rock is described by measuring the fractures or joint spacing. After eliminating drilling breaks, the average spacing is calculated and the fracturing is described by the following terms:

- Very broken (V. BR.) - Less than 2-inch spacing between fractures
- Broken (BR.) - 2-inch to 1-foot spacing between fractures
- Blocky (BL.) - 1- to 3-foot spacing between fractures
- Massive (M.) - 3 to 10-foot spacing between fractures

The structural integrity of the rock can be approximated by calculating the Rock Quality Designation (RQD) of cores recovered. The RQD is determined by adding the total lengths of all pieces exceeding 4 inches and dividing by the total length of the coring run, to obtain a percentage.

Method of Calculating RQD

(After Deere, 1964)

$$RQD\ \% = r/l \times 100$$

r = Total length of all pieces of the lithologic unit being measured, which are greater than 4 inches length, and have resulted from natural breaks. Natural breaks include slickensides, joints, compaction slicks, bedding plane partings (not caused by drilling), friable zones, etc.

l = Total length of the coring run.

5.3.6 Weathering

The degree of weathering is a significant parameter that is important in determining weathering profiles and is also useful in engineering designs. The following terms can be applied to distinguish the degree of weathering:

- Fresh - Rock shows little or no weathering effect. Fractures or joints have little or no staining and rock has a bright appearance.
- Slight - Rock has some staining which may penetrate several centimeters into the rock. Clay filling of joints may occur. Feldspar grains may show some alteration.
- Moderate - Most of the rock, with exception of quartz grains, is stained. Rock is weakened due to weathering and can be easily broken with hammer.
- Severe - All rock including quartz grains is stained. Some of the rock is weathered to the extent of becoming a soil. Rock is very weak.

5.3.7 Other Characteristics

The following items shall be included in the rock description:

- Description of contact between two rock units. These can be sharp or gradational.
- Stratification (parallel, cross stratified).
- Description of any filled cavities or vugs.
- Cementation (calcareous, siliceous, hematitic).
- Description of any joints or open fractures.
- Observation of the presence of fossils.
- Notation of joints with depth, approximate angle to horizontal, any mineral filling or coating, and degree of weathering.

All information shown on the boring logs shall be neat to the point where it can be reproduced on a copy machine for report presentation. The data shall be kept current to provide control of the drilling program and to indicate various areas requiring special consideration and sampling.

5.3.8 Additional Terms Used in the Description of Rock

The following terms are used to further identify rocks:

- Seam - Thin (12 inches or less), probably continuous layer.

- Some - Indicates significant (15 to 40 percent) amounts of the accessory material. For example, rock composed of seams of sandstone (70 percent) and shale (30 percent) would be "sandstone -- some shale seams."

- Few - Indicates insignificant (0 to 15 percent) amounts of the accessory material. For example, rock composed of seam of sandstone (90 percent) and shale (10 percent) would be "sandstone -- few shale seams."

- Interbedded - Used to indicate thin or very thin alternating seams of material occurring in approximately equal amounts. For example, rock composed of thin alternating seams of sandstone (50 percent) and shale (50 percent) would be "interbedded sandstone and shale."

- Interlayered - Used to indicate thick alternating seams of material occurring in approximately equal amounts.

The preceding sections describe the classification of sedimentary rocks. The following are some basic names that are applied to igneous rocks:

- Basalt - A fine-grained extrusive rock composed primarily of calcic plagioclase and pyroxene.

- Rhyolite - A fine-grained volcanic rock containing abundant quartz and orthoclase. The fine-grained equivalent of a granite.

- Granite - A coarse-grained plutonic rock consisting essentially of alkali feldspar and quartz.

- Diorite - A coarse-grained plutonic rock consisting essentially of sodic plagioclase and hornblende.

- Gabbro - A coarse-grained plutonic rock consisting of calcic plagioclase and clinopyroxene. Loosely used for any coarse-grained dark igneous rock.

The following are some basic names that are applied to metamorphic rocks:

- Slate - A very fine-grained foliated rock possessing a well developed slaty cleavage. Contains predominantly chlorite, mica, quartz, and sericite.

- Phyllite - A fine-grained foliated rock that splits into thin flaky sheets with a silky sheen on cleavage surface.

- Schist - A medium to coarse-grained foliated rock with subparallel arrangement of the micaceous minerals which dominate its composition.

- Gneiss - A coarse-grained foliated rock with bands rich in granular and platy minerals.

- Quartzite - A fine- to coarse-grained nonfoliated rock breaking across grains, consisting essentially of quartz sand with silica cement.

5.4 Abbreviations

Abbreviations may be used in the description of a rock or soil. However, they shall be kept at a minimum. Following are some of the abbreviations that may be used:

C - Coarse	Lt - Light	Yl - Yellow

Med - Medium	BR - Broken	Or - Orange
F - Fine	BL - Blocky	SS - Sandstone
V - Very	M - Massive	Sh - Shale
Sl - Slight	Br - Brown	LS - Limestone
Occ - Occasional	Bl - Black	Fgr - Fine-grained
Tr - Trace		

5.5 Boring Logs and Documentation

This section describes in more detail the procedures to be used in completing boring logs in the field. Information obtained from the preceding sections shall be used to complete the logs. A sample boring log has been provided as Figure 5.

The field geologist/engineer shall use this example as a guide in completing each boring log. Each boring log shall be fully described by the geologist/engineer as the boring is being drilled. Every sheet contains space for 25 feet of log. Information regarding classification details is provided either on the back of the boring log or on a separate sheet, for field use.

5.5.1 Soil Classification

- Identify site name, boring number, job number, etc. Elevations and water level data to be entered when surveyed data is available.

- Enter sample number (from SPT) under appropriate column. Enter depth sample was taken from (1 block = 1 foot). Fractional footages, i.e., change of lithology at 13.7 feet, shall be lined off at the proportional location between the 13- and 14-foot marks. Enter blow counts (Standard Penetration Resistance) diagonally (as shown). Standard penetration resistance is covered in Section 5.2.3.

- Determine sample recovery/sample length as shown. Measure the total length of sample recovered from the split-spoon sampler, including material in the drive shoe. Do not include cuttings or wash material that may be in the upper portion of the sample tube.

- Indicate any change in lithology by drawing a line at the appropriate depth. For example, if clayey silt was encountered from 0 to 5.5 feet and shale from 5.5 to 6.0 feet, a line shall be drawn at this increment. This information is helpful in the construction of cross-sections. As an alternative, symbols may be used to identify each change in lithology.

- The density of granular soils is obtained by adding the number of blows for the last two increments. Refer to Density of Granular Soils Chart on back of log sheet. For consistency of cohesive soils refer also to the back of log sheet - Consistency of Cohesive Soils. Enter this information under the appropriate column. Refer to Section 5.2.3.

FIGURE 5
COMPLETED BORING LOG (EXAMPLE)

BORING LOG

Page 1 of 1

PROJECT NAME: NSB - SITE
PROJECT NUMBER: 9594
DRILLING COMPANY: SOILTEST CO.
DRILLING RIG: CME-55
BORING NUMBER: SB/MW 1
DATE: 3/8/96
GEOLOGIST: SJ CONTI
DRILLER: R. ROCK

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1	0.0	7/6	1.5/2.0		M DENSE	BRN	SILTY SAND - SOME	SM	MOIST SL. ORG.	5	0	0	0
e 0800	2.0	9/10				TO BLK	ROCK FR: TR BRICKS		ODOR				
							(FILL)		FILL TO 4'±				
	4.0			4.0									
S-2 e		5/7	2.0/2.0		M DENSE	BRN	SILTY SAND - TR FINE	SM	MOIST - W ODOR	10	0	–	–
0810	6.0	9/8					GRAVEL		NAT. MATL. TOOK SAMPLE				
	•			7'± ▽					SB01-0406 FOR ANALYSIS				
	8.0			8.0									
S-3 e		6/8	1.9/2.0		DENSE	TAN BRN	FINE TO COARSE SAND	SW	WET	0	0	0	0
0820	10.0	17/16					TR. F. GRAVEL		HIT WATER: 7'±				
	12.0			12.0									
S-4 e		7/6	1.6/2.0		STIFF	GRAY	SILTY CLAY	CL	MOIST → WET	0	.5	–	–
0830	14.0	5/8											
	15.0			15.0					AUGER REF @ 15'				
				16	M HARD	BRN	SILTSTONE	VBR	WEATHERED				
									LO & JNTS @ 15.5				
9/5	①		4.0/5.0						WATER STAINS @ 16.5, 17.1, 17.5	0	0	0	0
				19'					LOSING SOME				
	20.0				HARD	GRAY	SANDSTONE - SOME	BR	DRILL H2O @ 17'±				
							SILTSTONE		SET TEMP 6" CAS TO 15.5				
4.0/5.0	②		5.0/5.0						SET 2"Φ PVC SCREEN 16-25	0	0	0	0
									SAND 14-25				
	25.0			25					PELLETS 12-14				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

• 1-20Z
1-80Z

Drilling Area Background (ppm): 0

Remarks: CME-55 R16, 4¼" ID HSA - 9" OD ±
2" SPLIT SPOONS - 140 LB HAMMER - 30" DROP
NX CORE IN BEDROCK RUN ① = 25 min, RUN ② = 15 min

Converted to Well: Yes ✓ No _____ Well I.D. #: MW-1

- Enter color of the material in the appropriate column.

- Describe material using the USCS. Limit this column for sample description only. The predominant material is described last. If the primary soil is silt but has fines (clay) - use clayey silt. Limit soil descriptors to the following:

  - Trace: 0 - 10 percent
  - Some: 11 - 30 percent
  - And/Or: 31 - 50 percent

- Also indicate under Material Classification if the material is fill or natural soils. Indicate roots, organic material, etc.

- Enter USCS symbol - use chart on back of boring log as a guide. If the soils fall into one of two basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example ML/CL or SM/SP.

- The following information shall be entered under the "Remarks" column and shall include, but is not limited by, the following:

  - Moisture - estimate moisture content using the following terms - dry, moist, wet and saturated. These terms are determined by the individual. Whatever method is used to determine moisture, be consistent throughout the log.

  - Angularity - describe angularity of coarse grained particles using the terms angular, subangular, subrounded, or rounded. Refer to ASTM D 2488 or Earth Manual for criteria for these terms.

  - Particle shape - flat, elongated, or flat and elongated.

  - Maximum particle size or dimension.

  - Water level observations.

  - Reaction with HCl - none, weak, or strong.

- Additional comments:

  - Indicate presence of mica, caving of hole, when water was encountered, difficulty in drilling, loss or gain of water.

  - Indicate odor and Photoionization Detector (PID) or Flame Ionization Detector (FID) reading if applicable.

  - Indicate any change in lithology by drawing a line through the lithology change column and indicate the depth. This will help when cross-sections are subsequently constructed.

  - At the bottom of the page indicate type of rig, drilling method, hammer size and drop, and any other useful information (i.e., borehole size, casing set, changes in drilling method).

  - Vertical lines shall be drawn (as shown in Figure 5) in columns 6 to 8 from the bottom of each sample to the top of the next sample to indicate consistency of material from sample to sample, if the material is consistent. Horizontal lines shall be drawn if there is a change in lithology, then vertical lines drawn to that point.

- Indicate screened interval of well, as needed, in the lithology column. Show top and bottom of screen. Other details of well construction are provided on the well construction forms.

5.5.2 Rock Classification

- Indicate depth at which coring began by drawing a line at the appropriate depth. Indicate core run depths by drawing coring run lines (as shown) under the first and fourth columns on the log sheet. Indicate RQD, core run number, RQD percent, and core recovery under the appropriate columns.

- Indicate lithology change by drawing a line at the appropriate depth as explained in Section 5.5.1.

- Rock hardness is entered under designated column using terms as described on the back of the log or as explained earlier in this section.

- Enter color as determined while the core sample is wet; if the sample is cored by air, the core shall be scraped clean prior to describing color.

- Enter rock type based on sedimentary, igneous or metamorphic. For sedimentary rocks use terms as described in Section 5.3. Again, be consistent in classification. Use modifiers and additional terms as needed. For igneous and metamorphic rock types use terms as described in Sections 5.3.8.

- Enter brokenness of rock or degree of fracturing under the appropriate column using symbols VBR, BR, BL, or M as explained in Section 5.3.5 and as noted on the back of the Boring Log.

- The following information shall be entered under the remarks column. Items shall include but are not limited to the following:

  - Indicate depths of joints, fractures and breaks and also approximate to horizontal angle (such as high, low), i.e., 70E angle from horizontal, high angle.
  - Indicate calcareous zones, description of any cavities or vugs.
  - Indicate any loss or gain of drill water.
  - Indicate drop of drill tools or change in color of drill water.

- Remarks at the bottom of Boring Log shall include:

  - Type and size of core obtained.
  - Depth casing was set.
  - Type of rig used.

- As a final check the boring log shall include the following:

  - Vertical lines shall be drawn as explained for soil classification to indicate consistency of bedrock material.

  - If applicable, indicate screened interval in the lithology column. Show top and bottom of screen. Other details of well construction are provided on the well construction forms.

5.5.3 Classification of Soil and Rock from Drill Cuttings

The previous sections describe procedures for classifying soil and rock samples when cores are obtained. However, some drilling methods (air/mud rotary) may require classification and borehole

logging based on identifying drill cuttings removed from the borehole. Such cuttings provide only general information on subsurface lithology. Some procedures that shall be followed when logging cuttings are:

- Obtain cutting samples at approximately 5-foot intervals, sieve the cuttings (if mud rotary drilling) to obtain a cleaner sample, place the sample into a small sample bottle or "zip lock" bag for future reference, and label the jar or bag (i.e. hole number, depth, date, etc.). Cuttings shall be closely examined to determine general lithology.

- Note any change in color of drilling fluid or cuttings, to estimate changes in lithology.

- Note drop or chattering of drilling tools or a change in the rate of drilling, to determine fracture locations or lithologic changes.

- Observe loss or gain of drilling fluids or air (if air rotary methods are used), to identify potential fracture zones.

- Record this and any other useful information onto the boring log as provided in Figure 1.

This logging provides a general description of subsurface lithology and adequate information can be obtained through careful observation of the drilling process. It is recommended that split-barrel and rock core sampling methods be used at selected boring locations during the field investigation to provide detailed information to supplement the less detailed data generated through borings drilled using air/mud rotary methods.

5.6 Review

Upon completion of the borings logs, copies shall be made and reviewed. Items to be reviewed include:

- Checking for consistency of all logs.
- Checking for conformance to the guideline.
- Checking to see that all information is entered in their respective columns and spaces.

6.0 REFERENCES

Unified Soil Classification System (USCS).

ASTM D2488, 1985.

Earth Manual, U.S. Department of the Interior, 1974.

7.0 RECORDS

Originals of the boring logs shall be retained in the project files.

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS **3**

5.0 HEALTH AND SAFETY **4**

6.0 PROCEDURES **5**

6.1 Overview 6
6.2 Soil Sample Collection 6
6.2.1 Procedure for Preserving and Collecting Soil Samples for Volatile Organic Compound Analysis 6
6.2.2 Procedure for Collecting Soil Samples for Non-Volatile Analyses 9
6.2.3 Procedure for Collecting Undisturbed Soil Samples 10
6.3 Surface Soil Sampling 13
6.4 Near-Surface Soil Sampling 14
6.5 Subsurface Soil Sampling With a Hand Auger 15
6.6 Subsurface Soil Sampling with a Split-Barrel Sampler 17
6.7 Subsurface Soil Sampling Using Direct-Push Technology 18
6.8 Excavation and Sampling of Test Pits and Trenches 18
6.8.1 Applicability 18
6.8.2 Test Pit and Trench Excavation 19
6.8.3 Sampling in Test Pits and Trenches 21
6.8.4 Backfilling of Trenches and Test Pits 25
6.9 Records 25

7.0 REFERENCES **26**

ATTACHMENTS

A SOIL & SEDIMENT SAMPLE LOG SHEET **28**
B SPLIT-SPOON SAMPLER **29**
C TEST PIT LOG **30**
D REMOTE SAMPLE HOLDER FOR TEST PIT/TRENCH SAMPLING **31**

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures to be used to collect surface, near-surface, and subsurface soil samples. Additionally, it describes the methods for sampling of test pits and trenches to determine subsurface soil and rock conditions and for recovery of small-volume or bulk samples from pits.

2.0 SCOPE

This document applies to the collection of surface, near-surface, and subsurface soil samples exposed through hand digging, hand augering, drilling, or machine excavating at hazardous substance sites for laboratory testing, onsite visual examination, and onsite testing.

3.0 GLOSSARY

Composite Sample - A composite sample is a combination of more than one grab sample from various locations and/or depths and times that is homogenized and treated as one sample. This type of sample is usually collected when determination of an average waste concentration for a specific area is required. Composite samples shall not be collected for volatile organics analysis.

Confined Space - As stipulated in 29 Code of Federal Regulations (CFR) 1910.146, a confined space means a space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work; (2) has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, pits, and excavations); and (3) is not designed for continuous employee occupancy. Tetra Tech considers all confined space as permit-required confined spaces.

Grab Sample - One sample collected at one location and at one specific time.

Hand Auger - A sampling device used to extract soil from the ground.

Representativeness – A qualitative description of the degree to which an individual sample accurately reflects population characteristics or parameter variations at a sampling point. It is therefore an important characteristic not only of assessment and quantification of environmental threats posed by the site, but also for providing information for engineering design and construction. Proper sample location selection and proper sample collection methods are important to ensure that a truly representative sample has been collected.

Sample for Non-Volatile Analyses - Includes all chemical parameters other than volatile organics (e.g., semivolatiles, pesticides/PCBs, metals, etc.) and those engineering parameters that do not require undisturbed soil for their analysis.

Split-Barrel Sampler - A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. Also called a split-spoon sampler, this device can be driven into resistant materials using a drive weight mounted in the drilling string. A standard split-barrel sampler is typically available in two common lengths, providing either 20-inch or 26-inch longitudinal clearance for obtaining 18-inch or 24-inch-long samples, respectively. These split-barrel samplers commonly range in size from 2 to 3.5 inches OD. The larger sizes are commonly used when a larger volume of sample material is required (see Attachment B).

Test Pit and Trench - Open, shallow excavations, typically rectangular (if a test pit) or longitudinal (if a trench), excavated to determine shallow subsurface conditions for engineering, geological, and soil chemistry exploration and/or sampling purposes. These pits are excavated manually or by machine (e.g., backhoe, clamshell, trencher, excavator, or bulldozer).

Thin-Walled Tube Sampler - A thin-walled metal tube (also called a Shelby tube) used to recover relatively undisturbed soil samples. These tubes are available in various sizes, ranging from 2 to 5 inches outside diameter (OD) and from 18 to 54 inches in length.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Project Manager - The Project Manager is responsible for determining the sampling objectives, selecting proposed sampling locations, and selecting field procedures used in the collection of soil samples. Additionally, in consultation with other project personnel (geologist, hydrogeologist, etc.), the Project Manager establishes the need for test pits or trenches and determines their approximate locations and dimensions.

Site Safety Officer (SSO) - The SSO (or a qualified designee) is responsible for providing the technical support necessary to implement the project Health and Safety Plan. This will include (but not be limited to) performing air quality monitoring during sampling, boring, and excavation activities and to ensure that workers and offsite (downwind) individuals are not exposed to hazardous levels of airborne contaminants. The SSO/designee may also be required to advise the FOL on other safety-related matters regarding boring, excavation, and sampling, such as mitigative measures to address potential hazards from unstable trench walls, puncturing of drums or other hazardous objects, etc.

Field Operations Leader (FOL) - This individual is primarily responsible for the execution of the planning document containing the Sampling and Analysis Plan (SAP). This is accomplished through management of a field sampling team for the proper acquisition of samples. He or she is responsible for the supervision of onsite analyses; ensuring proper instrument calibration, care, and maintenance; sample collection and handling; the completion and accuracy of all field documentation; and making sure that custody of all samples obtained is maintained according to proper procedures. When appropriate and as directed by the FOL, such responsibilities may be performed by other qualified personnel (e.g., field technicians) where credentials and time permit. The FOL is responsible for finalizing the locations for collection of surface, near-surface, and subsurface (hand and machine borings, test pits/trenches) soil samples. He/she is ultimately responsible for the sampling and backfilling of boreholes, test pits, and trenches and for adherence to Occupational Safety and Health Administration (OSHA) regulations during these operations through self acquisition or through the management of a field team of samplers.

Project Geologist/Sampler - The project geologist/sampler is responsible for the proper acquisition of samples in accordance with this SOP and/or other project-specific documents. In addition, this individual is responsible for the completion of all required paperwork (e.g., sample log sheets, field notebook, boring logs, test pit logs, container labels, custody seals, and chain-of-custody forms) associated with the collection of those samples.

Competent Person - A Competent Person, as defined in 29 CFR 1929.650 of Subpart P - Excavations, means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

General personnel qualifications for groundwater sample collection and onsite water quality testing include the following:

- Occupational Safety and Health Administration (OSHA) 40-hour and applicable refresher training.
- Capability of performing field work under the expected physical and environmental (i.e., weather) conditions.
- Familiarity with appropriate procedures for sample documentation, handling, packaging, and shipping.

5.0 HEALTH AND SAFETY

Health and safety precautions are identified for individual sample collection procedures throughout this SOP. In addition to those precautions, the following general hazards may be incurred during sampling activities:

- Knee injuries from kneeling on hard or uneven surfaces
- Slips, trips, and falls
- Cuts and lacerations
- Traffic hazards associated with sampling in parking areas, along roadways and highways.

Methods of avoiding these hazards are provided below.

Knee injuries – If kneeling is required during soil sampling, this could result in knee injuries from stones/foreign objects and general damage due to stress on the joints. To minimize this hazard:

- Clear any foreign objects from the work area.
- Wear hard-sided knee pads.
- Stretch ligaments, tendons and muscles before, during and after. Take breaks as frequently as necessary.
- Report pre-existing conditions to the SSO if you feel this activity will aggravate an existing condition.

Slips, Trips, and Falls – These hazards exist while traversing varying terrains carrying equipment to sample locations. To minimize these hazards:

- Pre-survey sampling locations. Eliminate, barricade, or otherwise mark physical hazards leading to the locations.
- Carry small loads that do not restrict the field of vision.
- Travel the safest and clearest route (not necessarily the shortest).

Cuts and Lacerations - To prevent cuts and lacerations associated with soil sampling, the following provisions are required:

- Always cut away from yourself and others when cutting tubing or rope. This will prevent injury to yourself and others if the knife slips.
- Do not place items to be cut in your hand or on your knee.
- Change blades as necessary to maintain a sharp cutting edge. Many accidents result from struggling with dull cutting attachments.
- Whenever practical, wear cut-resistant gloves (e.g., leather or heavy cotton work gloves) at least on the hand not using the knife.

- Keep cutting surfaces clean and smooth.
- Secure items to be cut – do not hold them against the opposing hand, a leg, or other body part.
- When transporting glassware, keep it in a hard-sided container such as a cooler so that if there is a fall, you will be less likely to get cut by broken glass.
- DO NOT throw broken sample jars or glass ampoules into garbage bags. Place broken glass and glass ampoules in hard-sided containers such as a cardboard box or directly into a dumpster. DO NOT reach into garbage bags to retrieve any item accidentally thrown away. Empty the contents onto a flat surface to avoid punctures and lacerations from reaching where you cannot see.

Vehicular and Foot Traffic Hazards – When sampling along the roadway or near traffic patterns, follow the following precautions:

- Motorists may be distracted by onsite activities – ASSUME THEY DO NOT SEE YOU OR MEMBERS OF YOUR FIELD CREW.
- DO NOT place obstructions (such as vehicles) along the sides of the road that may cause site personnel to move into the flow of traffic to avoid your activities or equipment or that will create a blind spot.
- **Provide a required free space of travel**. Maintain at least 6 feet of space between you and moving traffic. Where this is not possible, use flaggers and/or signs to warn oncoming traffic of activities near or within the travel lanes.
- Face Traffic. Whenever feasible, if you must move within the 6 feet of the required free space or into traffic, attempt to face moving traffic at all times. Always leave yourself an escape route.
- Wear high-visibility vests to increase visual recognition by motorists.
- Do not rely on the vehicle operator's visibility, judgment, or ability. Make eye contact with the driver. Carefully and deliberately use hand signals so they will not startle or confuse motorists or be mistaken for a flagger's direction before moving into traffic.
- Your movements may startle a motorist and cause an accident, so move deliberately. Do not make sudden movements that might confuse a motorist.

6.0 PROCEDURES

The following procedures address surface and subsurface sampling.

CAUTION

Each situation must be evaluated individually to determine the applicability and necessity for obtaining a utility clearance ticket/dig permit. Common sense dictates, prior to digging or boring with power equipment, no matter what the depth, or digging by hand in a manner that could damage unprotected underground utilities, that a dig permit is required. See SOP HS-1.0, Utility Locating and Excavation Clearance, for additional clarification. If you do not know or are unsure as to whether a ticket is necessary – **Get the Ticket**.

6.1 Overview

Soil sampling is an important adjunct to groundwater monitoring. Sampling of the soil horizons above the groundwater table can detect contaminants before they migrate to the water table, and can establish the amount of contamination absorbed or adsorbed on aquifer solids that have the potential of contributing to groundwater contamination.

Soil types can vary considerably on a hazardous waste site. These variations, along with vegetation, can affect the rate of contaminant migration through the soil. It is important, therefore, that a detailed record be maintained during sampling operations, particularly noting sampling locations, depths, and such characteristics as grain size, color, and odor. Subsurface conditions are often stable on a daily basis and may demonstrate only slight seasonal variation especially with respect to temperature, available oxygen and light penetration. Changes in any of these conditions can radically alter the rate of chemical reactions or the associated microbiological community, thus further altering specific site conditions. Certain vegetation species can create degradation products that can alter contaminant concentrations in soil. This is why vegetation types and extent of degradation of this foliage must be recorded. To prevent degradation, samples must be kept at their at-depth temperature or lower, protected from direct light, sealed tightly in approved glass containers, and be analyzed as soon as possible after collection. In addition, to the extent possible, vegetation should be removed from the sample.

The physical properties of the soil, its grain size, cohesiveness, associated moisture, and such factors as depth to bedrock and water table, will limit the depth from which samples can be collected and the method required to collect them. It is the intent of this document to present the most commonly employed soil sampling methods used at hazardous waste sites.

6.2 Soil Sample Collection

6.2.1 Procedure for Preserving and Collecting Soil Samples for Volatile Organic Compound Analysis

Samples collected using traditional methods such as collection in a jar with no preservation have been known to yield non-representative samples due to loss of volatile organic compounds (VOCs). To prevent such losses, preservation of samples with methanol or sodium bisulfate may be used to minimize volatilization and biodegradation. This preservation may be performed either in the field or laboratory, depending on the sampling methodology employed. Because of the large number of sampling methods and associated equipment required, careful coordination between field and laboratory personnel is needed.

Soil samples to be preserved by the laboratory are currently being collected using Method SW-846, 5035. For samples preserved in the field, laboratories are currently performing low-level analyses (sodium bisulfate preservation) and high- to medium-level analyses (methanol preservation) depending on the needs of the end user.

The following procedures outline the necessary steps for collecting soil samples to be preserved at the laboratory, and for collecting soil samples to be preserved in the field with methanol or sodium bisulfate.

6.2.1.1 Soil Samples to be Preserved at the Laboratory

Soil samples collected for volatile organic analysis that are to be preserved at the laboratory shall be obtained using a hermetically sealed sample vial such as an EnCore™ sampler. Each sample shall be

obtained using a reusable sampling handle (T-handle) that can be provided with the EnCore™ sampler when requested and purchased. Collect the sample in the following manner for each EnCore™ sampler:

1. Scene Safety - Evaluate the area where sampling will occur. Ensure that the area is safe from physical, chemical, and natural hazards. Clear or barricade those hazards that have been identified.

2. Wear the appropriate personal protective equipment (PPE). This will include, at a minimum, safety glasses and nitrile surgeon's gloves. If you must kneel on the ground or place equipment on the surface being sampled, cover the ground surface with plastic to minimize surface contamination of your equipment and clothing. Wear knee pads to protect your knees from kneeling on hard or uneven surfaces.

3. Load the Encore™ sampler into the T-handle with the plunger fully depressed.

4. Expose the area to be sampled using a hand trowel or similar device to remove surface debris.

5. Press the T-handle against the freshly exposed soil surface, forcing soil into the sampler. The plunger will be forced upward as the cavity fills with soil.

6. When the sampler is full, rotate the plunger and lock it into place. If the plunger does not lock, the sampler is not full. This method ensures there is no headspace. Soft soil may require several plunges or forcing soil against a hard surface such as a sample trowel to ensure that headspace is eliminated.

7. Use a paper towel to remove soil from the side of the sampler so a tight seal can be made between the sample cap and the rubber O-ring.

8. With soil slightly piled above the rim of the sampler, force the cap on until the catches hook the side of the sampler.

9. Remove any surface soil from the outside of the sampler and place in the foil bag provided with the sampler. Good work hygiene practices and diligent decontamination procedures prevents the spread of contamination even on the outside of the containers.

10. Label the bag with appropriate information in accordance with SOP SA-6.3.

11. Place the full sampler inside a lined cooler with ice and cool to 4˚C ± 2 ˚C. Make sure any required trip blanks and temperature blanks are also in the cooler. Secure custody of the cooler in accordance with SOP SA-6.3.

12. Typically, collect three Encore™ samplers at each location. Consult the SAP or laboratory to determine the required number of Encore™ samplers to be collected.

13. The T-handle shall be decontaminated before moving to the next interval or location using a soap and water wash and rinse, and where applicable, the selected solvent as defined in the project planning documents.

Using this type of sampling device eliminates the need for field preservation and the shipping restrictions associated with preservatives. A complete set of instructions is included with each Encore™ sampler.

After the Encore™samples are collected, they should be placed on ice immediately and delivered to the laboratory within 48 hours (following the chain-of-custody and documentation procedures outlined in SOP SA-6.1). Samples must be preserved by the laboratory within 48 hours of sample collection.

6.2.1.2 Soil Samples to be Preserved in the Field

Soil samples preserved in the field may be prepared for analyses using both the low-level (sodium bisulfate preservation) and high- to medium-level (methanol preservation) methods.

> ***Safety Reminder***
> When using chemicals in the field to preserve samples, the FOL and/or SSO must ensure that Materials Safety Data Sheets (MSDSs) have been provided with the chemicals to be used. They also must ensure that these chemicals have been added to the Chemical Inventory List contained within Section 5.0, Hazard Communication, of your Health and Safety Guidance Manual (HSGM). Lastly, but most importantly, the FOL and/or SSO must review the hazards with personnel using these chemicals and ensure that provisions are available for recommended PPE and emergency measures (e.g., eyewash, etc.).

Methanol Preservation (High to Medium Level):

Bottles may be pre-spiked with methanol in the laboratory or prepared in the field. Soil samples to be preserved in the field with methanol shall utilize 40 to 60 mL glass vials with septum-lined lids. Each sample bottle shall be filled with 25 mL of demonstrated analyte-free purge-and-trap grade methanol. The preferred method for adding methanol to the sample bottle is by removing the lid and using a pipette or scaled syringe to add the methanol directly to the bottle.

> ***CAUTION***
> NEVER attempt to pipette by mouth
>
> In situations where personnel are required to spike the septum using a hypodermic needle, the following provisions for handling sharps must be in place:
>
> - Training of personnel regarding methods for handling of sharps
> - Hard-sided containers for the disposal of sharps
> - Provisions for treatment in cases where persons have received a puncture wound

Soil shall be collected with the use of a decontaminated (or disposable), small-diameter coring device such as a disposable tube/plunger-type syringe with the tip cut off. The outside diameter of the coring device must be smaller than the inside diameter of the sample bottle neck.

A small electronic balance or manual scale will be necessary for measuring the volume of soil to be added to the methanol-preserved sample bottle. Calibration of the scale shall be performed prior to use and intermittently throughout the day according to the manufacturer's requirements.

The sample should be collected as follows:

1. Weigh the unused syringe and plunger to the nearest 0.01 gram.

2. Pull the plunger back and insert the syringe into the soil to be sampled.

3. Collect 8 to 12 grams of soil by pushing the syringe barrel into the soil.

4. Weigh the sample and adjust until obtaining the required amount of sample.

5. Record the sample weight to the nearest 0.01 gram in the field logbook and/or on the sample log sheet.

6. Extrude the weighed soil sample into the methanol-preserved sample bottle taking care not to contact the sample container with the syringe.

7. If dirty, wipe soil particles from the threads of the bottle and cap. Cap the bottle tightly.

8. After capping the bottle, swirl the sample (do not shake) in the methanol and break up the soil such that all of the soil is covered with methanol.

9. Place the sample on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

Sodium Bisulfate Preservation (Low Level):

> ***CAUTION***
> Care should be taken when adding the soil to the sodium bisulfate solution. A chemical reaction of soil containing carbonates (limestone) may cause the sample to effervesce or the vial to possibly explode. To avoid this hazard or hazards of this type, a small sample aliquot should be subjected to the sample preservative. If it effervesces in an open air environment, utilize an alternative method such as Encore™ or 2-ounce jar.

Bottles may be prepared in the laboratory or in the field with sodium bisulfate solution. Samples to be preserved in the field using the sodium bisulfate method are to be prepared and collected as follows:

1. Add 1 gram of sodium bisulfate to 5 mL of laboratory-grade deionized water in a 40 to 60 mL glass vial with septum-lined lid.

2. Collect the soil sample and record the sample weight to the nearest 0.01 gram in the field logbook or on the sample log sheet as described for methanol preservation

3. Add the weighed sample to the sample vial.

4. Collect duplicate samples using the methanol preservation method on a one-for-one sample basis because it is necessary for the laboratory to perform both low-level and medium-level analyses.

5. Place the samples on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

> ***NOTE***
> If lower detection limits are necessary, an option to field preserving with sodium bisulfate may be to collect EnCore™ samplers at a given sample location. Consult the planning documents to determine whether this is required. If it is, collect samples in accordance with the Encore™ sampling procedure above and then send all samplers to the laboratory to perform the required preservation and analyses.

6.2.2 Procedure for Collecting Soil Samples for Non-Volatile Analyses

Samples collected for non-volatile analyses may be collected as either grab or composite samples as follows:

1. With a stainless steel trowel or other approved tool, transfer a portion of soil to be sampled to a stainless steel bowl or disposable inert plastic tray.

2. Remove roots, vegetation, sticks, and stones larger than the size of a green pea.

3. Thoroughly mix the soil in the bowl or tray to obtain as uniform a texture and color as practicable. The soil type, moisture content, amount of vegetation, and other factors may affect the amount of time required to obtain a properly mixed sample. In some cases, it may be impossible to obtain a uniform sample appearance. Use the field logbook to describe any significant difficulties encountered in obtaining a uniform mixture.

4. Transfer the mixed soil to the appropriate sample containers and close the containers.

5. Label the sample containers in accordance with SOP SA-6.3.

6. Place the containers in a cooler of ice as soon after collection as possible.

7. Prepare the sample shipment and ship the samples in accordance with SOP SA-6.1.

> ***NOTE***
> Cooling may not be required for some samples depending on the scheduled analyses. Consult the planning documents if in doubt regarding correct sample preservation conditions. When in doubt – Cool to 4˚C.

> ***NOTE***
> Head space is permitted in soil sample containers for non-volatile analyses to allow for sample expansion.

6.2.3 Procedure for Collecting Undisturbed Soil Samples

> ***NOTE***
> Use of thin-walled undisturbed tube samplers is restricted by the consistency of the soil to be sampled. Often, very loose and/or wet samples cannot be retrieved by the samplers, and soil with a consistency in excess of very stiff cannot be penetrated by the sampler. Devices such as Dennison or Pitcher core samplers can be used to obtain undisturbed samples of stiff soil. Using these devices normally increases sampling costs, and therefore their use should be weighed against the need for acquiring an undisturbed sample. These devices are not discussed in this SOP because they are not commonly used.

When it is necessary to acquire undisturbed samples of soil for purposes of engineering parameter analysis (e.g., permeability), a thin-walled, seamless tube sampler (Shelby tube) shall be employed using the following collection procedure:

1. In preparation for sampling utilizing a drill rig, field personnel must complete the following activities:

   - Ensure that all subsurface drilling activities are preceded by a utility clearance for the area to be investigated. This includes activities described in SOP HS-1.0, Utility Location and Excavation Clearance, as well as any location-specific procedures that may apply.

REMEMBER

If you are digging near a marked utility (within the diameter of an underground utility that has been marked plus 18 inches), you must first locate the utility through vacuum extraction or hand digging to ensure that your activities will not damage the utility.

- Complete an Equipment Inspection Checklist for the drill rig or direct-push technology (DPT) rig. This checklist will be provided in the HASP.
- Review the Safe Work Permit prior to conducting the activity.
- Review the activity to be conducted.

2. Remove all surface debris (e.g., vegetation, roots, twigs, etc.) from the specific sampling location and drill and/or clean out the borehole to the desired sampling depth. Be careful to minimize potential disturbance of the material to be sampled. In saturated material, withdraw the drill bit slowly to prevent loosening of the soil around the borehole and to maintain the water level in the hole at or above groundwater level.

CAUTION

The use of bottom-discharge bits or jetting through an open-tube sampler to clean out the borehole shall not be allowed. Only the use of side-discharge bits is permitted.

3. Determine whether a stationary piston-type sampler is required to limit sample disturbance and aid in retaining the sample. Either the hydraulically operated or control rod activated-type of stationary piston sampler may be used.

4. Prior to inserting the tube sampler into the borehole, check to ensure that the sampler head contains a check valve. The check valve is necessary to keep water in the rods from pushing the sample out the tube sampler during sample withdrawal. In addition, the check valve maintains a positive suction within the tube to help retain the sample.

5. A stainless steel tube sampler is typically used to minimize chemical reaction between the sample and the sampling tube.

6. With the sampling tube resting on the bottom of the hole and the water level in the boring at groundwater level or above, push the tube into the soil with a continuous and rapid motion, without impacting or twisting. If the soil is too hard to penetrate by pushing alone, careful hammering may be used by minimizing drop distance (tapping) of the hammer. Before pulling the tube, turn it at least one revolution to shear the sample off at the bottom. In no case shall the tube be pushed farther than the length provided for the soil sample. Allow about 3 inches in the tube for cuttings and sludge.

7. Upon removal of the sampling tube from the hole, measure the length of sample in the tube and also the length penetrated.

8. Remove disturbed material in the upper end of the tube and measure the length of sample again.

9. After removing at least 1 inch of soil from the lower end, place enough packing material (clean inert material such as paper or cloth) tightly in each end of the Shelby tube and then pour melted wax into each end to make at least a ½-inch wax plug and then add more packing material to fill the voids at both ends.

10. Place plastic caps on the ends, tape the caps in place, and dip the ends in wax to prevent loss of soil.

11. Affix label(s) to the tube as required and record sample number, depth, penetration, and recovery length on the label.

12. Mark the "up" direction on the side and upper end of the tube with indelible ink.

13. Complete a chain-of-custody form (see SOP SA-6.3) and other required forms (including Attachment A of this SOP).

14. Ship samples protected with suitable resilient packing material to reduce shock, vibration, and disturbance.

CAUTION

To preserve sample integrity do not allow tubes to freeze, and store the samples vertically with the same orientation they had in the ground, (i.e., top of sample is up) in a cool place out of the sun at all times.

CAUTION

A primary concern in the preparation of the wax plugs is the potential for the heat source and melted wax to cause a fire and/or burns. Follow the directions below to prevent injury or fire.

Electrical Heating

Using hot plates to melt the wax is acceptable. In an outdoor setting, make sure a Ground Fault Circuit Interrupter (GFCI) is employed within the electrical circuit. If a portable generator is used, ensure that the generator is an adequate distance from the sampling operation (at least 50 feet). Ensure that the extension cord is rated for the intended load and for outdoor use and is free from recognizable damage. Ensure flammable preservatives are not employed or stored near the hot plate. Although a Hot Work Permit is not required, scene safety evaluation by site personnel of the above elements is. As always, if a fire potential exists, the provisions for extinguishing must be immediately accessible as well as any provisions for first aid measures.

Open Flame

If an open flame is used, the following provisions are necessary:

- Complete a Hot Work Permit and any local permit required for elevated temperature applications. The Hot Work Permit, provided in your HASP, will aid the FOL and/or the SSO in ensuring that fire protection provisions (extinguishers, fire watches, etc.) are in place as well as ensuring that local requirements have been addressed.

- Ensure that water is available to address any wax splashes or contact. If possible, immerse the contacted area. Where this is not possible, run water over the area and apply cold compresses. The need for medical attention or first aid shall be determined on site under the direction of the SSO.

6.3 Surface Soil Sampling

The simplest, most direct method of collecting surface soil samples for subsequent analysis is by use of a stainless steel shovel, hand auger, soil corer, or stainless steel or disposable plastic trowel.

> ***NOTE***
> Multiple depth intervals are used to describe surface soil. Sometimes surface soil is defined as soil from 0 to 2 inches below ground surface (bgs), and sometimes it is defined as soil from other depths such as 0 to 2 feet bgs. Ensure that the definition of surface soil depth is clear before collecting surface soil samples.
>
> For the purposes of instruction, the terms "surface soil" and "near-surface soil" are used in this SOP as follows:
>
> - Surface soil - 0 to 6 inches bgs
> - Near-surface soil - 6 to 18 inches bgs
>
> If these intervals are defined differently in the planning documents, substitute the appropriate depth ranges.

In general, the following equipment is necessary for obtaining surface soil samples:

- Stainless steel or pre-cleaned disposable trowel.
- Stainless steel hand auger, soil corer, or shovel.
- Real-time air monitoring instrument (e.g., PID, FID) as directed in project planning document.
- Required PPE.
  - Nitrile surgeon's or latex gloves may be used, layered as necessary.
  - Safety glasses
  - Other – Items identified on the Safe Work Permit may be required based on location-specific requirements such as hearing protection, steel-toed work boots, and a hard hat when working near a drill rig. These provisions will be listed in the HASP or directed by the FOL and/or SSO.

> ***Safety Reminder***
> The use of latex products may elicit an allergic reaction in some people. Should this occur, remove the latex gloves, treat for an allergic reaction, and seek medical attention as necessary.

- Required paperwork (see SOP SA-6.3 and Attachment A of this SOP)
- Required decontamination equipment
- Required sample container(s)
- Wooden stakes or pin flags

- Sealable polyethylene bags (e.g., Ziploc® baggies)
- Heavy duty cooler
- Ice
- Chain-of-custody records and custody seals

When acquiring surface soil samples, use the following procedure:

1. Place padding or use knee pads when kneeling near the sample location. If necessary, place plastic sheeting to provide a clean surface for sample equipment to avoid possible cross- contamination.
2. Carefully remove vegetation, roots, twigs, litter, etc. to expose an adequate soil surface area to accommodate sample volume requirements.
3. Using a precleaned syringe or EnCore™ samplers, follow the procedure in Section 6.2.1 for collecting surface soil samples for volatile analysis. Surface soil samples for volatile organic analysis should be collected deeper than 6 inches bgs because shallower material has usually lost most of the volatiles through evaporation. Ensure that the appropriate surface soil depth is being analyzed in accordance with the planning document.
4. Using decontaminated sampling tools, thoroughly mix in place a sufficient amount of soil to fill the remaining sample containers. See Section 6.5 of this procedure for hand auger instruction, as needed.
5. Transfer the sample into those containers utilizing a stainless steel trowel.
6. Cap and securely tighten all sample containers.
7. Affix a sample label to each container. Be sure to fill out each label carefully and clearly, addressing all the categories described in SOP SA-6.3.
8. Proceed with the handling and processing of each sample container as described in SOP SA-6.2.
9. Site restoration – Whenever removing sample materials, always restore the surface. It is our intent to leave the area better than we found it. Do NOT create trip hazards in areas when pedestrian traffic may exist.

6.4 Near-Surface Soil Sampling

Collection of samples from near the surface (depth of 6 to 18 inches) can be accomplished with tools such as shovels, hand auger, soil corers, and stainless steel or pre-cleaned disposable trowels and the equipment listed under Section 6.5 of this procedure.

To obtain near-surface soil samples, the following protocol shall be used:

1. With a clean shovel, make a series of vertical cuts in the soil to the depth required to form a square approximately 1 foot by 1 foot.
2. Lever out the formed plug and scrape the bottom of the freshly dug hole with a decontaminated stainless steel or pre-cleaned disposable trowel to remove any loose soil.

3. Follow steps 1 through 9 of Section 6.3.

6.5 Subsurface Soil Sampling With a Hand Auger

A hand augering system generally consists of a variety of stainless steel bucket bits (approximately 6.5 inches long and 2, 2.75, 3.25, and 4 inches in diameter), series of extension rods (available in 2-, 3-, 4- and 5-inch lengths), and a T-handle connected to extension rods and to the auger bucket. A larger-diameter bucket bit is commonly used to bore a hole to the desired sampling depth and then it is withdrawn. The larger-diameter bit is then replaced with a smaller-diameter bit, lowered down the hole, and slowly turned into the soil to the completion depth (approximately 6 inches). The apparatus is then withdrawn and the soil sample collected.

The hand auger can be used in a wide variety of soil conditions. It can be used to sample soil either from the surface, or to depths in excess of 12 feet. However, the presence of subsurface rocks and landfill material and collapse of the borehole normally limit sampling depth.

To accomplish soil sampling using a hand augering system, the following equipment is required:

- Complete hand auger assembly (variety of bucket bit sizes)
- Stainless steel mixing bowls
- The equipment listed in Section 6.3
- Miscellaneous hand tools as required to assemble and disassemble the hand auger units

CAUTION

Potential hazards associated with hand augering include:

- Muscle strain and sprain due to over twisting and/or over compromising yourself.
- Equipment failure due to excessive stress on the T-handle or rods through twisting. Failure of any of these components will result in a sudden release and potential injury due to that failure.

As in all situations, any intrusive activities that could damage underground utilities shall be proceeded by a Dig/Excavation permit/ticket. Call the Utility Locating service in the area or your Project Health and Safety Officer for more information. When in doubt – **Get the Ticket!**

To obtain soil samples using a hand auger, use the following procedure:

1. Wearing designated PPE, attach a properly decontaminated bucket bit to a clean extension rod and attach the T-handle to the extension rod.
2. Clear the area to be sampled of any surface debris (vegetation, twigs, rocks, litter, etc.).
3. Twist the bucket into the ground while pushing vertically downward on the auger. The cutting shoes fill the bucket as it is advanced into the ground.
4. As the auger bucket fills with soil, periodically remove any unneeded soil.

5. Add rod extensions as necessary to extend the reach of the auger. Also, note (in a field notebook, boring log, and/or on a standardized data sheet) any changes in the color, texture or odor of the soil as a function of depth. The project-specific planning document (SAP, HASP, etc.) describe requirements for scanning the soil with a real-time air monitoring instrument (e.g., PID, FID, etc.) and recording the measurements.

6. After reaching the desired depth (e.g., the top of the interval to be sampled), slowly and carefully withdraw the apparatus from the borehole to prevent or minimize movement of soil from shallower intervals to the bottom of the hole.

7. Remove the soiled bucket bit from the rod extension and replace it with another properly decontaminated bucket bit. The bucket bit used for sampling is to be smaller in diameter than the bucket bit employed to initiate the borehole.

8. Carefully lower the apparatus down the borehole. Care must be taken to avoid scraping the borehole sides.

9. Slowly turn the apparatus until the bucket bit is advanced approximately 6 inches.

10. Discard the top of the core (approximately 1 inch), which represents any loose material collected by the bucket bit before penetrating the sample material.

11. Using a precleaned syringe or EnCore™ samplers, follow the procedure in Section 6.2.1 for collecting a soil sample for volatile compound analysis directly from the bucket bit.
12. Utilizing a properly decontaminated stainless steel trowel or dedicated disposable trowel, remove the remaining sample material from the bucket bit and place into a properly decontaminated stainless steel mixing bowl.

13. Homogenize the sample material as thoroughly as practicable then fill the remaining sample containers. Refer to Section 6.2.2.

14. Follow steps 4 through 7 listed in Section 6.3.

6.5.1 Sampling Using Stainless Steel Soil Corers

A soil corer is a stainless steel tube equipped with a cutting shoe and sample window in the side. The soil corer is advanced into the soil by applying downward pressure (body weight). The soil is unloaded by then forcing a ram towards the cutting shoe, which results in the discharge of the soil core through a window in the sleeve.

Use, application, and sample protocol is the same as for hand augering provided above, but without necessarily rotating the corer while advancing it.

SAFETY REMINDER

Hand augering and soil corer sampling can be physically demanding based on the type of geology and subsurface encumbrances encountered. Soil coring has some added hazards such the corer collapsing under your weight. To reduce the potential for muscle strain and damage, the following measures will be incorporated:

- Stretch and limber your muscles before heavy exertion. This hazard becomes more predominant in the early morning hours (prior to muscles becoming limber) and later in the day (as a result of fatigue).

- Job rotation – Share the duties so that repetitive actions do not result in fatigue and injury.
- Increase break frequencies as needed, especially as ambient conditions of heat and/or cold stress may dictate.
- Do not force the hand tools or use cheater pipes or similar devices to bypass an obstruction. Move to another location near the sampling point. Exerting additional forces on the sampling devices can result in damage and/or failure that could potentially injure someone in the immediate vicinity.
- Do not over compromise yourself when applying force to the soil corer or hand auger. If there is a sudden release, it could result in a fall or muscle injury due to strain.

6.6 Subsurface Soil Sampling with a Split-Barrel Sampler

A split-barrel (split-spoon) sampler consists of a heavy carbon steel or stainless steel sampling tube that can be split into two equal halves to reveal the soil sample (see Attachment B). A drive head is attached to the upper end of the tube and serves as a point of attachment for the drill rod. A removable tapered nosepiece/drive shoe attaches to the lower end of the tube and facilitates cutting. A basket-like sample retainer can be fitted to the lower end of the split tube to hold loose, dry soil samples in the tube when the sampler is removed from the drill hole. This split-barrel sampler is made to be attached to a drill rod and forced into the ground by means of a 140-pound or larger casing driver.

Safety Reminder

It is intended through the Equipment Inspection for Drill Rigs form provided in the HASP that the hammer and hemp rope, where applicable, associated with this activity will be inspected (no physical damage is obvious), properly attached to the hammer (suitable knots or sufficient mechanical devices), and is in overall good condition.

Split-barrel samplers are used to collect soil samples from a wide variety of soil types and from depths greater than those attainable with other soil sampling equipment.

The following equipment is used for obtaining split-barrel samples:

- Drilling equipment (provided by subcontractor).
- Split-barrel samplers (2-inch OD, 1-3/8-inch ID, either 20 inches or 26 inches long); Larger OD samplers are available if a larger volume of sample is needed.
- Drive weight assembly, 140-pound weight, driving head, and guide permitting free fall of 30 inches.
- Stainless steel mixing bowls.
- Equipment listed in Section 6.3.

The following steps shall be followed to obtain split-barrel samples (Steps 1 through 4 are typically performed by the drilling subcontractor):

1. Attach the split-barrel sampler to the sampling rods.

2. Lower the sampler into the borehole inside the hollow stem auger bits.

3. Advance the split-barrel sampler by hammering the length (typically 18 or 24 inches) of the split-barrel sampler into the soil using 140-pound or larger hammer.

4. When the desired depth is achieved, extract the drill rods and sampler from the augers and/or borehole.

5. Detach the sampler from the drill rods.

6. Place the sampler securely in a vise so it can be opened using pipe wrenches.

> ***CAUTION***
> Pipe wrenches are used to separate the split spoon into several components. The driller's helper should not apply excessive force through the use of cheater pipes or push or pull in the direction where, if the wrench slips, hands or fingers will be trapped against an immovable object.

7. Remove the drive head and nosepiece with the wrenches, and open the sampler to reveal the soil sample.

8. Immediately scan the sample core with a real-time air monitoring instrument (e.g., FID, PID, etc.) (as project-specific planning documents dictate). Carefully separate (or cut) the soil core, with a decontaminated stainless steel knife or trowel, at about 6-inch intervals while scanning the center of the core for elevated readings. Also scan stained soil, soil lenses, and anomalies (if present), and record readings.

9. If elevated vapor readings were observed, collect the sample scheduled for volatile analysis from the center of the core where elevated readings occurred. If no elevated readings where encountered, the sample material should be collected from the core's center (this area represents the least disturbed area with minimal atmospheric contact) (refer to Section 6.2.1).

10. Using the same trowel, remove remaining sample material from the split-barrel sampler (except for the small portion of disturbed soil usually found at the top of the core sample) and place the soil into a decontaminated stainless steel mixing bowl.

11. Homogenize the sample material as thoroughly as practicable then fill the remaining sample containers (refer to Section 6.2.2).

12. Follow steps 4 through 7 in Section 6.3.

6.7 Subsurface Soil Sampling Using Direct-Push Technology

Subsurface soil samples can be collected to depths of 40+ feet using DPT. DPT equipment, responsibilities, and procedures are described in SOP SA-2.5.

6.8 Excavation and Sampling of Test Pits and Trenches

6.8.1 Applicability

This subsection presents routine test pit or trench excavation techniques and specialized techniques that are applicable under certain conditions.

CAUTION

During the excavation of trenches or pits at hazardous waste sites, several health and safety concerns arise from the method of excavation. No personnel shall enter any test pit or excavation over 4 feet deep except as a last resort, and then only under direct supervision of a Competent Person (as defined in 29 CFR 1929.650 of Subpart P - Excavations). Whenever possible, all required chemical and lithological samples should be collected using the excavator bucket or other remote sampling apparatus. If entrance is required, all test pits or excavations must be stabilized by bracing the pit sides using specifically designed wooden, steel, or aluminum support structures or through sloping and benching. Personnel entering the excavation may be exposed to toxic or explosive gases and oxygen-deficient environments; therefore, monitoring will be conducted by the Competent Person to determine if it is safe to enter. Any entry into a trench greater than 4 feet deep will constitute a Confined Space Entry and must be conducted in conformance with OSHA standard 29 CFR 1910.146. In all cases involving entry, substantial air monitoring, before entry, appropriate respiratory gear and protective clothing determination, and rescue provisions are mandatory. There must be at least three people present at the immediate site before entry by one of the field team members. This minimum number of people will increase based on the potential hazards or complexity of the work to be performed. The reader shall refer to OSHA regulations 29 CFR 1926.650, 29 CFR 1910.120, 29 CFR 1910.134, and 29 CFR 1910.146. High-hazard entries such as this will be supported by members of the Health Sciences Group professionally trained in these activities.

Excavations are generally not practical where a depth of more than about 15 to 20-feet is desired, and they are usually limited to a few feet below the water table. In some cases, a pumping system may be required to control water levels within the pit, providing that pumped water can be adequately stored or disposed. If soil data at depths greater than 15-feet are required, the data are usually obtained through test borings instead of test pits.

In addition, hazardous wastes may be brought to the surface by excavation equipment. This material, whether removed from the site or returned to the subsurface, must be properly handled according to any and all applicable federal, state, and local regulations.

6.8.2 Test Pit and Trench Excavation

Test pits or trench excavations are constructed with the intent that they will provide an open view of subsurface lithology and/or disposal conditions that a boring will not provide. These procedures describe the methods for excavating and logging test pits and trenches installed to determine subsurface soil and rock conditions. Test pit operations shall be logged and documented (see Attachment C).

Test pits and trenches may be excavated by hand or power equipment to permit detailed descriptions of the nature and contamination of the in-situ materials. The size of the excavation will depend primarily on the following:

- The purpose and extent of the exploration
- The space required for efficient excavation
- The chemicals of concern
- The economics and efficiency of available equipment

Test pits normally have a cross section that is 4 to 10 feet square; test trenches are usually 3 to 6 feet wide and may be extended for any length required to reveal conditions along a specific line. The following table provides guidelines for design consideration based on equipment efficiencies.

Equipment	Typical Widths, in Feet
Trenching machine	0.25 to 1.0
Backhoe/Track Hoe	2 to 6

The lateral limits of excavation of trenches and the position of test pits shall be carefully marked on area base maps. If precise positioning is required to indicate the location of highly hazardous materials, nearby utilities, or dangerous conditions, the limits of the excavation shall be surveyed. Also, if precise determination of the depth of buried materials is needed for design or environmental assessment purposes, the elevation of the ground surface at the test pit or trench location shall also be determined by survey. If the test pit/trench will not be surveyed immediately, it shall be backfilled and its position identified with stakes placed in the ground at the margin of the excavation for later surveying.

The construction of test pits and trenches shall be planned and designed in advance as much as possible. However, the following field conditions may necessitate revisions to the initial plans:

- Subsurface utilities
- Surface and subsurface encumbrances
- Vehicle and pedestrian traffic patterns
- Purpose for excavation (e.g., the excavation of potential ordnance items)

The final depth and construction method shall be collectively determined by the FOL and designated Competent Person. The actual layout of each test pit, temporary staging area, and spoils pile may further be predicated based on site conditions and wind direction at the time the test pit is excavated. Prior to excavation, the area may be surveyed by magnetometer or metal detector or other passive methods specified in SOP HS1.0, Utility Location and Excavation Clearance, to identify the presence of underground utilities or drums. Where possible, the excavator should be positioned upwind and preferably within an enclosed cab.

No personnel shall enter any test pit or excavation except as a last resort, and then only under direct supervision of a Competent Person. If entrance is required, OSHA requirements must be met (e.g., walls must be braced with wooden or steel braces, ladders must be placed for every 25 feet of lateral travel and extended 3 feet above ground surface). A temporary guard rail or vehicle stop must be placed along the surface of the hole before entry in situations where the excavation may be approached by traffic. Spoils will be stockpiled no closer than 2 feet from the sidewall of the excavation. The excavation equipment operator shall be careful not to undercut sidewalls and will, where necessary, bench back to increase stability. The top cover, when considered clean, will be placed separately from the subsurface materials to permit clean cover. It is emphasized that the project data needs should be structured such that required samples can be collected without requiring entrance into the excavation. For example, samples of leachate, groundwater, or sidewall soil can be collected with telescoping poles or similar equipment.

Dewatering and watering may be required to ensure the stability of the side walls, to prevent the bottom of the pit from heaving, and to keep the excavation stable. This is an important consideration for excavations in cohesionless material below the groundwater table and for excavations left open greater than a day. Liquids removed as a result of dewatering operations must be handled as potentially

contaminated materials. Procedures for the collection and disposal of such materials should be discussed in the site-specific project plans.

Where possible excavations and test pits shall be opened and closed within the same working day. Where this is not possible, the following engineering controls shall be put in place to control access:

- Trench covers/street plates
- Fences encompassing the entire excavation intended to control access
- Warning signs warning personnel of the hazards
- Amber flashing lights to demarcate boundaries of the excavation at night

Excavations left open will have emergency means to exit should someone accidentally enter.

6.8.3 Sampling in Test Pits and Trenches

6.8.3.1 General

Log test pits and trenches as they are excavated in accordance with the Test Pit Log presented in Attachment C. These records include plan and profile sketches of the test pit/trench showing materials encountered, their depth and distribution in the pit/trench, and sample locations. These records also include safety and sample screening information.

Entry of test pits by personnel is extremely dangerous, shall be avoided unless absolutely necessary, and can occur only after all applicable health and safety and OSHA requirements have been met as stated above. These provisions will be reiterated as appropriate in the project-specific HASP.

The final depth and type of samples obtained from each test pit will be determined at the time the test pit is excavated. Sufficient samples are usually obtained and analyzed to quantify contaminant distribution as a function of depth for each test pit. Additional samples of each waste phase and any fluids encountered in each test pit may also be collected.

In some cases, samples of soil may be extracted from the test pit for reasons other than waste sampling and chemical analysis, for instance, to obtain geotechnical information. Such information includes soil types, stratigraphy, strength, etc., and could therefore entail the collection of disturbed (grab or bulk) or relatively undisturbed (hand-carved or pushed/driven) samples that can be tested for geotechnical properties. The purposes of such explorations are very similar to those of shallow exploratory or test borings, but often test pits offer a faster, more cost-effective method of sampling than installing borings.

6.8.3.2 Sampling Equipment

The following equipment is needed for obtaining samples for chemical or geotechnical analysis from test pits and trenches:

- Backhoe or other excavating machinery.
- Shovels, picks, hand augers, and stainless steel trowels/disposable trowels.
- Sample container - bucket with locking lid for large samples; appropriate bottle ware for chemical or geotechnical analysis samples.

- Polyethylene bags for enclosing sample containers; buckets.

- Remote sampler consisting of 10-foot sections of steel conduit (1-inch-diameter), hose clamps, and right angle adapter for conduit (see Attachment D).

6.8.3.3 Sampling Methods

The methods discussed in this section refer to test pit sampling from grade level. If test pit entry is required, see Section 6.8.3.4.

- Excavate the trench or pit in several 0.5- to 1.0-foot depth increments. Where soil types support the use of a sand bar cutting plate, use of this device is recommended to avoid potentially snagging utilities with the excavator teeth. It is recommended that soil probes or similar devices be employed where buried items or utilities may be encountered. This permits the trench floor to be probed prior to the next cut.
- After each increment:

  - the operator shall wait while the sampler inspects the test pit from grade level

  - the sampler shall probe the next interval where this is considered necessary. Practical depth increments for lithological evaluations may range from 2 to 4 feet i or where lithological changes are noted.

- The backhoe operator, who will have the best view of the test pit, shall immediately cease digging if:

  - Any fluid phase, including groundwater seepage, is encountered in the test pit

  - Any drums, other potential waste containers, obstructions, or utility lines are encountered

  - Distinct changes of material being excavated are encountered

This action is necessary to permit proper sampling of the test pit and to prevent a breach of safety protocol. Depending on the conditions encountered, it may be required to excavate more slowly and carefully with the backhoe.

For obtaining test pit samples from grade level, the following procedure shall be followed:

- Use the backhoe to remove loose material from the excavation walls and floor to the greatest extent possible.

- Secure the walls of the pit, if necessary. (There is seldom any need to enter a pit or trench that would justify the expense of shoring the walls. All observations and samples should be taken from the ground surface.)

- Samples of the test pit material are to be obtained either directly from the backhoe bucket or from the material after it has been deposited on the ground, as follows:

  a. The sampler or FOL shall direct the backhoe operator to remove material from the selected depth or location within the test pit/trench.

  b. The backhoe operator shall bring the bucket over to a designated location on the sidewall a sufficient distance from the pit (at least 5 feet) to allow the sampler to work around the bucket.

c. After the bucket has been set on the ground, the backhoe operator shall either disengage the controls or shut the machine down.

d. When signaled by the operator that it is safe to do, the sampler will approach the bucket.

e. The soil shall be monitored with a photoionization or flame ionization detector (PID or FID) as directed in the project -specific planning documents.

f. The sampler shall collect the sample from the center of the bucket or pile in accordance with surface soil sampling procedures of Section 6.3 or 6.4, as applicable. Collecting samples from the center of a pile or bucket eliminates cross-contamination from the bucket or other depth intervals.

- If a composite sample is desired, several depths or locations within the pit/trench will be selected, and the bucket will be filled from each area. It is preferable to send individual sample bottles filled from each bucket to the laboratory for compositing under the more controlled laboratory conditions. However, if compositing in the field is required, each sample container shall be filled from materials that have been transferred into a mixing bucket and homogenized. Note that homogenization/compositing is not applicable for samples to be subjected to volatile organic analysis.

> ***CAUTION***
> Care must be exercised when using the remote sampler described in the next step because of potential instability of trench walls. In situations where someone must move closer than 2 feet to the excavation edge, a board or platform should be used to displace the sampler's weight to minimize the chance of collapse of the excavation edge. Fall protection should also be employed when working near the edges or trenches greater than 6 feet deep. An immediate means to extract people who have fallen into the trench will be immediately available. These means may include ladders or rope anchor points.

- Using the remote sampler shown in Attachment D, samples can be taken at the desired depth from the sidewall or bottom of the pit as follows:

  a. Scrape the face of the pit/trench using a long-handled shovel or hoe to remove the smeared zone that has contacted the backhoe bucket.

  b. Collect the sample directly into the sample jar, by scraping with the jar edge, eliminating the need for sample handling equipment and minimizing the likelihood of cross-contamination.

  c. Cap the sample jar, remove it from the remote sampler assembly, and package the sample for shipment in accordance with SOP SA-6.3.

- Complete documentation as described in SOP SA-6.3 and Attachment C of this SOP.

6.8.3.4 <u>In-Pit Sampling</u>

Under rare conditions, personnel may be required to enter the test pit/trench. This is necessary only when soil conditions preclude obtaining suitable samples from the backhoe bucket (e.g., excessive mixing of soil or wastes within the test pit/trench) or when samples from relatively small discrete zones within the test pit are required. This approach may also be necessary to sample any seepage occurring at discrete levels or zones in the test pit that are not accessible with remote samplers.

In general, personnel shall sample and log pits and trenches from the ground surface, except as provided for by the following criteria:

- There are no practical alternative means of obtaining such data.
- The SSO and Competent Person determine that such action can be accomplished without breaching site safety protocol. This determination will be based on actual monitoring of the pit/trench after it is dug (including, at a minimum, measurements of oxygen concentration, flammable gases, and toxic compounds, in that order). Action levels will be provided in project-specific planning documents.
- A company-designated Competent Person determines that the pit/trench is stable trough soil classification evaluation/inspections or is made stable (by cutting/grading the sidewalls or using shoring) prior to entrance of any personnel. OSHA requirements shall be strictly observed.

If these conditions are satisfied, only one person may enter the pit/trench. On potentially hazardous waste sites, this individual shall be dressed in selected PPE as required by the conditions in the pit. He/she shall be affixed to a harness and lifeline and continuously monitored while in the pit.

A second and possible third individual shall be fully dressed in protective clothing including a self-contained breathing device and on standby during all pit entry operations to support self rescue or assisted self rescue. The individual entering the pit shall remain therein for as brief a period as practical, commensurate with performance of his/her work. After removing the smeared zone, samples shall be obtained with a decontaminated trowel or spoon.

6.8.3.5 Geotechnical Sampling

In addition to the equipment described in Section 6.8.3.2, the following equipment is needed for geotechnical sampling:

- Soil sampling equipment, similar to that used in shallow drilled boring (i.e., thin-walled tube samplers), that can be pushed or driven into the floor of the test pit.
- Suitable driving (e,g., sledge hammer) or pushing (e.g., backhoe bucket) equipment used to advance the sampler into the soil.
- Knives, spatulas, and other suitable devices for trimming hand-carved samples.
- Suitable containers (bags, jars, tubes, boxes, etc.), labels, wax, etc. for holding and safely transporting collected soil samples.
- Geotechnical equipment (pocket penetrometer, torvane, etc.) for field testing collected soil samples for classification and strength properties.

Disturbed grab or bulk geotechnical soil samples may be collected for most soil in the same manner as comparable soil samples for chemical analysis. These collected samples may be stored in jars or plastic-lined sacks (larger samples), which will preserve their moisture content. Smaller samples of this type are usually tested for their index properties to aid in soil identification and classification: larger bulk samples are usually required to perform compaction tests.

Relatively undisturbed samples are usually extracted in cohesive soil using thin-walled tube samplers, and such samples are then tested in a geotechnical laboratory for their strength, permeability, and/or compressibility. The techniques for extracting and preserving such samples are similar to those used in performing Shelby tube sampling in borings, except that the sampler is advanced by hand or backhoe,

rather than by a drill rig. Also, the sampler may be extracted from the test pit by excavation around the tube when it is difficult to pull it out of the ground. If this excavation requires entry of the test pit, the requirements described in Section 6.8.3.4 shall be followed. The thin-walled tube sampler shall be pushed or driven vertically into the floor or steps excavated in the test pit at the desired sampling elevations. Extracting tube samples horizontally from the walls of the test pit is not appropriate because the sample will not have the correct orientation.

A sledge hammer or backhoe may be used to drive or push the tube into the ground. Place a piece of wood over the top of the sampler or sampling tube to prevent damage during driving/pushing of the sample. Pushing the sampler with a constant thrust is always preferable to driving it with repeated blows, thus minimizing disturbance to the sample. When using a sledge hammer, it is recommended that the sampler be stabilized using a rope/strap wrench or pipe wrench to remove the person's hands holding the sampler from the strike zone. If the sample cannot be extracted by rotating it at least two revolutions (to shear off the sample at the bottom), hook the sampler to the excavator or backhoe and extract. This means an alternative head will be used as a connection point or that multiple choke hitches will be applied to extract the sampler. If this fails and the excavator can dig deeper without potentially impacting subsurface utilities, excavate the sampler. If this fails or if the excavator cannot be used due to subsurface utilities, hand-excavate to remove the soil from around the sides of the sampler. If hand-excavation requires entry into the test pit, the requirements in Section 6.8.3.4 must be followed. Prepare the sample as described in Steps 9 through 13 in Section 6.2.3, and label, pack and transport the sample in the required manner, as described in SOPs SA-6.3 and SA-6.1.

6.8.4 Backfilling of Trenches and Test Pits

All test pits and excavations must be either backfilled, covered, or otherwise protected at the end of each day. No excavations shall remain open during non-working hours unless adequately covered or otherwise protected.

Before backfilling, the onsite crew may photograph, if required by the project-specific work plan, all significant features exposed by the test pit and trench and shall include in the photograph a scale to show dimensions. Photographs of test pits shall be marked to include site number, test pit number, depth, description of feature, and date of photograph. In addition, a geologic description of each photograph shall be entered in the site logbook. All photographs shall be indexed and maintained as part of the project file for future reference.

After inspection, backfill material shall be returned to the pit under the direction of the FOL. Backfill should be returned to the trench or test pit in 6-inch to 1-foot lifts and compacted with the bucket. Remote controlled tampers or rollers may be lowered into the trench and operated from top side. This procedure will continue to the grade surface. It is recommended that the trench be tracked or rolled in. During excavation, clean soil from the top 2 feet may have been separated to be used to cover the last segments. Where these materials are not clean, it is recommended that clean fill be used for the top cover.

If a low-permeability layer is penetrated (resulting in groundwater flow from an upper contaminated flow zone into a lower uncontaminated flow zone), backfill material must represent original conditions or be impermeable. Backfill could consist of a soil-bentonite mix prepared in a proportion specified by the FOL (representing a permeability equal to or less than original conditions). Backfill can be covered by "clean" soil and graded to the original land contour. Revegetation of the disturbed area may also be required.

6.9 Records

The appropriate sample log sheet (see Attachment A of this SOP) must be completed by the site geologist/sampler for all samples collected. All soil sampling locations should be documented by tying in

the location of two or more nearby permanent landmarks (building, telephone pole, fence, etc.) or obtaining GPS coordinates; and shall be noted on the appropriate sample log sheet, site map, or field notebook. Surveying may also be necessary, depending on the project requirements.

Test pit logs (see Attachment C of this SOP) shall contain a sketch of pit conditions. If the project-specific work plan requires photographs, at least one photograph with a scale for comparison shall be taken of each pit. Included in the photograph shall be a card showing the test pit number. Boreholes, test pits, and trenches shall be logged by the field geologist in accordance with SOP GH-1.5.

Other data to be recorded in the field logbook include the following:

- Name and location of job
- Date of boring and excavation
- Approximate surface elevation
- Total depth of boring and excavation
- Dimensions of pit
- Method of sample acquisition
- Type and size of samples
- Soil and rock descriptions
- Photographs if required
- Groundwater levels
- PID/FID/LEL/O_2 meter readings
- Other pertinent information, such as waste material encountered

In addition, site-specific documentation to be maintained by the SSO and/or Competent Person will be required including:

- Calibration logs
- Excavation inspection checklists
- Soil type classification

7.0 REFERENCES

American Society for Testing and Materials, 1987. ASTM Standards D1587-83 and D1586-84. ASTM Annual Book of Standards. ASTM. Philadelphia, Pennsylvania. Volume 4.08.

NUS Corporation, 1986. Hazardous Material Handling Training Manual.

NUS Corporation and CH2M Hill, August, 1987. Compendium of Field Operation Methods. Prepared for the U.S. EPA.

OSHA, Excavation, Trenching and Shoring 29 CFR 1926.650-653.

OSHA, Confined Space Entry 29 CFR 1910.146.

USEPA, November 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual.

ATTACHMENT A
SOIL & SEDIMENT SAMPLE LOG SHEET

Tetra Tech

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date:	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

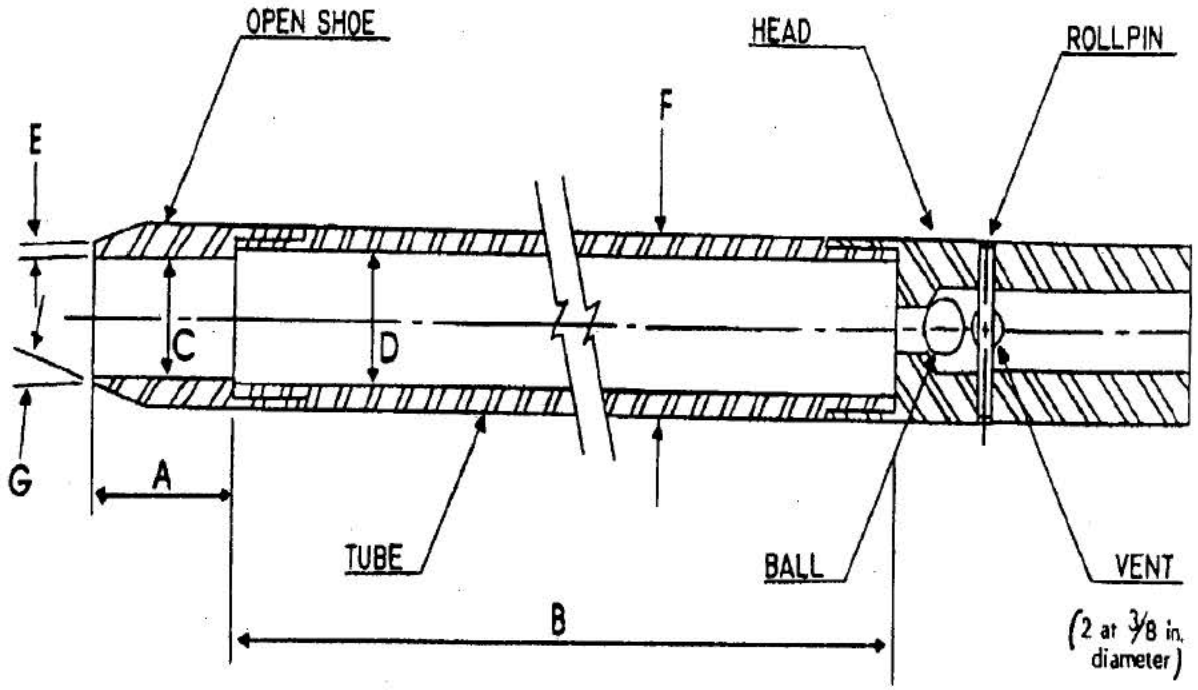
MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

ATTACHMENT B
SPLIT-SPOON SAMPLER



A = 1.0 to 2.0 in. (25 to 50 mm)
B = 18.0 to 30.0 in. (0.457 to 0.762 m)
C = 1.375 ± 0.005 in. (34.93 ± 0.13 mm)
D = 1.50 ± 0.05 – 0.00 in. (38.1 ± 1.3 – 0.0 mm)
E = 0.10 ± 0.02 in. (2.54 ± 0.25 mm)
F = 2.00 ± 0.05 – 0.00 in. (50.8 ± 1.3 – 0.0 mm)
G = 16.0° to 23.0°

The 1½ in. (38 mm) inside diameter split barrel may be used with a 16-gage wall thickness split liner. The penetrating end of the drive shoe may be slightly rounded. Metal or plastic retainers may be used to retain soil samples.

ATTACHMENT C
TEST PIT LOG

Tetra Tech

TEST PIT LOG

Page ___ of ___

PROJECT NAME: _____ TEST PIT No.: _____
PROJECT NUMBER: _____ DATE: _____
LOCATION: _____ GEOLOGIST: _____

Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING Source (ppm)	BZ (ppm)

TEST PIT CROSS SECTION AND / OR PLAN VIEW

REMARKS: _____

PHOTO LOG: _____

ATTACHMENT D
REMOTE SAMPLE HOLDER FOR TEST PIT/TRENCH SAMPLING

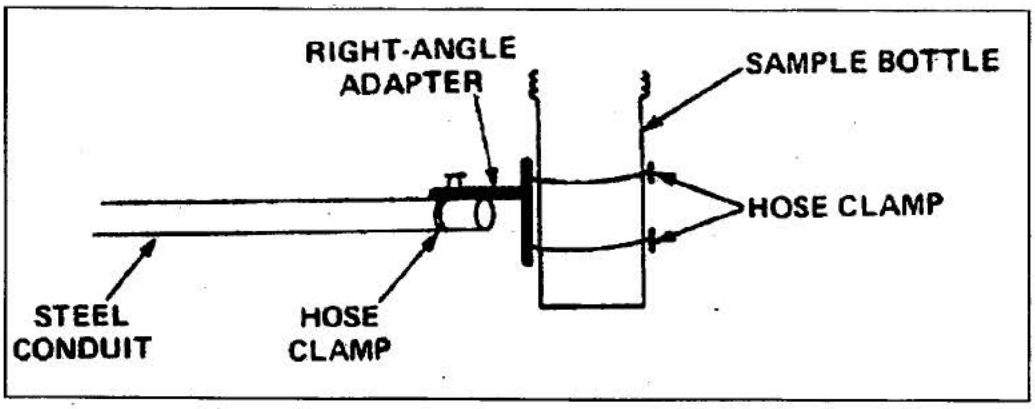


TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES **2**

5.0 SOIL SAMPLING PROCEDURES **3**

5.1 GENERAL 3
5.2 SAMPLING EQUIPMENT 3
5.3 DPT SAMPLING METHODOLOGY 3

6.0 GROUNDWATER SAMPLING PROCEDURES **4**

6.1 GENERAL 4
6.2 SAMPLING EQUIPMENT 4
6.3 DPT TEMPORARY WELL POINT INSTALLATION AND SAMPLING METHODOLOGY 5

7.0 RECORDS **5**

ATTACHMENTS

1 SAFE WORK PERMIT 6

1.0 PURPOSE

The purpose of this procedure is to provide general reference information on Direct Push Technology (DPT). DPT is designed to collect soil, groundwater, and soil gas samples without using conventional drilling techniques. The advantage of using DPT over conventional drilling includes the generation of little or no drill cuttings, sampling in locations with difficult accessibility, reduced overhead clearance requirements, no fluid introduction during probing, and typical lower costs per sample than with conventional techniques. Disadvantages include a maximum penetration depth of approximately 15 to 40 feet in dense soils (although it may be as much as 60 to 80 feet in certain types of geological environments), reduced capability of obtaining accurate water-level measurements, and the inability to install permanent groundwater monitoring wells. The methods and equipment described herein are for collection of surface and subsurface soil samples and groundwater samples. Soil gas sampling is discussed in SOP SA-2.4.

2.0 SCOPE

This procedure provides information on proper sampling equipment and techniques for DPT. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described shall be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments in methodology.

3.0 GLOSSARY

Direct Push Technology (DPT) - DPT refers to sampling tools and sensors that are driven directly into the ground without the use of conventional drilling equipment. DPT typically utilizes hydraulic pressure and/or percussion hammers to advance the sampling tools. A primary advantage of DPT over conventional drilling techniques is that DPT results in the generation of little or no investigation derived waste.

Geoprobe7 - Geoprobe7 is a manufacturer of a hydraulically-powered, percussion/probing machines utilizing DPT to collect subsurface environmental samples. Geoprobe7 relies on a relatively small amount of static weight (vehicle) combined with percussion as the energy for advancement of a tool string. The Geoprobe7 equipment can be mounted in a multitude of vehicles for access to all types of environmental sites.

HydroPunchϑ - HydroPunchϑ is a manufacturer of stainless steel and Teflon7 sampling tools that are capable of collecting representative groundwater and/or soil samples without requiring the installation of a groundwater monitoring well or conventional soil boring. HydroPunchϑ is an example of DPT sampling equipment.

Flame Ionization Detector (FID) - A portable instrument for the measurement of many combustible organic compounds and a few inorganic compounds in air at parts-per million levels. The basis for the detection is the ionization of gaseous species utilizing a flame as the energizing source.

Photo Ionization Detector (PID) - A portable instrument for the measurement of many combustible organic compounds and a few inorganic compounds in air at parts-per million levels. The basis for the detection is the ionization of gaseous species utilizing ultraviolet radiation as the energizing source.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for selecting and/or reviewing the appropriate DPT drilling procedure required to support the project objectives.

Field Operations Leader (FOL)- The FOL is primarily responsible for performing the DPT in accordance with the project-specific plan.

5.0 SOIL SAMPLING PROCEDURES

5.1 General

The common methodology for the investigation of the vadose zone is soil boring drilling and soil sampling. However, drilling soil borings can be very expensive. Generally the advantage of DPT for subsurface soil sampling is the reduced cost of disposal of drilling cuttings and shorter sampling times.

5.2 Sampling Equipment

Equipment needed for conducting DPT drilling for subsurface soil sampling includes, but is not limited to, the following:

- Geoprobe® Sampling Kit
- Cut-resistant gloves
- 4-foot x 1.5-inch diameter macrocore sampler
- Probe sampling adapters
- Roto-hammer with 1.5-inch bit
- Disposable acetate liners for soil macrocore sampler
- Cast aluminum or steel drive points
- Geoprobe® AT-660 Series Large Bore Soil Sampler, or equivalent
- Standard decontamination equipment and solutions

For health and safety equipment and procedures, follow the direction provided in the Safe Work Permit in Attachment 1, or the more detailed directions provided in the project's Health and Safety Plan.

5.3 DPT Sampling Methodology

There are several methods for the collection of soil samples using DPT drilling. The most common method is discussed in the following section. Variations of the following method may be conducted upon approval of the Project Manager in accordance with the project-specific plan.

- Macrocore samplers fitted with detachable aluminum or steel drive points are driven into the ground using hydraulic pressure. If there is concrete or pavement over a sampling location, a Roto-hammer is used to drill a minimum 1.5-inch diameter hole through the surface material. A Roto-hammer may also be used if very dense soils are encountered.

- The sampler is advanced continuously in 4-foot intervals or less if desired. No soil cuttings are generated because the soil which is not collected in the sampler is displaced within the formation.

- The sampler is retracted from the hole, and the 4-foot continuous sample is removed from the outer coring tube. The sample is contained within an inner acetate liner.

- Attach the metal trough from the Geoprobe® Sampling Kit firmly to the tail gate of a vehicle. If a vehicle with a tail gate is not available, secure the trough on another suitable surface.

- Place the acetate liner containing the soils in the trough.

- While wearing cut-resistant gloves (constructed of leather or other suitable material), cut the acetate liner through its entire length using the double-bladed knife that accompanies the Geoprobe® Sampling Kit. Then remove the strip of acetate from the trough to gain access to the collected soils. Do not attempt to cut the acetate liner while holding it in your hand.

- Field screen the sample with an FID or PID, and observe/examine the sample (according to SOP GH-1.3). If appropriate, transfer the sample to sample bottles for laboratory analysis. If additional volume is required, push an additional boring adjacent to the first and composite/mix the same interval. Field compositing is usually not acceptable for sample requiring volatile organics analysis.

- Once sampling has been completed, the hole is backfilled with bentonite chips or bentonite cement grout, depending upon project requirements. Asphalt or concrete patch is used to cap holes through paved or concrete areas. All holes should be finished smooth to existing grade.

- In the event the direct push van/truck cannot be driven to a remote location or a sampling location with difficult accessibility, sampling probes may be advanced and sampled manually or with air/electric operated equipment (e.g., jack hammer).

- Sampling equipment is decontaminated prior to collecting the next sample.

6.0 GROUNDWATER SAMPLING PROCEDURES

6.1 General

The most common methodology for the investigation of groundwater is the installation and sampling of permanent monitoring wells. If only groundwater screening is required, the installation and sampling of temporary well points may be performed. The advantage of temporary well point installation using DPT is reduced cost due to no or minimal disposal of drilling cuttings and well construction materials, and shorter installation/times sampling.

Two disadvantages of DPT drilling for well point installation are:

- In aquifers with low yields, well points may have to be sampled without purging or development.
- If volume requirements are high, this method can be time consuming for low yield aquifers.

6.2 Sampling Equipment

Equipment needed for temporary well installation and sampling using DPT includes, but is not limited, to the following:

- 2-foot x 1-inch diameter mill-slotted (0.005 to 0.02-inch) well point
- Connecting rods
- Roto-hammer with 1.5-inch bit
- Mechanical jack
- 1/4-inch OD polyethylene tubing
- 3/8-inch OD polyethylene tubing
- Peristaltic pump
- Standard decontamination equipment and solutions

6.3 DPT Temporary Well Point Installation and Sampling Methodology

There are several methods for the installation and sampling of temporary well points using DPT. The most common methodology is discussed below. Variations of the following method may be conducted upon approval of the Project Manager in accordance with the project specific plan.

- A 2-foot x 1-inch diameter mill-slotted (0.005 to 0.02-inch) well point attached to connecting rods is driven into the ground to the desired depth using a rotary electric hammer or other direct push drill rig. If there is concrete or pavement over a sampling location, a Roto-hammer or electric coring machine is used to drill a hole through the surface material.

- The well point will be allowed to equilibrate for at least 15 minutes, after which a measurement of the static water level will be taken. The initial measurement of the water level will be used to assess the amount of water which is present in the well point and to determine the amount of silt and sand infiltration that may have occurred.

- The well point will be developed using a peristaltic pump and polyethylene tubing to remove silt and sand which may have entered the well point. The well point is developed by inserting polyethylene tubing to the bottom of the well point and lifting and lowering the tubing slightly while the pump is operating. The pump will be operated at a maximum rate of approximately 2 liters per minute. After removal of sediment from the bottom of the well point, the well point will be vigorously pumped at maximum capacity until discharge water is visibly clear and no further sediments are being generated. Measurements of pH, specific conductance, temperature, and turbidity shall be recorded every 5 to 10 minutes during the purging process. After two consistent readings of pH, specific conductance, temperature and turbidity ($\forall$10 percent), the well may be sampled.

- A sample will be collected using the peristaltic pump set at the same or reduced speed as during well development. Samples (with the exception of the samples to be analyzed for volatile organic compounds, VOCs) will be collected directly from the pump discharge. Sample containers for VOCs will be filled by (first shutting off the pump) crimping the discharge end of the sample tubing when filled, removing the inlet end of the sample tubing from the well, suspending the inlet tubing above the vial, and allowing water to fill each vial by gravity flow.

- Once the groundwater sample has been collected, the connecting rods and well point will be removed from the hole with the direct push rig hydraulics. The hole will be backfilled with bentonite chips or bentonite cement grout, depending upon project requirements. Asphalt or concrete patch will be used to cap holes through paved or concrete areas. All holes will be finished smooth to existing grade.

- In the event the direct push van/truck cannot be driven to a remote location or sampling location with difficult accessibility, sampling probes may be advanced and sampled manually or with air/electric-operated equipment (e.g., jack hammer).

- Decontaminate the equipment before moving to the next location.

7.0 RECORDS

A record of all field procedures, tests, and observations must be recorded in the field logbook, boring logs, and sample log sheets, as needed. Entries should include all pertinent data regarding the investigation. The use of sketches and field landmarks will help to supplement the investigation and evaluation.

ATTACHMENT 1
SAFE WORK PERMIT FOR DPT OPERATIONS

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): **Monitoring well drilling and installation through direct push technology**

II. Required Monitoring Instruments: _____

III. Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ _____
Tetra Tech

SECTION II: General Safety Requirements (To be filled in by permit issuer)

V. Protective equipment required

Level D ☒ Level B ☐
Level C ☐ Level A ☐
Detailed on Reverse

Respiratory equipment required

Full face APR	☐	Escape Pack	☐
Half face APR	☐	SCBA	☐
SKA-PAC SAR	☐	Bottle Trailer	☐
Skid Rig	☐	None	☒

Level D Minimum Requirements: Sleeved shirt and long pants, safety footwear, and work gloves. Safety glasses, hard hats, and hearing protection will be worn when working near or sampling in the vicinity of the DPT rig.

Modifications/Exceptions.

VI. Chemicals of Concern | Action Level(s) | Response Measures

VII. Additional Safety Equipment/Procedures

Hard-hat	☒ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☒ Yes	☐ No
Safety Glasses	☒ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☒ No	Radio	☐ Yes	☒ No
Splash Shield	☐ Yes	☒ No	Barricades	☒ Yes	☐ No
Splash suits/coveralls	☐ Yes	☐ No	Gloves (Type - _____)	☐ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/warming regimen	☐ Yes	☐ No

Modifications/Exceptions: Reflective vests for high traffic areas.

VIII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☒	Emergency alarms	☐	☐
Daily tail gate meetings	☒	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

IX. Site Preparation

Utility Clearances obtained for areas of subsurface investigation	☐ Yes	☐ No
Physical hazards removed or blockaded	☐ Yes	☐ No
Site control boundaries demarcated/signage	☐ Yes	☐ No

X. Equipment Preparation

	Yes	NA
Equipment drained/depressurized	☐	☒
Equipment purged/cleaned	☐	☒
Isolation checklist completed	☐	☒
Electrical lockout required/field switch tested	☐	☒
Blinds/misalignments/blocks & bleeds in place	☐	☒
Hazardous materials on walls/behind liners considered	☐	☒

XI. Additional Permits required (Hot work, confined space entry). ☐ Yes ☐ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

XII. Special instructions, precautions:

_____

Permit Issued by: _____ Permit Accepted by: _____

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES **3**

5.0 PROCEDURES **3**

5.1 SAMPLE CONTAINERS 3
5.2 SAMPLE PRESERVATION 3
5.2.1 Overview 4
5.2.2 Preparation and Addition of Reagents 4
5.3 FIELD FILTRATION 5
5.4 SAMPLE PACKAGING AND SHIPPING 6
5.4.1 Environmental Samples 6

6.0 REFERENCES **7**

ATTACHMENTS

A GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS 8
B ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES 9

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

2.0 SCOPE

This procedure describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.

3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of ∋172.101 and ∋172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173. With slight modifications, IATA has adopted DOT "hazardous materials" as IATA "Dangerous Goods."

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (ɣ261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (ɣ261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - H_2SO_4
- Nitric Acid - HNO_3
- Sodium Hydroxide - NaOH

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - $Na_2S_2O_3$

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent.

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR ∋172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the shipper.

5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. However, for collection of volatile organic compounds, head space shall be omitted. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis. Sufficient lead time shall be allowed for a delivery of sample container orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded. Because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete

and irreversible preservation of samples is not possible, preservation does retard the chemical and biological changes that inevitably take place after the sample is collected. Preservation techniques are usually limited to pH control, chemical addition(s), and refrigeration/ freezing (certain biological samples only).

5.2.1 Overview

The preservation techniques to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will either be added to the sample containers by the laboratory prior to their shipment to the field or be added in the field (in a clean environment). Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4EC. Medium-concentration aqueous samples, high-hazard organic samples, and some gas samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with HNO_3, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4EC, whereas high-hazard samples are not cooled.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

The FOL is responsible for ensuring that an accurate Chemical Inventory is created and maintained for all hazardous chemicals brought to the work site (see Section 5 of the TtNUS Health and Safety Guidance Manual). Furthermore, the FOL must ensure that a corresponding Material Safety Data Sheet (MSDS) is collected for every substance entered on the site Chemical Inventory, and that all persons using/handling/ disposing of these substances review the appropriate MSDS for substances they will work with. The Chemical Inventory and the MSDSs must be maintained at each work site in a location and manner where they are readily-accessible to all personnel.

5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

Acid/Base	Dilution	Concentration	Estimated Amount Required for Preservation
Hydrochloric Acid (HCl)	1 part concentrated HCl: 1 part double-distilled, deionized water	6N	5-10 mL
Sulfuric Acid (H_2SO_4)	1 part concentrated H_2SO_4: 1 part double-distilled, deionized water	18N	2 - 5 mL
Nitric Acid (HNO_3)	Undiluted concentrated HNO_3	16N	2 - 5 mL
Sodium Hydroxide (NaOH)	400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution	10N	2 mL

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample. This assumes that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions

vary, more preservative may be required. Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.

- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).

- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for ascorbic acid addition.

  If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

  Continue with proper base preservation of the sample as described above.

- Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

  The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

  The sample pH is then raised to 9 using the NaOH preservative.

- Sodium thiosulfate must be added to remove residual chlorine from a sample. To test the sample for residual chlorine use a field test kit specially made for this purpose.

  If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

  Continue with proper acidification of the sample as described above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory before sampling begins.

5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed prior to the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated tubing, and a

peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

- To perform filtration, thread the tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration. Run approximately 100 ml of sample through the filter and discard prior to sample collection.

- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

5.4 Sample Packaging and Shipping

Only employees who have successfully completed the TtNUS "Shipping Hazardous Materials" training course are authorized to package and ship hazardous substances. These trained individuals are responsible for performing shipping duties in accordance with this training.

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)

- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental samples are outlined in the remainder of this section.

5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place properly identified sample container, with lid securely fastened, in a plastic bag (e.g. Ziploc baggie), and seal the bag.

- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic bag (e.g. "garbage" bag). Drain plugs on coolers must be taped shut.

- Pack with enough cushioning materials such as bubble wrap (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.

- If cooling is required (see Attachments A and B), place ice around sample container shoulders, and on top of packing material (minimum of 8 pounds of ice for a medium-size cooler).

- Seal (i.e., tape or tie top in knot) large liner bag.

- The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the cooler containing the vials for VOC analysis. The COC form should then state how many coolers are included with that shipment.

- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

6.0 REFERENCES

American Public Health Association, 1981. Standard Methods for the Examination of Water and Wastewater, 15th Edition. APHA, Washington, D.C.

International Air Transport Association (latest issue). Dangerous Goods Regulations, Montreal, Quebec, Canada.

U.S. Department of Transportation (latest issue). Hazardous Materials Regulations, 49 CFR 171-177.

U.S. EPA, 1984. "Guidelines Establishing Test Procedures for the Analysis of Pollutants under Clean Water Act." Federal Register, Volume 49 (209), October 26, 1984, p. 43234.

U.S. EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, U.S. EPA-EMSL, Cincinnati, Ohio.

ATTACHMENT A

GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample Type and Concentration		Container[1]	Sample Size	Preservation[2]	Holding Time[2]
WATER					
Organics (GC&GC/MS)	VOC Low	Borosilicate glass	2 x 40 mL	Cool to 4EC HCl to # 2	14 days[9]
	Extractables (Low SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	Cool to 4EC	7 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	None	7 days to extraction; 40 days after extraction
Inorganics	Metals Low	High-density polyethylene	1 L	HNO_3 to pH #2	6 months (Hg-28 days)
	Medium	Wide-mouth glass	16 oz.	None	6 months
	Cyanide Low	High-density polyethylene	1 L	NaOH to pH>12	14 days
	Cyanide Medium	Wide-mouth glass	16 oz.	None	14 days
Organic/ Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	14 days
SOIL					
Organics (GC&GC/MS)	VOC	EnCore Sampler	(3) 5 g Samplers	Cool to 4EC	48 hours to lab preservation
	Extractables (Low SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4EC	14 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4EC	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium	Wide-mouth glass	8 oz.	Cool to 4EC	6 months (Hg - 28 days) Cyanide (14 days)
Organic/Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	NA
Dioxin/Furan	All	Wide-mouth glass	4 oz.	None	35 days until extraction; 40 days after extraction
TCLP	All	Wide-mouth glass	8 oz.	None	7 days until preparation; analysis as per fraction
AIR					
Volatile Organics	Low/Medium	Charcoal tube -- 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4EC	5 days recommended

1 All glass containers should have Teflon cap liners or septa.
2 See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

ATTACHMENT B

ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter Number/Name	Container[1]	Preservation[2][3]	Maximum Holding Time[4]
INORGANIC TESTS:			
Acidity	P, G	Cool, 4EC	14 days
Alkalinity	P, G	Cool, 4EC	14 days
Ammonia - Nitrogen	P, G	Cool, 4EC; H_2SO_4 to pH 2	28 days
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4EC	48 hours
Bromide	P, G	None required	28 days
Chemical Oxygen Demand (COD)	P, G	Cool, 4EC; H_2SO_4 to pH 2	28 days
Chloride	P, G	None required	28 days
Chlorine, Total Residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4EC	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4EC; NaOH to pH 12; 0.6 g ascorbic acid[5]	14 days[6]
Fluoride	P	None required	28 days
Hardness	P, G	HNO_3 to pH 2; H_2SO_4 to pH 2	6 months
Total Kjeldahl and Organic Nitrogen	P, G	Cool, 4EC; H_2SO_4 to pH 2	28 days
Nitrate - Nitrogen	P, G	None required	48 hours
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4EC; H_2SO_4 to pH 2	28 days
Nitrite - Nitrogen	P, G	Cool, 4EC	48 hours
Oil & Grease	G	Cool, 4EC; H_2SO_4 to pH 2	28 days
Total Organic Carbon (TOC)	P, G	Cool, 4EC; HCl or H_2SO_4 to pH 2	28 days
Orthophosphate	P, G	Filter immediately; Cool, 4EC	48 hours
Oxygen, Dissolved-Probe	G Bottle & top	None required	Analyze immediately
Oxygen, Dissolved-Winkler	G Bottle & top	Fix on site and store in dark	8 hours
Phenols	G	Cool, 4EC; H_2SO_4 to pH 2	28 days
Phosphorus, Total	P, G	Cool, 4EC; H_2SO_4 to pH 2	28 days
Residue, Total	P, G	Cool, 4EC	7 days
Residue, Filterable (TDS)	P, G	Cool, 4EC	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4EC	7 days
Residue, Settleable	P, G	Cool, 4EC	48 hours
Residue, Volatile (Ash Content)	P, G	Cool, 4EC	7 days
Silica	P	Cool, 4EC	28 days
Specific Conductance	P, G	Cool, 4EC	28 days
Sulfate	P, G	Cool, 4EC	28 days

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE TWO

Parameter Number/Name	Container[1]	Preservation[2][3]	Maximum Holding Time[4]
INORGANIC TESTS (Cont'd):			
Sulfide	P, G	Cool, 4EC; add zinc acetate plus sodium hydroxide to pH 9	7 days
Sulfite	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4EC	48 hours
METALS:[7]			
Chromium VI (Hexachrome)	P, G	Cool, 4EC	24 hours
Mercury (Hg)	P, G	HNO_3 to pH 2	28 days
Metals, except Chromium VI and Mercury	P, G	HNO_3 to pH 2	6 months
ORGANIC TESTS:[8]			
Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4EC; 0.008% $Na_2S_2O_3$[5]	14 days
Purgeable Aromatic Hydrocarbons	G, Teflon-lined septum	Cool, 4EC; 0.008% $Na_2S_2O_3$[5] HCl to pH 2 [9]	14 days
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4EC; 0.008% $Na_2S_2O_3$[5] adjust pH to 4-5 [10]	14 days
Phenols[11]	G, Teflon-lined cap	Cool, 4EC; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction
Benzidines[11], [12]	G, Teflon-lined cap	Cool, 4EC; 0.008% $Na_2S_2O_3$[5]	7 days until extraction[13]
Phthalate esters[11]	G, Teflon-lined cap	Cool, 4EC	7 days until extraction; 40 days after extraction
Nitrosamines[11], [14]	G, Teflon-lined cap	Cool, 4EC; store in dark; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction
PCBs[11]	G, Teflon-lined cap	Cool, 4EC	7 days until extraction; 40 days after extraction
Nitroaromatics & Isophorone[11]	G, Teflon-lined cap	Cool, 4EC; 0.008% $Na_2S_2O_3$[5]; store in dark	7 days until extraction; 40 days after extraction
Polynuclear Aromatic Hydrocarbons (PAHs)[11],[14]	G, Teflon-lined cap	Cool, 4EC; 0.008% $Na_2S_2O_3$[5]; store in dark	7 days until extraction; 40 days after extraction
Haloethers[11]	G, Teflon-lined cap	Cool, 4EC; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction
Dioxin/Furan (TCDD/TCDF)[11]	G, Teflon-lined cap	Cool, 4EC; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE THREE

(1) Polyethylene (P): generally 500 ml or Glass (G): generally 1L.
(2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4EC until compositing and sample splitting is completed.
(3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).
(4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.
(5) Should only be used in the presence of residual chlorine.
(6) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.
(7) Samples should be filtered immediately on site before adding preservative for dissolved metals.
(8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
(9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
(10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
(11) When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4EC, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re: the analysis of benzidine).
(12) If 1,2-diphenylthydrazine is likely to be present, adjust the pH of the sample to 4.0∀0.2 to prevent rearrangement to benzidine.
(13) Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.
(14) For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.
(15) The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS **2**

5.0 PROCEDURES **2**

5.1 SITE LOGBOOK 2
5.1.1 General 2
5.1.2 Photographs 3
5.2 FIELD NOTEBOOKS 3
5.3 FIELD FORMS 4
5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results 4
5.3.2 Hydrogeological and Geotechnical Forms 5
5.3.3 Equipment Calibration and Maintenance Form 6
5.4 FIELD REPORTS 6
5.4.1 Daily Activities Report 7
5.4.2 Weekly Status Reports 7

6.0 LISTING OF FIELD FORMS ON THE TtNUS INTRANET SITE **7**

ATTACHMENTS

A TYPICAL SITE LOGBOOK ENTRY **9**
B SAMPLE LABEL **10**
C CHAIN-OF-CUSTODY RECORD FORM **11**
D CHAIN-OF-CUSTODY SEAL **12**

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to identify and designate the field data record forms, logs, and reports generally initiated and maintained for documenting Tetra Tech NUS, Inc. (TtNUS) field activities.

2.0 SCOPE

Documents presented within this SOP (or equivalents) shall be used for all TtNUS field activities, as applicable. Other or additional documents may be required by specific client contracts or project planning documents.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Project Manager (PM) - The PM is responsible for obtaining hardbound controlled-distribution logbooks (from the appropriate source), as needed. In addition, the Project Manager is responsible for placing all field documentation used in site activities (i.e., records, field reports, sample data sheets, field notebooks, and the site logbook) in the project's central file upon the completion of field work.

Field Operations Leader (FOL) - The FOL is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports included in this SOP (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time frame.

General personnel qualifications for field documentation activities include the following:

- Occupational Safety and Health Administration (OSHA) 40-hour and applicable refresher training.
- Capability of performing field work under the expected physical and environmental (i.e., weather) conditions.
- Familiarity with appropriate procedures for documentation, handling, packaging, and shipping.

5.0 PROCEDURES

5.1 SITE LOGBOOK

5.1.1 General

The site logbook is a hard-bound, paginated, controlled-distribution record book in which all major on-site activities are documented. At a minimum, record or reference the following activities/events (daily) in the site logbook:

- All field personnel present
- Arrival/departure times and names of site visitors
- Times and dates of health and safety training
- Arrival/departure times of equipment
- Times and dates of equipment calibration

- Start and/or completion of borehole, trench, monitoring well installation activities, etc.
- Daily on-site activities
- Sample pickup information
- Health and safety issues (level of protection, personal protective equipment [PPE], etc.)
- Weather conditions

Maintain a site logbook for each project and initiate it at the start of the first on-site activity (e.g., site visit or initial reconnaissance survey). Make entries every day that on-site activities take place involving TtNUS or subcontractor personnel. Upon completion of the fieldwork, provide the site logbook to the PM or designee for inclusion in the project's central file.

Record the following information on the cover of each site logbook:

- Project name
- TtNUS project number
- Sequential book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks (see Section 5.2) but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). An example of a typical site logbook entry is shown in Attachment A.

If measurements are made at any location, either record the measurements and equipment used in the site logbook or reference the field notebook in which the measurements are recorded (see Attachment A).

Make all logbook, notebook, and log sheet entries in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, cross out the entry with a single strike mark, initial, and date it. At the completion of entries by any individual, the logbook pages used must be signed and dated by the person making the entries. The site logbook must also be signed by the FOL at the end of each day.

5.1.2 Photographs

Sequentially number movies, slides, or photographs taken of a site or any monitoring location to correspond to logbook/notebook entries. Enter the name of the photographer, date, time, site location, site description, and weather conditions in the logbook/notebook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook/notebook. If possible, such techniques shall be avoided because they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend on the subject matter, type of camera (digital or film), and the processing it requires. Follow chain-of-custody procedures for film used for aerial photography, confidential information, or criminal investigation. After processed, consecutively number the slides of photographic prints and label them according to the logbook/notebook descriptions. Docket the site photographs and associated negatives and/or digitally saved images to compact disks into the project's central file.

5.2 FIELD NOTEBOOKS

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a

separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

5.3 FIELD FORMS

All TtNUS field forms (see list in Section 6.0 of this SOP) can be found on the company's intranet site (http://intranet.ttnus.com) under Field Log Sheets. Forms may be altered or revised for project-specific needs, subject to client approval. Care must be taken to ensure that all essential information can be documented. Guidelines for completing these forms can be found in the related sampling SOPs.

5.3.1 Sample Collection, Labeling, Shipment, Request for Analysis, and Field Test Results

5.3.1.1 Sample Log Sheet

Sample log sheets are used to record specified types of data while sampling. The data recorded on these sheets are useful in describing the sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. Complete a sample log sheet for each sample obtained, including field quality control (QC) samples.

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B. Complete the required information on the adhesive labels and apply them to every sample container. Obtain sample labels from the appropriate program/project source, request that they be electronically generated in house, or request them the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record

The chain-of-custody record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used as follows for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site:

- Retain one carbonless copy of the completed chain-of custody form in the field.
- Send one copy is sent to the PM (or designee)
- Send the original to the laboratory with the associated samples. Place the original (top, signed copy) of the chain-of custody form inside a large Ziploc®-type bag taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one chain-of custody form, send the form with the cooler containing vials for volatile organic compound (VOC) analysis or the cooler with the air bill attached. Indicate on the air bill how many coolers are included with that shipment.

An example of a chain-of-custody form is provided as Attachment C. After the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed chain-of custody form (any discrepancies between the sample labels and chain-of custody form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the TtNUS PM). The chain-of custody form is signed and copied. The laboratory will retain the copy, and the original becomes part of the samples' corresponding analytical data package.

5.3.1.4 Chain-of-Custody Seal

Attachment D is an example of a custody seal. The custody seal is an adhesive-backed label that is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. Sign and date custody seals

and affix them across the lid and body of each cooler (front and back) containing environmental samples (see SOP SA-6.1). Obtain custody seals from the laboratory (if available) or purchase them from a supplier.

5.3.1.5 Geochemical Parameters Log Sheets

Complete Field Analytical Log Sheets to record geochemical and/or natural attenuation field test results.

5.3.2 Hydrogeological and Geotechnical Forms

5.3.2.1 Groundwater Level Measurement Sheet

Complete a Groundwater Level Measurement Sheet for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

During the performance of a pumping test (or an in-situ hydraulic conductivity test), a large amount of data must be recorded, often within a short time period. Use a Pumping Test Data Sheet to facilitate this task by standardizing the data collection format for the pumping well and observation wells, and allowing the time interval for collection to be established in advance.

5.3.2.3 Packer Test Report Form

Complete a Packer Test Report Form for each well at which a packer test is conducted.

5.3.2.4 Boring Log

Complete a Summary Log of Boring, or Boring Log for each soil boring performed to document the materials encountered, operation and driving of casing, and locations/depths of samples collected. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a photoionization detector [PID] or flame ionization detector [FID]), enter these readings on the boring log at the appropriate depth. When they become available, enter the laboratory sample number, concentrations of key contaminants, or other pertinent information in the "Remarks" column. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

Complete a Monitoring Well Construction Details Form for every monitoring well, piezometer, or temporary well point installed. This form contains specific information on length and type of well riser pipe and screen, backfill, filter pack, annular seal and grout characteristics, and surface seal characteristics. This information is important in evaluating the performance of the monitoring well, particularly in areas where water levels show temporal variation or where there are multiple (immiscible) phases of contaminants. Depending on the type of monitoring well (in overburden or bedrock, stick-up or flush mount), different forms are used.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log must be filled out by the responsible field geologist or sampling technician.

5.3.2.7 Miscellaneous Monitoring Well Forms

Miscellaneous monitoring well forms that may be required on a project-specific basis include the Monitoring Well Materials Certificate of Conformance and Monitoring Well Development Record. Use a Monitoring Well Materials Certificate of Conformance to document all materials utilized during each monitoring well installation. Use a Monitoring Well Development Record to document all well development activities.

5.3.2.8 Miscellaneous Field Forms – Quality Assurance and Checklists

Miscellaneous field forms/checklists forms that may be required on a project-specific basis include the following:

- Container Sample and Inspection Sheet – use this form when a container (drum, tank, etc.) is sampled and/or inspected.
- QA Sample Log Sheet – use this form when a QA sample such as an equipment rinsate blank, source blank, etc. is collected.
- Field Task Modification Request (FTMR) – use this form to document deviations from the project planning documents. The FOL is responsible for initiating the FTMRs. Maintain copies of all FTMRs with the on-site planning documents, and place originals in the final evidence file.
- Field Project Daily Activities Checklist and Field Project Pre-Mobilization Checklist – used these during both the planning and field effort to ensure that all necessary tasks are planned for and completed. These two forms are not requirements but are useful tools for most field work.

5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring, or test equipment is necessary to ensure the proper operation and response of the equipment, to document the accuracy, precision, or sensitivity of the measurements, and determine if correction should be applied to the readings. Some items of equipment require frequent calibration, others infrequent. Some are calibrated by the manufacturer, others by the user.

Each instrument requiring calibration has its own Equipment Calibration Log, which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. Maintain an Equipment Calibration Log for each electronic measuring device used in the field; make entries for each day the equipment is used or in accordance with manufacturer recommendations.

5.4 FIELD REPORTS

The primary means of recording on-site activities is the site logbook. Other field notebooks may also be maintained. These logbooks and notebooks (and supporting forms) contain detailed information required for data interpretation or documentation but are not easily used for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain on site for extended periods of time and are thus not accessible for timely review by project management. Other reports useful for tracking and reporting the progress of field activities are described below.

5.4.1 Daily Activities Report

To provide timely oversight of on-site contractors, complete and submit Daily Activities Reports (DARs) as described below.

5.4.1.1 Description

The DAR documents the activities and progress for each day's field work. Complete this report on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring that involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors. The DAR form can be found on the TtNUS intranet site.

5.4.1.2 Responsibilities

It is the responsibility of the rig geologist to complete the DAR and obtain the driller's signature acknowledging that the times and quantities of material entered are correct.

5.4.1.3 Submittal and Approval

At the end of the shift, the rig geologist must submit the DAR to the FOL for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DARs are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the PM.

5.4.2 Weekly Status Reports

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

In addition to those described herein, other summary reports may also be contractually required.

All TtNUS field forms can be found on the company's intranet site at http://intranet.ttnus.com under Field Log Sheets.

6.0 LISTING OF FIELD FORMS ON THE TtNUS INTRANET SITE

- Boring Log
- Container Sample and Inspection Sheet
- Daily Activities Checklist
- Daily Activities Record
- Equipment Calibration Log
- Field Task Modification Request
- Field Analytical Log sheet - Geochemical Parameters
- Groundwater Level Measurement Sheet
- Groundwater Sample Log Sheet
- Hydraulic Conductivity Test Data Sheet
- Low Flow Purge Data Sheet
- Bedrock Monitoring Well Construction (Stick Up)
- Bedrock Monitoring Well Construction Flush Mount
- Bedrock Monitoring Well Construction Open Hole
- Confining Layer Monitoring Well Construction
- Monitoring Well Development Record

- Monitoring Well Materials Certificate of Conformance
- Overburden Monitoring Well Construction Flush Mount
- Overburden Monitoring Well Construction Stick Up
- Packer Test Report Form
- Pumping Test Data Sheet
- QA Sample Log Sheet
- Soil/Sediment Sample Log Sheet
- Surface Water Sample Log Sheet
- Test Pit Log
- Field Project Pre-Mobilization Checklist

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: _____ DATE: _____

SITE LEADER: _____
PERSONNEL:

TtNUS	DRILLER	SITE VISITORS
_____	_____	_____
_____	_____	_____
_____	_____	_____

WEATHER: Clear, 68°F, 2-5 mph wind from SE

ACTIVITIES:

1. Steam jenney and fire hoses were set up.
2. Drilling activities at well ____ resumes. Rig geologist was _____. See Geologist's Notebook, No. 1, page 29-30, for details of drilling activity. Sample No. 123-21-S4 collected; see sample logbook, page 42. Drilling activities completed at 11:50 and a 4-inch stainless steel well installed. See Geologist's Notebook, No. 1, page 31, and well construction details for well _____.
3. Drilling rig No. 2 steam-cleaned at decontamination pit. Then set up at location of well _____.
4. Well _____ drilled. Rig geologist was _____. See Geologist's Notebook, No. 2, page ____ for details of drilling activities. Sample numbers 123-22-S1, 123-22-S2, and 123-22-S3 collected; see sample logbook, pages 43, 44, and 45.
5. Well _____ was developed. Seven 55-gallon drums were filled in the flushing stage. The well was then pumped using the pitcher pump for 1 hour. At the end of the hour, water pumped from well was "sand free."
6. EPA remedial project manger arrives on site at 14:25 hours.
7. Large dump truck arrives at 14:45 and is steam-cleaned. Backhoe and dump truck set up over test pit _____.
8. Test pit _____ dug with cuttings placed in dump truck. Rig geologist was _____. See Geologist's Notebook, No. 1, page 32, for details of test pit activities. Test pit subsequently filled. No samples taken for chemical analysis. Due to shallow groundwater table, filling in of test pit ___ resulted in a very soft and wet area. A mound was developed and the area roped off.
9. Express carrier picked up samples (see Sample Logbook, pages 42 through 45) at 17:50 hours. Site activities terminated at 18:22 hours. All personnel off site, gate locked.

_____

Field Operations Leader

ATTACHMENT B
SAMPLE LABEL

Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090	Project: Site: Location:		
Sample No:			Matrix:
Date:	Time:	Preserve:	
Analysis:			
Sampled by:	Laboratory:		

ATTACHMENT C
CHAIN-OF-CUSTODY RECORD FORM

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER 3413 | PAGE ____ OF _____

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
		CARRIER/WAYBILL NUMBER		CITY, STATE

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

TYPE OF ANALYSIS

DATE YEAR ____	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS										COMMENTS

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

ATTACHMENT D
CHAIN-OF-CUSTODY SEAL

CUSTODY SEAL	**CUSTODY SEAL**
Date _____	**Date** _____
Signature _____	**Signature** _____

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE AND APPLICABILITY **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS **3**

5.0 HEALTH AND SAFETY **3**

6.0 EQUIPMENT LIST **3**

7.0 PROCEDURES **4**

- **7.1 Decontamination Pad Design/Construction Considerations** **5**
- 7.1.1 Temporary Decontamination Pads 5
- 7.1.2 Decontamination Activities at Drill Rigs/DPT Units 7
- 7.1.3 Decontamination Activities at Remote Sample Locations 7
- **7.2 Equipment Decontamination Procedures** **7**
- 7.2.1 Monitoring Well Sampling Equipment 7
- 7.2.2 Downhole Drilling Equipment 9
- 7.2.3 Soil/Sediment Sampling Equipment 11
- **7.3 Contact Waste/Materials** **11**
- 7.3.1 Investigation-Derived Wastes - Decontamination Wash Waters and Sediments 12
- **7.4 Decontamination Evaluation** **13**

ATTACHMENTS

A INVESTIGATION-DERIVED WASTE LABEL 15

1.0 PURPOSE

Decontamination is the process of removing and/or neutralizing site contaminants that have contacted and/or accumulated on equipment. The purpose of this Standard Operating Procedure (SOP) is to protect site personnel, the general public, and the environment while preserving or maintaining sample integrity. It is further intended through this procedure to describe the steps necessary for proper decontamination of drilling equipment, earth-moving equipment , chemical sampling equipment and field operation and analytical equipment.

2.0 SCOPE AND APPLICABILITY

This procedure applies to all equipment used to provide access to/acquire environmental samples that may have become contaminated through direct contact with contaminated media including air, water, and soil. This equipment includes drilling and heavy equipment and chemical sampling and field analytical equipment. Where technologically and economically feasible, single-use sealed disposable equipment will be employed to minimize the potential for cross-contamination. This SOP also provides general reference information on the control of contaminated materials.

Decontamination methods and equipment requirements may differ from one project to another. General equipment items are specified in Section 6.0, but project-specific equipment must be obtained to address the project-specific decontamination procedures presented in Section 7.0 and applicable subsections.

3.0 GLOSSARY

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

Decontamination Solution - A solution selected/identified in the Health and Safety Plan or Project-Specific Quality Assurance Plan. The solution is selected and employed as directed by the project chemist/health and safety professional.

Deionized Water (DI) - Tap water that has been treated by passing through a standard deionizing resin column. This water may also pass through additional filtering media to attain various levels of analyte-free status. The DI water should meet College of American Pathologists (CAP) and National Committee for Clinical Laboratory Standards (NCCLS) specifications for reagent-grade Type I water.

Potable Water - Tap water from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Pressure Washing - Process employing a high-pressure pump and nozzle configuration to create a high-pressure spray of potable water. High-pressure spray is employed to remove solids from equipment.

Solvent – A liquid in which solid chemicals or other liquids are dissolved. The solvent of choice is pesticide-grade isopropanol. Use of other solvents (methanol, acetone, or hexane) may be required for particular projects or for a particular purpose (e.g., removal of concentrated waste) and must be justified in the project planning documents. For example, it may be necessary to use hexane when analyzing for trace levels of pesticides, PCBs, or fuels. In addition, because many of these solvents are not miscible in water, the equipment should be air dried prior to use. Solvents should not be used on PVC equipment or well construction materials.

Steam Pressure Washing - A cleaning method employing a high-pressure spray of heated potable water to remove various organic/inorganic chemicals from equipment.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Project Manager - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

Decontamination Personnel - Individuals assigned the task of decontamination. It is the responsibility of these individuals to understand the use and application of the decontamination process and solutions as well as the monitoring of that process to ensure that it is working properly. This is accomplished through visual evaluation, monitoring instrument scanning of decontaminated items, and/or through the collection of rinsate blanks to verify contaminant removal.

Field Operations Leader (FOL) - Responsible for the implementation of project-specific planning documents. This includes on-site verification that all field activities are performed in compliance with approved SOPs or as otherwise dictated by the approved project plan(s). The FOL is also responsible for the completion and accuracy of all field documentation.

Site Safety Officer (SSO) - Exercises shared responsibility with the FOL concerning decontamination effectiveness. All equipment arriving on site (as part of the equipment inspection), leaving the site, and moving between locations is required to go through a decontamination evaluation. This is accomplished through visual examination and/or instrument screening to determine the effectiveness of the decontamination process. Improper or incomplete decontamination is sufficient to restrict equipment from entering the site, exiting the site, or moving to a new location on the site until the objectives are successfully completed.

General personnel qualifications for decontamination activities include the following:

- Occupational Safety and Health Administration (OSHA) 40-hour and applicable refresher training.
- Capability of performing field work under the expected physical and environmental (i.e., weather) conditions.
- Familiarity with appropriate decontamination procedures.

5.0 HEALTH AND SAFETY

In addition to the health and safety issues and reminders specified in subsections of this SOP, the following considerations and requirements must be observed as SOPs for field equipment decontamination activities:

- If any solvents or hazardous chemicals (e.g., isopropyl alcohol) are to be used in equipment decontamination activities, the FOL must first obtain the manufacturer's/supplier's Material Safety Data Sheet (MSDS) and assure that it is reviewed by all users (prior to its use), added to the site Hazardous Chemical Inventory, and maintained on site as part of the project Hazard Communication Program.
- Review and observe specific health and safety requirements (e.g., personal protective equipment [PPE]) specified in the project-specific health and safety plan for this activity.

6.0 EQUIPMENT LIST

- Wood for decontamination pad construction, when applicable (see Section 7.1).

- Tools for constructing decontamination pad frame, when applicable (see Section 7.1).
- Visqueen sheeting or comparable material to cover decontamination pad frame, when applicable (see Section 7.1).
- Wash/drying racks for auger flights and drill/drive rods, when applicable (see Section 7.2).
- PPE as specified in the project health and safety plan.
- Soap and water for washing and rinsing.
- Deionized water for final rinsing.
- Solvents (e.g., pesticide-grade isopropanol) for rinsing (see applicable portions of Section 7.2).
- Tubs, buckets, etc. for containerizing rinse water (see applicable portions of Section 7.2).
- Sample bottles for collecting rinsate blanks (see Section 7.2).
- Calibrated photoionization detector (PID) or flame ionization detector (FID) to monitor decontaminated equipment for organic vapors generated through the existence of residual contamination or the presence of decontamination solvent remaining after the piece was rinsed.
- Aluminum foil or clear clean plastic bag for covering cleaned equipment (see applicable portions of Section 7.2).
- Paper towels or cloths for wiping.
- Brushes, scrapers, or other hand tools useful for removing solid materials from equipment.
- Clear plastic wrap for covering or wrapping large decontaminated equipment items (see Section 7.2.2).
- Drum-moving equipment for moving filled waste drums (optional) (see Section 7.3).
- Drum labels for waste drums (see Attachment A).

7.0 PROCEDURES

The process of decontamination is accomplished through the removal of contaminants, neutralization of contaminants, or isolation of contaminants. To accomplish this activity, preparation is required including site preparation, equipment selection, and evaluation of the decontamination requirements and processes. Site contaminant types, concentrations, and media types are primary drivers in the selection of the types of decontamination and where it will be conducted. For purposes of this SOP, discussion is limited to decontamination procedures for general environmental investigations.

Decontamination processes will be performed at the location(s) specified in project-specific planning documents. Typical decontamination locations include the following:

- Temporary decontamination pads/facilities
- Sample locations
- Centralized decontamination pad/facilities

- Combination of some or all of the above

The following discussion includes general considerations for the decontamination process. Specific construction and implementation procedures will be as specified in the project-specific planning documents and/or may be as dictated by site-specific conditions as long as the intent of the requirements in the planning documents is met. This intent is to contain any residual fluids and solids generated through the decontamination process.

7.1 Decontamination Pad Design/Construction Considerations

7.1.1 Temporary Decontamination Pads

Temporary decontamination pads may be constructed at satellite locations within the site area in support of temporary work areas. These structures are generally constructed to support the decontamination of heavy equipment such as drill rigs and earth-moving equipment but can be employed for smaller articles.

The purpose of the decontamination pad is to contain wash waters and potentially contaminated soil generated during decontamination procedures. Therefore, construction of these pads should take into account the following considerations:

- Site location – The decontamination site selected should be far enough from the work site to maximize decontamination effectiveness while minimizing travel distance. The location of the decontamination site shall be selected to provide, in the judgment of the FOL or FOL designee, compliance with as many of the following characteristics as practicable:

  - Well removed from pedestrian/vehicle thoroughfares.

  - Avoidance of areas where control/custody cannot be maintained.

  - Avoidance of areas where potential releases of contaminated media or decontamination fluids may be compounded through access to storm water transport systems, streams, or other potentially sensitive areas.

  - Avoidance of potentially contaminated areas.

  - Avoidance of areas too close to the ongoing operation, where cross-contamination may occur.

  The selected decontamination site should include the following, where possible:

  - Areas where potable water and electricity are provided.

> ***Safety Reminder***
>
> When utilizing electrical power sources, either hard-wired or portable-generated sources, ensure that:
>
> - All power is routed through a Ground Fault Circuit Interrupter (GFCI).
>
> - All power cords are in good condition (no physical damage), rated for the intended energy load, and designated for outdoor use.
>
> In situations where accomplishing these elements is not possible, it will be necessary to implement a site electrical grounding program.

- Areas where support activities such as removing decontamination waters soil and sediment are possible without entering an active exclusion zone.

- Areas that offer sufficient size to carry out the specific decontamination sequence.

- Decontamination pad (decon pad) – The decon pad shall be constructed to meet the following characteristics:

  - Size – The size of the pad should be sufficient to accept the equipment to be decontaminated as well as permitting free movement around the equipment by the personnel conducting the decontamination. The size should permit these movements utilizing pressure/steam washer wands and hoses and minimizing splash due to work in close quarters.

  - Slope – An adequate slope will be constructed to permit the collection of water and potentially contaminated soil within a trough or sump constructed at one end. The collection point for wash waters should be of adequate distance that the decontamination workers do not have to walk through the wash waters while completing their tasks. Because the pad will be sloped, place a light coating of sand over the plastic to minimize potential slips and falls. See the text about liners below.

  - Sidewalls – The sidewalls shall be at least 6 inches in height (or as high as possible if 6 inches is not achievable) to provide adequate containment for wash waters and soil. If splash represents a potential problem, splash guards should be constructed to control overspray. Sidewalls may be constructed of wood, inflatables, sand bags, etc. to permit containment. Splash guards are typically wood frames with Visqueen coverings to control overspray.

  - Liner – Depending on the types of equipment and decontamination method to be used, the liner should be of sufficient thickness to provide a puncture-resistant barrier between the decontamination operation and the unprotected environment. Care should be taken to examine the surface area prior to placing the liner to remove sharp articles (sticks, stones, debris) that could puncture the liner. Liners are intended to form an impermeable barrier. The thickness may vary from a minimum recommended thickness of 10 mil to 30 mil. The desired thickness may be achieved through layering materials of lighter construction. It should be noted that various materials (rubber, polyethylene sheeting) become slippery when wet. To minimize this potential hazard associated with a sloped liner, a light coating of sand shall be applied to provide traction as necessary.

  - Wash/drying racks – Auger flights, drill/drive rods, and similar equipment require racks positioned off of the ground to permit these articles to be washed, drained, and dried while secured from falling during this process.

For decontamination of direct-push technology (DPT) equipment, the pad may be as simple as a mortar tub containing buckets of soapy water for washing and an empty bucket to capture rinse waters. Decontamination may be conducted at the rear of the rig to permit rapid tool exchange.

- Maintenance – Maintain the decontamination area by:

  - Periodically clearing the work area of standing water, soil, and debris, and coiling hoses to aid in eliminating slip, trip, and fall hazards. In addition, these articles will reduce potential backsplash and cross-contamination.

- Regularly changing the decontamination fluids to ensure proper cleaning and prevent cross-contamination.

- PPE – Periodically evaluate the condition of, and maintain the decontamination equipment, including regular cleaning of face shields and safety glasses. This is critical to ensuring the safety of decontamination personnel and the integrity of the decontamination process, and it will ensure that equipment is functioning properly.

7.1.2 Decontamination Activities at Drill Rigs/DPT Units

During subsurface sampling activities including drilling and DPT activities, decontamination of drive rods, Macro Core Samplers, split spoons, etc. is typically conducted at an area adjacent to the operation. Decontamination is generally accomplished using a soap/water wash and rinse utilizing buckets and brushes. This area requires sufficient preparation to accomplish the decontamination objectives.

Buckets shall be placed within mortar tubs or similar secondary containment tubs to prevent splash and spills from reaching unprotected environmental media. Drying racks shall be employed as directed for temporary pads to permit parts to dry and be evaluated prior to use/reuse. Methodology regarding this activity is provided in Section 7.2.

7.1.3 Decontamination Activities at Remote Sample Locations

When sampling at remote locations, sampling equipment such as trowels and pumps/tubing should be evacuated of potentially contaminated media to the extent possible. This equipment should be wrapped in plastic for transport to the temporary/centralized decontamination location for final cleaning and disposition. Flushing and cleaning of single-use equipment such as disposable trowels, tubing, and surgeon's gloves may allow disposal of this equipment after visible soil and water remnants have been removed.

7.2 Equipment Decontamination Procedures

The following represents procedures to be employed for the decontamination of equipment that may have contacted and/or accumulated contamination through site investigation activities.

7.2.1 Monitoring Well Sampling Equipment

7.2.1.1 Groundwater sampling equipment – This includes pumps inserted into monitoring wells such as bladder pumps, Whale pumps, and Redi-Flo pumps and reusable bailers, etc.

1. Evacuate to the extent possible, any purge water within the pump/bailer.

2. Scrub using soap and water and/or steam clean the outside of the pump/bailer and, if applicable, the pump tubing.

3. Insert the pump and tubing/bailer into a clean container of soapy water. Pump/run a sufficient amount of soapy water through the pump/bailer to flush out any residual well water. After the pump is flushed, circulate soapy water through the pump to ensure that the internal components are thoroughly flushed.

4. Remove the pump and tubing/bailer from the container

5. Rinse external pump components using tap water.

6. Insert the pump and tubing/bailer into a clean container of tap water. Pump/run a sufficient amount of tap water through the pump/bailer to evacuate all of the soapy water (until clear).

> ***CAUTION***
> Do not rinse PE, PVC, and associated tubing with solvents –
> Use the procedures defined in the project-specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 7 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.

7. If groundwater contains or is suspected to contain oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse the equipment to be cleaned with pesticide-grade isopropanol.

8. Pass deionized water through the hose to flush out the tap water and solvent residue as applicable.

9. Drain residual deionized water to the extent possible.

10. Allow components of the equipment to air dry.

11. For bladder pumps, disassemble the pump and wash the internal components with soap and water, then rinse with tap water, isopropanol, and deionized water and allow to dry. After the parts are dry, conduct a visual inspection and a monitoring instrument scan to ensure that potential contaminants and all decontamination solvent have been removed. Collect a rinsate blank in accordance with the project-specific planning documents to ensure that the decontamination process is functioning as intended. The typical frequency of collection for rinsate blanks is 1 per 20 field samples. In addition, wipe samples or field tests such as UV light may be used.

12. Wrap pump/bailer in aluminum foil or a clear clean plastic bag for storage.

> ***SAFETY REMINDER***
> Remember when handling powered equipment to disconnect the power source and render the equipment to a zero energy state (both potential and kinetic) before opening valves, disconnecting lines, etc.

7.2.1.2 Electronic Water Level Indicators/Sounders/Tapes

During water level measurements, rinsing the extracted tape and probe with deionized water and wiping the surface of the extracted tape between locations is acceptable. However, periodic full decontamination should be conducted as follows:

1. Wash with soap and water
2. Rinse with tap water
3. Rinse with deionized water

> ***NOTE***
> In situations where oil, grease, free product, other hard to remove materials are encountered, probes and exposed tapes should be washed in hot soapy water. If probes or tapes cannot be satisfactorily decontaminated (they are still stained, discolored, etc.), they should be removed from service.

7.2.1.3 Miscellaneous Equipment

Miscellaneous equipment including analytical equipment (water quality testing equipment) shall be cleaned per manufacturers' instructions. This generally includes wiping the sensor housing and rinsing with tap and deionized water.

Coolers/shipping containers employed to ship samples are received from the laboratory in a variety of conditions including marginal to extremely poor. Coolers shall be evaluated prior to use for the following:

- Structural integrity – Coolers missing handles or having breaks in the outer housing should be removed and not used. Notify the laboratory that the risk of shipping samples in the cooler(s) provided is too great and request a replacement unit.

- Cleanliness – As per protocol, only volatile organic samples are accompanied by a trip blank. If a cooler's cleanliness is in question (visibly dirty/stained) or if there are noticeable odors, the cooler should be decontaminated prior to use as follows:

  1. Wash with soap and water
  2. Rinse with tap water
  3. Dry

If these measures fail to clean the cooler to an acceptable level, remove the unit from use as a shipping container and ask the cooler provider (e.g., the analytical laboratory) to provide a replacement unit.

7.2.2 Downhole Drilling Equipment

This includes any portion of the drill rig that is over the borehole, including auger flights, drill stems, rods, and associated tooling that would extend over the borehole. The following procedure is to be employed prior to initiating the drilling/sampling activity, then between locations:

> ***CAUTION***
> Exercise care when using scrapers to remove soil and debris from downhole drilling equipment. Inadvertent slips of scrapers have resulted in cuts, scrapes, and injured knuckles, so use scrapers carefully when removing soil from these items.

1. Remove loose soil using shovels, scrapers, etc.

2. Through a combination of scrubbing using soap and water and/or steam cleaning or pressure washing, remove visible dirt/soil from the equipment being decontaminated.

> ***CAUTION***
> In Step 3, do not rinse PE, PVC, and associated tubing with solvents. The appropriate procedures should be defined within the project-specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 4 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.

3. Rinse the equipment with tap water, where applicable (steam cleaning and pressure washing incorporate rinsing as part of the process).

4. If the equipment has directly or indirectly contacted contaminated sample media and is known or suspected of being contaminated with oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse equipment with pesticide-grade isopropanol

5. To the extent possible, allow components to air dry.

6. If the decontaminated equipment is to be used immediately after decontamination, screen it with a calibrated photoionization detector (PID)/flame ionization detector (FID) to ensure that all contaminants and possible decontamination solvents (if they were used) have been adequately removed.

7. Wrap or cover equipment in clear plastic until it is time to be used.

SAFETY REMINDER

Even when equipment is disconnected from power sources, dangers such as the following may persist:

Falls - An auger flight standing on its end may fall and injure someone. Secure all loose articles to prevent heavy articles from falling onto people or equipment.

Burns - Steam cleaner water is heated to more than 212 ˚F and exhibits thermal energy that can cause burns. Prevent contact of skin with hot water or surfaces.

High water pressure - Pressure washer discharge can have 2,000 to 4,000 psi of water pressure. Water under this amount of pressure can rupture skin and other human tissues. Water at 4,000 psi exiting a 0˚ tip can be dangerous because of its relatively high cutting power. The exit velocity and cutting power of the water are reduced when exiting a 40˚ fan tip, but damage to soft tissues is still possible.

In general, follow the rules below to avoid injury, equipment damage, or incomplete decontamination:

1. Read the operating manual and follow the manufacturers' recommended safety practices before operating pressure washers and steam cleaners.

2. Never point the pressure washer or steam cleaner at another person or use to clean your boots or other parts of your body. Water lacerations and burns may appear to be minor at first but can be life threatening. Do not attempt to hold small parts in your hand while washing them with high-temperature or high-pressure water.

3. Always wear PPE as specified in the HASP such as:

   - Hard hat, safety glasses, splash shield, impermeable apron or splash suit, and hearing protection. Remember that excessive noise is a hazard when operating gas-powered engines and electrically driven pressure washers. PPE will be identified in your project specific planning documents.

4. Inspect each device before use. An inspection checklist will be provided in the project-specific planning documents. If it is a rented device, safety measures are typically provided by the vendor. In all cases, if you are not familiar with the operation of a pressure washer/steam cleaner, do not operate it until you obtain and thoroughly review operating instructions and recommended safety practices.

5. Do not modify equipment unless the manufacturer has approved the modifications.

7.2.3 Soil/Sediment Sampling Equipment

This section applies to soil sampling equipment including but not limited to hand augers, stainless steel trowels/spoons, bowls, dredges, scoops, split spoons, Macro Core samplers, etc.

1. Remove all loose soil from the equipment through manual means.

2. Through a combination of scrubbing using soap and water and/or steam cleaning or pressure washing, remove visible dirt/soil from the equipment.

3. Rinse the equipment with tap water.

> ***CAUTION***
> Do not rinse PE, PVC, and associated tubing with solvents. The appropriate procedures should be defined within the project-specific planning documents. If they are not defined, contact the FOL for guidance. The solvent rinse described in Step 4 may be omitted if groundwater does not contain oil, grease, PAHs, PCBs, or other hard to remove organic materials.

4. If the equipment is contaminated or suspected to be contaminated with oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse the equipment with pesticide-grade isopropanol.

5. Rinse the equipment with deionized water.

6. To the extent possible, allow components to air dry.

7. If the equipment is to be used immediately after decontamination, screen it with a calibrated PID/FID to ensure that all solvents (if they were used) and trace contaminants have been adequately removed.

8. After the equipment has dried, wrap it in aluminum foil for storage until use.

Dredges employed in sediment sampling are typically decontaminated as follows:

- Remove the sediment sample from the sampling device

- If sufficient associated surface water is available at the sampling site, place the dredge in the water and flush to remove visible sediment.

- Extract the dredge and wash it in soap and water per the project-specific planning documents.

> ***CAUTION***
> When handling dredges, the primary safety concern is trapping fingers or extremities in the larger dredge samplers within the jaws or pinch points of the mechanical jaws. Keep hands, fingers, and extremities away from these pinch and compression points. Either handle the device by the rope or preferably lock the jaws in place to control the potential for closing during maintenance and/or cleaning.

7.3 Contact Waste/Materials

During the course of field investigations, disposable/single-use equipment becomes contaminated. These items include tubing, trowels, PPE (gloves, overboots, splash suits, etc.), and broken sample containers.

With the exception of the broken glass, single-use articles should be cleaned (washed and rinsed) of visible materials and disposed as normal refuse. The exception to this rule is that extremely soiled materials that cannot be cleaned shall be containerized for disposal in accordance with applicable federal, state, and local regulations.

7.3.1 Investigation-Derived Wastes - Decontamination Wash Waters and Sediments

> ***NOTE***
> Requirements for waste storage may differ from one facility to the next. Facility-specific directions for waste storage areas will be provided in project-specific documents, or separate direction will be provided by the Project Manager.

1. Assume that all investigation-derived waste (IDW) generated from decontamination activities contains the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. Waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

2. Where possible, use filtering systems to extend the use of water within a closed system wash unit to recycle water and to reduce possible waste amounts.

> ***NOTE***
> Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility.

3. Label waste storage containers appropriately labeled (see Attachment A).

4. Ensure that the IDW storage area is configured to meet the following specifications to permit access to the containers and to conduct spill/leak monitoring, sampling, and extraction when the disposal route is determined:

   - Enclose areas accessible by the general public using construction fencing and signs.

   - Stored materials in 55-gallon drums on pallets with four (or fewer) drums per pallet.

   - Maintain the retaining bolt and label on the outside of storage containers where readily visible.

   - Provide at least 4 feet of room between each row of pallets to allow access to containers for sampling, drum removal, and spill response.

   - As directed in project-specific planning documents, maintain an IDW Inventory List and provide the list to the site Point of Contact at the termination of each shift.

   - Maintain spill response equipment at the IDW storage area in case it is required for immediate access.

- Where possible, use equipment for moving containers. Where not possible, obtain help to manipulate containers.

CAUTION

Each container of water can weigh up to 490 pounds. Each 55-gallon drum of wet soil can weigh more than 750 pounds. Fill drums and temporary containers to 80 percent capacity to minimize spill and handling difficulties. Use drum carts to move filled drums.

See safe lifting techniques provided in Section 4.4 of the Tetra Tech NUS, Inc. Health and Safety Guidance Manual.

When placing drums, keep your fingers out of pinch and smash points such as between the drums. In some cases such as well development and/or purge water, you can place the drums to be filled on the pallet and transport materials in smaller easier to handle containers.

7.4 Decontamination Evaluation

Upon decontamination of equipment, determine the effectiveness of the decontamination process in the following manner:

- Visual evaluation – A visual evaluation will be conducted to ensure the removal of particulate matter. This shall be done to ensure that the washing/rinsing process is working as intended.

- Instrument Screening – A properly calibrated PID/FID should be used to evaluate the presence of site contaminants and solvents used in the cleaning process. The air intake of the instrument shall be passed over the article to be evaluated. Avoid placing the instrument probe into residual waters. A PID/FID reading greater than the daily established background level requires a repeat of the decontamination process, followed by rescreening with the PID/FID. This sequence must be repeated until no instrument readings greater than the daily established background level are observed. It should be noted that the instrument scan is only viable if the contaminants are detectable within the instrument's capabilities.

NOTE

When required by project-specific planning documents, collection of rinsate blanks (see next step) shall be completed without exception unless approval to not collect these samples is obtained from the Project Manager.

- Collection of Rinsate Blanks – It is recommended that rinsate samples be collected to:

  - Evaluate the decontamination procedure representing different equipment applications (pumps versus drilling equipment) and different decontamination applications.

  - Single-use disposable equipment – The number of samples should represent different types of equipment as well as different lot numbers of single-use articles.

  - The collection and the frequency of collection of rinsate samples are as follows unless specified differently in the project-specific planning documents:

    - Per decontamination method
    - Per disposable article/batch number of disposable articles

NOTE

It is recommended that an initial rinsate sample be collected early in the project to ensure that the decontamination process is functioning properly and to avoid using a contaminated batch of single-use articles. It is recommended that a follow-up sample be collected later during the execution of the project to ensure that those conditions do not change.

Rinsate samples collection may be driven by types of and/or levels of contaminant. Difficult to remove contaminants, oils/greases, some PAHs/PCBs, etc. may also support the collection of additional rinsates due to the obvious challenges to the decontamination process. This is a field consideration to be determined by the FOL.

Attachment A
iDW Label

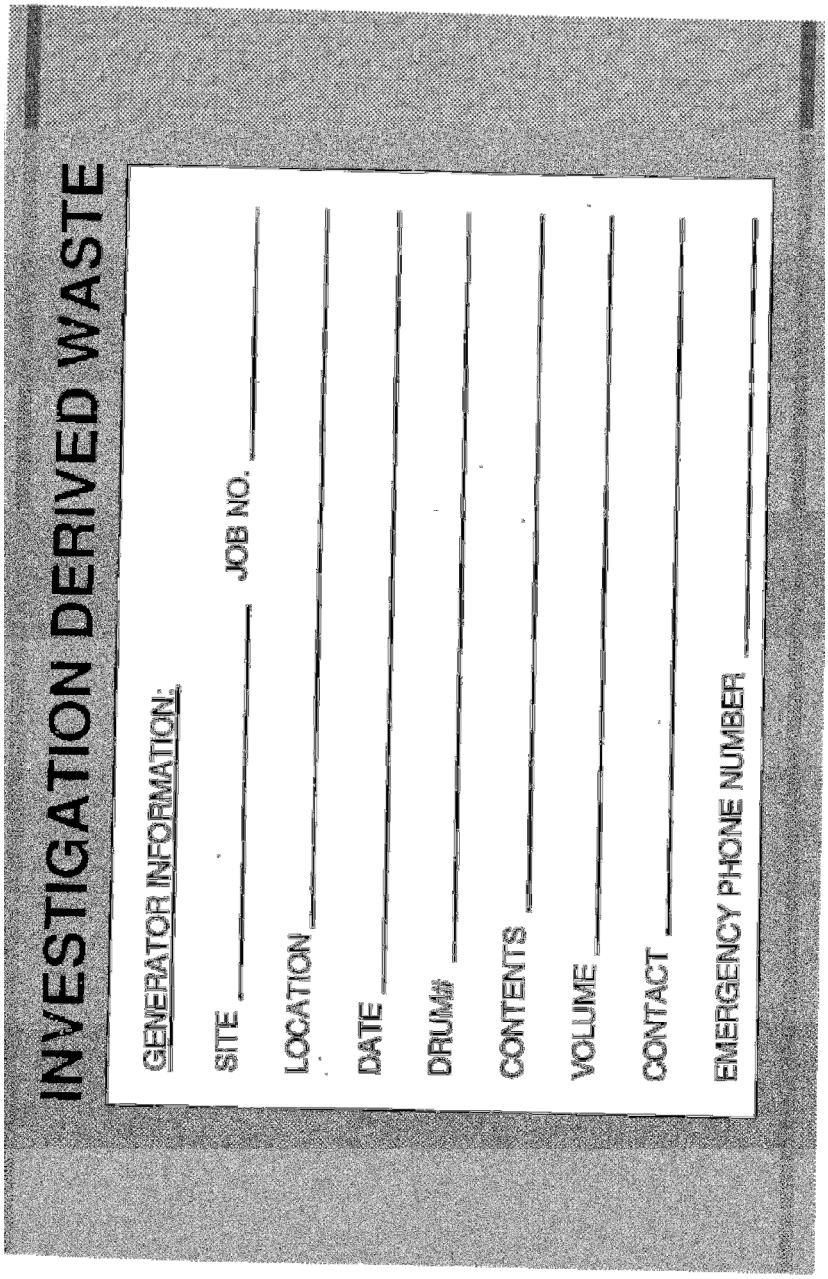


TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS **2**

5.0 PROCEDURES **3**

5.1 INTRODUCTION 3
5.2 SAMPLE IDENTIFICATION FIELD REQUIREMENTS 3
5.3 EXAMPLE SAMPLE FIELD DESIGNATIONS 4
5.4 EXAMPLES OF SAMPLE NOMENCLATURE 5
5.5 FIELD QA/QC SAMPLE NOMENCLATURE 6
5.6 EXAMPLES OF FIELD QA/QC SAMPLE NOMENCLATURE 6

6.0 DEVIATIONS **7**

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to specify a consistent sample nomenclature system that will facilitate subsequent data management in a cost-effective manner. The sample nomenclature system has been devised such that the following objectives can be attained:

- Sorting of data by matrix
- Sorting of data by depth
- Maintenance of consistency (field, laboratory, and database sample numbers)
- Accommodation of all project-specific requirements
- Accommodation of laboratory sample number length constraints (maximum of 20 characters)

2.0 SCOPE

The methods described in this SOP shall be used consistently for all projects requiring electronic data. Other contract- or project-specific sample nomenclature requirements may also be applicable.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Program Manager - It shall be the responsibility of the Project Manager (or designee) to inform contract-specific Project Managers (PMs) of the existence and requirements of this SOP.

Project Manager - It shall be the responsibility of the PM to determine the applicability of this SOP based on: (1) program-specific requirements and (2) project size and objectives. It shall be the responsibility of the PM (or designee) to ensure that sample nomenclature requirements are thoroughly specified in the relevant project planning document (e.g., sampling and analysis plan) and are consistent with this SOP if relevant. It shall be the responsibility of the PM to ensure that the FOL is familiar with the sample nomenclature system.

Field Operations Leader (FOL) - It shall be the responsibility of the FOL to ensure that all field technicians or sampling personnel are thoroughly familiar with this SOP and the project-specific sample nomenclature system. It shall be the responsibility of the FOL to ensure that the sample nomenclature system is used during all project-specific sampling efforts.

General personnel qualifications for sample nomenclature activities in the field include the following:

- Occupational Safety and Health Administration (OSHA) 40-hour and applicable refresher training.
- Capability of performing field work under the expected physical and environmental (i.e., weather) conditions.
- Familiarity with appropriate procedures for field documentation, handling, packaging, and shipping.

5.0 PROCEDURES

5.1 INTRODUCTION

The sample identification (ID) system can consist of as few as eight but not more than 20 distinct alpha-numeric characters. The sample ID will be provided to the laboratory on the sample labels and chain-of-custody forms. The basic sample ID provided to the laboratory has three segments and shall be as follows, where "A" indicates "alpha," and "N" indicates "numeric":

A or N 3 or 4 Characters	**AAA 2 or 3 Characters**	**A or N 3 to 6 Characters**
Site Identifier	Sample Type	Sample Location

Additional segments may be added as needed. For example:

(1) Soil and sediment sample ID

A or N 3 or 4 Characters	**AAA 2 or 3 Characters**	**A or N 3 to 6 Characters**	**NNNN 4 Characters**
Site identifier	Sample type	Sample location	Sample depth

(2) Aqueous (groundwater or surface water) sample ID

A or N 3 or 4 Characters	**AAA 2 or 3 Characters**	**A or N 3 to 6 Characters**	**NN 2 Characters**	**-A 1 Character**
Site identifier	Sample type	Sample location	Round number	Filtered sample only

(3) Biota sample ID

A or N 3 or 4 Characters	**AAA 2 or 3 Characters**	**A or N 3 to 6 Characters**	**AA 2 Characters**	**NNN 3 Characters**
Site identifier	Sample type	Sample location	Species identifier	Sample group number

5.2 SAMPLE IDENTIFICATION FIELD REQUIREMENTS

The various fields in the sample ID include but are not limited to the following:

- Site identifier
- Sample type
- Sample location
- Sample depth
- Sampling round number
- Filtered
- Species identifier
- Sample group number

The site identifier must be a three- or four-character field (numeric characters, alpha characters, or a mixture of alpha and numeric characters may be used). A site number is necessary because many

facilities/sites have multiple individual sites, Solid Waste Management Units (SWMUs), Operable Units (OUs), etc. Several examples are presented in Section 5.3 of this SOP.

The sample type must be a two- or three-character alpha field. Suggested codes are provided in Section 5.3 of this SOP.

The sample location must be at least a three-character field but may have up to six characters (alpha, numeric, or a mixture). The six characters may be useful in identifying a monitoring well to be sampled or describing a grid location.

The sample depth field is used to note the depth below ground surface (bgs) at which a soil or sediment sample is collected. The first two numbers of the four-number code specify the top interval, and the third and fourth specify the bottom interval in feet bgs of the sample. If the sample depth is equal to or greater than 100, then only the top interval would be represented and the sampling depth would be truncated to three characters. The depths will be noted in whole numbers only; further detail, if needed, will be recorded on the sample log sheet or boring log, in the logbook, etc.

A two-digit round number will be used to track the number of aqueous samples collected from a particular aqueous sample location. The first sample collected from a location will be assigned the round identifier 01, the second 02, etc. This applies to both existing and proposed monitoring wells and surface water locations.

Aqueous samples that are field filtered (dissolved analysis) will be identified with an "-F" in the last field segment. No entry in this segment signifies an unfiltered (total) sample.

The species identifier must be a two-character alpha field. Several suggested codes are provided in Section 5.3 of this SOP.

The three-digit sample group number will be used to track the number of biota sample groups (a particular group size may be determined by sample technique, media type, the number of individual caught, weight issues, time, etc.) by species and location. The first sample group of a particular species collected from a given location will be assigned the sample group number 001, and the second sample group of the same species collected from the same location will be assigned the sample group number 002.

5.3 EXAMPLE SAMPLE FIELD DESIGNATIONS

Examples of each of the fields are as follows:

Site identifier - Examples of site numbers/designations are as follows:

A01 - Area of Concern (AOC) 1
125 - SWMU 125
000 - Base- or facility-wide sample (e.g., upgradient well)
BBG - Base background

The examples cited are only suggestions. Each PM (or designee) must designate appropriate (and consistent) site designations for their individual project.

Sample type - Examples of sample types are as follows:

AH - Ash Sample
AS - Air Sample
BM - Building Material Sample

BSB - Biota Sample Full Body
BSF - Biota Sample Fillet
CP - Composite Sample
CS - Chip Sample
DS - Drum Sample
DU - Dust Sample
FP - Free Product
IDW - Investigation-Derived Waste Sample
LT - Leachate Sample
MW - Monitoring Well Groundwater Sample
OF - Outfall Sample
RW - Residential Well Sample
SB - Soil Boring Sample
SD - Sediment Sample
SC - Scrape Sample
SG - Soil Gas Sample
SL - Sludge Sample
SP - Seep Sample
SS - Surface Soil Sample
ST - Storm Sewer Water Sample
SW - Surface Water Sample
TP - Test Pit Sample
TW - Temporary Well Sample
WC - Well Construction Material Sample
WP - Wipe Sample
WS - Waste/Solid Sample
WW - Wastewater Sample

Sample location - Examples of the location field are as follows:

001 - Monitoring well 1
N32E92 - Grid location 32 North and 92 East
D096 - Investigation-derived waste drum number 96

Species identifier - Examples of species identifier are as follows:

BC - Blue Crab
GB - Blue Gill
CO - Corn
SB - Soybean

5.4 EXAMPLES OF SAMPLE NOMENCLATURE

The first round monitoring well groundwater sample collected from existing monitoring well 001 at SWMU 16 for a filtered sample would be designated as 016MW00101-F.

The second round monitoring well groundwater sample collected from existing monitoring well C20P2 at Site 23 for an unfiltered sample would be designated as 023MWC20P202.

The second surface water sample collected from point 01 at SWMU 130 for an unfiltered sample would be designated as 130SW00102.

A surface soil sample collected from grid location 32 North and 92 East at Site 32 at the 0- to 2-foot

interval would be designated as 032SSN32E920002.

A subsurface soil sample from soil boring 03 at SWMU 32 at an interval of 4 to 5 feet bgs would be designated as 032SB0030405.

A sediment sample collected at SWMU 19 from 0 to 6 inches at location 14 would be designated as 019SD0140001. The sample data sheet would reflect the precise depth at which this sample was collected.

During biota sampling for full-body analysis, the first time a minnow trap was checked at grid location A25 of SWMU 1415, three small blue gills were captured, collected, and designated with the sample ID of 1415BSBA25BG001. The second time blue gill were collected at the same location (grid location A25 at SWMU 1415), the sample ID would be 1415BSBA25BG002.

Note: No dash (-) or spacing is used between the segments with the exception of the filtered segment. The "F" used for a filtered aqueous sample is preceded by a dash (-F).

5.5 FIELD QA/QC SAMPLE NOMENCLATURE

Field Quality Assurance (QA)/Quality Control (QC) samples are designated using a different coding system. The QC code will consist of a three- to four-segment alpha-numeric code that identifies the sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

AA	NNNNNN	NN	-F
QC type	Date	Sequence number (per day)	Filtered (aqueous only, if needed)

The QC types are identified as:

TB = Trip Blank
RB = Rinsate Blank (Equipment Blank)
FD = Field Duplicate
AB = Ambient Conditions Blank
WB = Source Water Blank

The sampling time recorded on the chain-of-custody form, labels, and tags for duplicate samples will be 0000 so that the samples are "blind" to the laboratory. 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). Documentation for all other QC types (TB, RB, AB, and WB) will be recorded on the QC Sample Log Sheet (see SOP SA-6.3, Field Documentation).

5.6 EXAMPLES OF FIELD QA/QC SAMPLE NOMENCLATURE

The first duplicate of the day for a filtered groundwater sample collected on June 3, 2000, would be designated as FD06030001-F.

The third duplicate of the day taken of a subsurface soil sample collected on November 17, 2003, would be designated as FD11170303.

The first trip blank associated with samples collected on October 12, 2000, would be designated as TB10120001.

The only rinsate blank collected on November 17, 2001, would be designated as RB11170101.

6.0 DEVIATIONS

Any deviation from this SOP must be addressed in detail in the site-specific planning documents.

TABLE OF CONTENTS

SECTION **PAGE**

1.0 PURPOSE **2**

2.0 SCOPE **2**

3.0 GLOSSARY **2**

4.0 RESPONSIBILITIES **2**

5.0 PROCEDURES **4**

5.1 INTRODUCTION 4
5.2 FILE ESTABLISHMENT 4
5.3 ELECTRONIC DELIVERABLES 4
5.4 SAMPLE TRACKING FORMS 5
5.5 CHAIN-OF-CUSTODY FORMS 5
5.6 DATA VALIDATION LETTERS 5
5.7 HISTORICAL DATA 5

6.0 RECORDS **6**

ATTACHMENTS

A MIS REQUEST FORM **7**

1.0 PURPOSE

The purpose of this document is to specify a consistent procedure for the quality assurance review of electronic and hard copy databases. This SOP outlines the requirements for establishment of a Database Record File, Quality Assurance review procedures, and documentation of the Quality Assurance Review Process.

2.0 SCOPE

The methods described in this Standard Operating Procedure (SOP) shall be used consistently for all projects managed by Tetra Tech.

3.0 GLOSSARY

Chain-of-Custody Form - A Chain-of-Custody Form is a printed form that accompanies a sample or a group of samples from the time of sample collection to the laboratory. The Chain-of-Custody Form is retained with the samples during transfer of samples from one custodian to another. The Chain-of-Custody Form is a controlled document that becomes part of the permanent project file. Chain-of-Custody and field documentation requirements are addressed in SOP SA-6.1.

Electronic Database - A database provided on a compact laser disk (CD). Such electronic databases will generally be prepared using public domain software such as DBase, RBase, Oracle, Visual FoxPro, Microsoft Access, Paradox, etc.

Hardcopy Database - A printed copy of a database prepared using the software discussed under the definition of an electronic database.

Form I - A printed copy of the analytical results for each sample.

Sample Tracking Summary - A printed record of sample information including the date the samples were collected, the number of samples collected, the sample matrix, the laboratory to which the samples were shipped, the associated analytical requirements for the samples, the date the analytical data were received from the laboratory, and the date that validation of the sample data was completed.

4.0 RESPONSIBILITIES

Database Records Custodian - It shall be the responsibility of the Database Records Custodian to update and file the Sample Tracking Summaries for all active projects on a weekly basis. It shall be the responsibility of the Database Records Custodian to ensure that the most recent copies of the Sample Tracking Summaries are placed in the Database Records file. It shall be the responsibility of the Database Records Custodian to ensure that a copy of all validation deliverables is provided to the Project Manager (for placement in the project file). It shall be the responsibility of the Database Records Custodian to ensure that photocopies of all validation deliverables and historical data and reports (as applicable) are placed in the Database Records file.

Data Validation Coordinator - It shall be the responsibility of the Data Validation Coordinator (or designee) to ensure that the Sample Tracking Summaries are maintained by the Database Records Custodian. It shall be the responsibility of the Data Validation Coordinator (or designee) to ensure that photocopies of all data validation deliverables are placed in the applicable Database Records file by the Database Records Custodian.

Earth Sciences Department Manager - It shall be the responsibility of the Earth Sciences Department Manager (or equivalent) to ensure that all field personnel are familiar with the requirements of this Standard Operating Procedure (specifically Section 5.5).

FOL - It shall be the responsibility of the FOL (FOL) of each project to ensure that all field technicians or sampling personnel are thoroughly familiar with this SOP, specifically regarding provision of the Chain-of-Custody Forms to the Database Records Custodian. Other responsibilities of the FOL are described in Sections 5.4 and 5.5.

Management Information Systems (MIS) Manager - It shall be the responsibility of the MIS Manager to ensure that copies of original electronic deliverables (CDs) are placed in both the project files and the Database Records File. It shall be the responsibility of the MIS Manager (or designee) to verify the completeness of the database (presence of all samples) in both electronic and hardcopy form in the Database Records File. It shall be the responsibility of the MIS Manager to ensure that Quality Assurance Reviews are completed and are attested to by Quality Assurance Reviewers. It shall be the responsibility of the MIS Manager to ensure that records of the Quality Assurance review process are placed in the Database Records File. It shall be the responsibility of the MIS Manager to ensure that both electronic and hardcopy forms of the final database are placed in both the project and the Database Record File. It shall be the responsibility of the MIS Manager to ensure that data validation qualifiers are entered in the database.

Furthermore, it shall be the responsibility of the MIS Manager to participate in project planning at the request of the Project Manager, specifically with respect to the generation of level of effort and schedule estimates. To support the project planning effort, the MIS Manager shall provide a copy of the MIS Request From included as Attachment A to the project manager. It shall be the responsibility of the MIS Manager to generate level of effort and budget estimates at the time database support is requested if a budget does not exist at the time of the request. The MIS Request Form shall be provided to the Project Manager at the time of any such requests. It shall be the responsibility of the MIS Manager to notify the Project Manager of any anticipated level of effort overruns or schedule noncompliances as soon as such problems arise along with full justification for any deviations from the budget estimates (provided they were generated by the MIS Manager). It shall be the responsibility of the MIS Manager to document any changes to the scope of work dictated by the Project Manager, along with an estimate of the impact of the change on the level of effort and the schedule.

Program/Department Managers - It shall be the responsibility of the Department and/or Program Managers (or designees) to inform their respective department's Project Managers of the existence and requirements of this SOP.

Project Manager - It shall be the responsibility of each Project Manager to determine the applicability of this SOP based on: (1) program-specific requirements, and (2) project size and objectives. It shall be the responsibility of the Project Manager (or designee) to ensure that the FOL is familiar with the requirements regarding Chain-of-Custody Form provision to the Database Records Custodian. It shall be the responsibility of the Project Manager (or designee) to determine which, if any, historical data are relevant and to ensure that such data (including all relevant information such as originating entity, sample locations, sampling dates, etc.) are provided to the Database Records Custodian for inclusion in the Database Records File. It shall be the responsibility of the Project Manager to obtain project planning input regarding the level of effort and schedule from the MIS Manager. It shall be the responsibility of the Project Manager to complete the database checklist (Attachment A) to support the level of effort and schedule estimate and to facilitate database preparation and subroutine execution.

Risk Assessment Department Manager - It shall be the responsibility of the Risk Assessment Department Manager to monitor compliance with this Standard Operating Procedure, to modify this SOP as necessary, and to take corrective action if necessary. Monitoring of the process shall be completed on a quarterly basis.

Quality Assurance Reviewers - It shall be the responsibility of the Quality Assurance Reviewers to verify the completeness of the sample results via review of the Chain-of-Custody Forms and Sample Tracking Summaries. It shall be the responsibility of the Quality Assurance Reviewers to ensure the correctness of the database via direct comparison of the hardcopy printout of the database and the hardcopy summaries of the original analytical data (e.g., Form Is provided in data validation deliverables). Correctness includes the presence of all relevant sample information (all sample information fields), agreement of the laboratory and database analytical results, and the presence of data validation qualifiers.

Quality Manager - It shall be the responsibility of the Quality Manager to monitor compliance with this Standard Operating Procedure via routine audits.

5.0 PROCEDURES

5.1 Introduction

Verification of the accuracy and completeness of an electronic database can only be accomplished via comparison of a hardcopy of the database with hardcopy of all relevant sample information. The primary purposes of this SOP are to ensure that 1) all necessary hardcopy information is readily available to Quality Assurance Reviewers; 2) ensure that the Quality Assurance review is completed in a consistent and comprehensive manner, and; 3) ensure that documentation of the Quality Assurance review process is maintained in the project file.

5.2 File Establishment

A Database Record file shall be established for a specific project at the discretion of the Project Manager. Initiation of the filing procedure will commence upon receipt of the first set of Chain-of-Custody documents from a FOL or sampling technician. The Database Record Custodian shall establish a project-specific file for placement in the Database Record File. Each file in the Database Record File shall consist of standard components placed in the file as the project progresses. Each file shall be clearly labeled with the project number, which shall be placed on the front of the file drawer and on each and every hanging file folder relevant to the project. The following constitute the minimum components of a completed file:

- Electronic Deliverables
- Sample Tracking Forms
- Chain-of-Custody Forms
- Data Validation Letters
- Quality Assurance Records

5.3 Electronic Deliverables

The format of electronic deliverables shall be specified in the laboratory procurement specification and shall be provided by the laboratory. The integrity of all original electronic data deliverables shall be maintained. This shall be accomplished via the generation of copies of each electronic deliverable provided by the laboratory. The original electronic deliverable shall be provided to the project manager for inclusion in the project file. A copy of the original electronic deliverable shall be placed in the Database Record File. The second copy shall be maintained by the MIS Manager (or designee) to be used as a working copy.

5.4 Sample Tracking Forms

Updated versions of the sample tracking form for each relevant project shall be maintained by the Database Record Custodian. The Sample Tracking Forms shall be updated any time additional Chain-of-Custody Forms are received from a FOL or sampling technician, or at any time that data are received from a laboratory, or at any time that validation of a given data package (sample delivery group) is completed. The Data Validation Coordinator shall inform the Database Record Custodian of the receipt of any data packages from the laboratory and of completion of validation of a given data package to facilitate updating of the Sample Tracking Form. The Database Record Custodian shall place a revised copy of the Sample Tracking Form in the Database Record File anytime it has been updated. Copies of the updated Sample Tracking Form shall also be provided to the project manager to apprise the project manager of sample package receipt, completion of validation, etc.

5.5 Chain-of-Custody Forms

The Chain-of-Custody Forms for all sampling efforts will be used as the basis for (1) updating the Sample Tracking Form, and (2) confirming that all required samples and associated analyses have been completed. It shall be the responsibility of the FOL (or sample technician) to provide a photocopy of all Chain-of-Custody Forms to the Database Record Custodian immediately upon completion of a sampling effort. The Database Record Custodian shall then place the copies of the Chain-of-Custody Form(s) in the Database Record File. Upon receipt of a sample data package from an analytical laboratory, the Data Validation Coordinator shall provide a copy of the laboratory Chain-of-Custody Form to the Database Record Custodian. The Database Record Custodian shall use this copy to update the Sample Tracking Summary and shall place the copy of the laboratory-provided Chain-of-Custody Form in the Database Record File. The photocopy of the laboratory-provided Chain-of Custody Form shall be stapled to the previously filed field copy. Upon receipt of all analytical data, two copies of the Chain-of-Custody will therefore be in the file. Review of the Chain-of-Custody Forms will therefore be a simple mechanism to determine if all data have been received. Chain-of-Custody is addressed in SOP SA-6.1.

5.6 Data Validation Letters

All data validation deliverables (or raw data summaries if validation is not conducted) shall be provided for inclusion in both the Database Record File and the project file. If USEPA regional- or client-specific requirements are such that Form Is (or similar analytical results) need not be provided with the validation deliverable, copies of such results must be appended to the deliverable. It is preferable, although not essential that the validation qualifiers be hand-written directly on the data summary forms. The data validation deliverables (and attendant analytical summaries) will provide the basis for direct comparison of the database printout and the raw data and qualifiers.

5.7 Historical Data

At the direction of the Project Manager, historical data may also be included in a project-specific analytical database. In the event that historical data are germane to the project, hardcopy of the historical data must be included in the Database Record File. Historical data may be maintained in the form of final reports or as raw data. The information contained in the historical data file must be sufficient to identify its origin, its collection date, the sample location, the matrix, and any and all other pertinent information. All available analytical data, Chain-of-Custody Forms, boring logs, well construction logs, sample location maps, shall be photocopied by the Project Manager (or designee) and placed in one or more 3-ring binders. All information shall be organized chronologically by matrix. It shall be the responsibility of the Project Manager (or designee) to ensure that all inconsistencies between analytical data, Chain-of-Custody Forms, boring logs, sample log sheets, and field logbooks are identified and corrected. The Project Manager (or designee) shall decide which nomenclature is appropriate and edit, initial and date all

relevant forms. Data entry may only be performed on information that has undergone the aforementioned editing process, thereby having a direct correlation between hardcopy information and what will become the electronic database.

6.0 RECORDS

Records regarding database preparation and quality assurance review include all those identified in the previous section. Upon completion of the database task, records from the file will be forwarded to the Project Manager for inclusion in the project file, or will be placed in bankers boxes (or equivalent) for storage. The final records for storage shall include the following minimum information on placards placed on both the top and end of the storage box:

Database Record File
PROJECT NUMBER: ____
SITE NAME: _____
DATE FILED: __/__/__
SUMMARY OF CONTENTS ENCLOSED
BOX _ OF _

Project- or program-specific record keeping requirements shall take precedence over the record keeping requirements of this SOP.

ATTACHMENT A

MIS REQUEST FORM

Project Name: _____ Request Date: _____
CTO: _____ Date Data Available for Production: _____
Project Manager: _____ Request in Support of: _____
Requestor: _____ Database Lead: _____
Program/Client: _____ GIS Lead: _____
State/EPA Region: _____ Statistics Lead: _____
Risk Lead: _____
Site Name(s) (Area, OU, etc.): _____
Sampling Date(s): _____
Matrix: ☐ GW ☐ SO ☐ SD ☐ SW ☐ Other: _____

Labels: ☐ Labels needed for an upcoming sampling event _____ Total # of Samples
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
_____ FOL
Additional Instructions: _____

Data Entry:
☐ Chemical data needs to be entered from hardcopy _____ Estimated # of Samples
☐ Chemical data needs to be formated electronically
☐ Field analytical data needs to be entered from hardcopy
☐ Geologic data needs to be entered from hardcopy
☐ Hydrology data needs to be entered from hardcopy
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

Tables:
☐ Full Data Printout
☐ Summary of Positive Hits
☐ Occurance and Distribution ☐ with criteria
☐ Sampling Analytical Summary
☐ Other: _____
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

GIS:
☐ General Facility Location
☐ Site Location
☐ Potentiometric Contours/Groundwater Flow
☐ Sample Location Proposed
☐ Sample Location Existing
☐ Tag Map Single Round
☐ Tag Map Multiple Round
☐ Isoconcentrations
☐ Chart Map
☐ 3D Visualization
☐ EGIS CD
☐ Other: _____
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

Statistics: ☐ Yes
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

Geostatistics: ☐ Yes
_____ Estimated Hours
_____ Due Date
_____ Complete ETS Charge No.
Additional Instructions: _____

APPENDIX B

FIELD DOCUMENTATION FORMS

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER 4869 | PAGE ____ OF _____

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER	PHONE NUMBER	ADDRESS
		CARRIER/WAYBILL NUMBER		CITY, STATE

STANDARD TAT ☐
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

CONTAINER TYPE PLASTIC (P) or GLASS (G)

PRESERVATIVE USED

TYPE OF ANALYSIS

DATE YEAR	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAB (G) COMP (C)	No. OF CONTAINERS									COMMENTS

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS

DISTRIBUTION: WHITE (ACCOMPANIES SAMPLE) YELLOW (FIELD COPY) PINK (FILE COPY)

4/02R
FORM NO. TtNUS-001

TETRA TECH NUS, INC.

FIELD MODIFICATION RECORD

Site Name: _____ Location: _____

Project Number: _____ Task Assignment: _____

To: _____ Location: _____ Date: _____

Description:_____

_____

_____

_____

Reason for Change: _____

_____

_____

Recommended Action: _____

_____

_____

Field Operations Leader (Signature): _____ Date: _____

Disposition/Action:_____

_____

_____

Project Manager (Signature): _____ Date: _____

Distribution:

		Others as Required:
Program Manager:	_____	
Project Manager:	_____	_____
Quality Assurance Officer:	_____	_____
Field Operations Leader:	_____	_____
Project File:	_____	_____

TtNUS Form 0003

TETRA TECH NUS, INC.

PHOTOIONIZATION DETECTOR FIELD CALIBRATION LOG

Serial No.: _____ Model No.: _____ Decal No.: _____

Site Name/Location: _____ Tetra Tech NUS Charge No.: _____

CALIBRATION DATE	STANDARD GAS-ISOBUTYLENE	(AM) CALIBRATION READING Isobutylene Equiv. (ppm)	(PM) CALIBRATION CHECK Isobutylene Equiv. (ppm)	SIGNATURE	COMMENTS
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	
	Lot # _____ Conc. = _____ ppm	/		AM: PM:	

TtNUS Form 0006

Tetra Tech NUS, Inc.

QA SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____ Sample ID Number: _____
Project Number: _____ Sampled By: _____
Sample Location: _____ C.O.C. Number: _____
QA Sample Type:

[] Trip Blank [] Rinsate Blank
[] Source Water Blank [] Other Blank _____

SAMPLING DATA:

Date: _____
Time: _____
Method: _____

WATER SOURCE:

[] Laboratory Prepared [] Tap
[] Purchased [] Fire Hydrant
[] Other _____

PURCHASED WATER INFORMATION (If Applicable as Source or Rinsate Water):

Product Name: _____
Supplier: _____
Manufacturer: _____
Order Number: _____
Lot Number: _____
Expiration Date: _____

RINSATE INFORMATION (If Applicable):

Media Type: _____
Equipment Used: _____
Equipment Type:

[] Dedicated
[] Reusable

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
Volatiles	Cool 4°C & HCl		YES / NO
Semivolatiles	Cool 4°C		YES / NO
Pesticide / PCB	Cool 4°C		YES / NO
Metals	Cool 4°C & HNO_3		YES / NO
Cyanide	Cool 4°C & NaOH		YES / NO

OBSERVATIONS / NOTES:

Signature(s):

TETRA TECH NUS, INC.

SAMPLE COLLECTION SUMMARY RECORD

PROJECT NAME: _____ TETRA TECH NUS CHARGE NUMBER: _____

SAMPLING EVENT: _____ CASE NO.: _____ DAS NO.: _____

DATE	TIME	SAMPLE LOCATION	FIELD QC							COMMENTS

TtNUS Form 0012

TETRA TECH NUS, INC.

PROJECT NAME: _____ RIG NUMBER & TYPE _____

PROJECT NUMBER: _____ DATE: _____

LOCATION: _____ INSPECTED BY: _____

	ITEM	√	COMMENTS
1	Number of Emergency shutdown switches_____ All personnel knowledgeable of their location (s). Switches have been tested prior to commencement of drilling operations		
2	Steel cables are not frayed		
3	Ropes are not frayed		
4	Hydraulic fluids, and lubricants are not leaking		
5	Equipment with proper guards in place (chains to secure high-power air lines in the event of a break)		
6	Use of improper tools, pins, or other devices in poor condition		
7	Using worn air or hydraulic lines		
8	Cleaning-up the work site		
9	Storing fuels or other fluids in proper containers		
10	Hard hats, safety eyewear, steel toe/shank boots, hearing protection, Gloves, tyvek worn by driller/helper		
11	Proper protection equipment required by the Health & Safety Plan		
12	Decontamination Equipment		
13	Vehicle warning alarms (horn, mast, and back-up alarms)		
14	Fire extinguishers; fully charged and accessible		
15	Electrical wiring and switches		
16	Documentation of each driller's compliance with OSHA Health & Safety Training requirements		

TtNUS Form 0056

The FOL and SSO can request demonstration that the equipment is functioning properly.

BORING LOG FOR: _____ BORING NO.: _____
PROJECT NO.: _____ START DATE: _____
LOGGED BY: _____ TRANSCRIBED BY: _____ COMPLETION: DATE: _____
DRILLED BY (Company/Driller): _____ MON. WELL NO.: _____
GRD. SURFACE ELEVATION: _____ ELEVATION FROM: _____ CHECKED BY: _____

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID, (PPM)]

TYPE OF DRILLING RIG: _____
METHOD OF ADVANCING BORING: _____
METHOD OF SOIL SAMPLING: _____
METHOD OF ROCK CORING: _____
GROUNDWATER LEVELS: _____
OTHER OBSERVATIONS: _____ BORING NO.: _____

Tetra Tech NUS, Inc.

PAGE: OF

TtNUS Form 0018

APPENDIX C

ANALYTICAL LABORATORY CERTIFICATIONS

11617 Coldwater Rd., Ste 101
Fort Wayne, IN 46845
Tel: (260) 637 2705
Fax: (260) 637 2791
www.L-A-B.com

February 5, 2013

TestAmerica Laboratories, Inc.
Nasreen DeRubeis
301 Alpha Drive
Pittsburgh PA 15238

Dear Nasreen,

We appreciate your continued dedication to DoD/ELAP and the laboratory community. Laboratory Accreditation Bureau is granting an extension of your accreditation that was originally granted through **February 24, 2013.** This letter serves as an extension of your DoD/ELAP accreditation. The new granted through date is now **July 24, 2013**. The Certificate and the Scope of Accreditation of your location, **L2314** will remain valid until the new granted through date or a new certificate and scope are issued. If within this extension period your company decides to discontinue or cancel your accreditation, your accreditation will immediately be terminated and your listing discontinued as an accredited laboratory.

The current information as described above will be modified within two business days on the directory at www.l-a-b.com. It is L-A-B's policy not to modify the scope or certificate related to extensions of accreditation.

We look forward to a long and continued successful business relationship with your company. We appreciate your dedication to continuous improvement for our laboratory community.

Sincerely,

R. Douglas Leonard, Jr.
Managing Director

THE CERTIFICATE AND SCOPE, AS WELL AS ALL VERSIONS WHICH MAY BE ISSUED IN THE FUTURE, INCLUDING THIS EXTENSION LETTER, ARE THE SOLE PROPERTY OF LABORATORY ACCREDITATION BUREAU

LABORATORY ACCREDITATION BUREAU

Certificate of Accreditation

ISO/IEC 17025:2005 Certificate Number L2314

TestAmerica Laboratories Inc.

301 Alpha Drive
Pittsburgh, PA 15238

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).*

The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation valid through: February 24, 2013

R. Douglas Leonard, Jr., President, COO
Laboratory Accreditation Bureau
Presented the 24th of February 2012

*See the laboratory's Scope of Accreditation for details of accredited parameters
**Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

LABORATORY ACCREDITATION BUREAU

Certificate # L2314

Scope of Accreditation For TestAmerica Laboratories Inc. Pittsburgh Laboratory

301 Alpha Drive
Pittsburgh, PA 15238
Nasreen K. DeRubeis
412-963-2425

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.2) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to **TestAmerica Inc., Pittsburgh Laboratory** to perform the following tests:

Accreditation granted through: **February 24, 2013**

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B / 6010C	Aluminum
ICP-AES	EPA 6010B / 6010C	Antimony
ICP-AES	EPA 6010B / 6010C	Arsenic
ICP-AES	EPA 6010B / 6010C	Barium
ICP-AES	EPA 6010B / 6010C	Beryllium
ICP-AES	EPA 6010B / 6010C	Boron
ICP-AES	EPA 6010B / 6010C	Cadmium
ICP-AES	EPA 6010B / 6010C	Calcium
ICP-AES	EPA 6010B / 6010C	Chromium
ICP-AES	EPA 6010B / 6010C	Cobalt
ICP-AES	EPA 6010B / 6010C	Copper
ICP-AES	EPA 6010B / 6010C	Iron
ICP-AES	EPA 6010B / 6010C	Lead
ICP-AES	EPA 6010B / 6010C	Lithium
ICP-AES	EPA 6010B / 6010C	Magnesium
ICP-AES	EPA 6010B / 6010C	Manganese

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	EPA 6010B / 6010C	Molybdenum
ICP-AES	EPA 6010B / 6010C	Nickel
ICP-AES	EPA 6010B / 6010C	Potassium
ICP-AES	EPA 6010B / 6010C	Selenium
ICP-AES	EPA 6010B / 6010C	Silica
ICP-AES	EPA 6010B / 6010C	Silicon
ICP-AES	EPA 6010B / 6010C	Silver
ICP-AES	EPA 6010B / 6010C	Sodium
ICP-AES	EPA 6010B / 6010C	Strontium
ICP-AES	EPA 6010B / 6010C	Thallium
ICP-AES	EPA 6010B / 6010C	Tin
ICP-AES	EPA 6010B / 6010C	Titanium
ICP-AES	EPA 6010B / 6010C	Vanadium
ICP-AES	EPA 6010B / 6010C	Zinc
ICP-MS	EPA 6020 / 6020A	Aluminum
ICP-MS	EPA 6020 / 6020A	Antimony
ICP-MS	EPA 6020 / 6020A	Arsenic
ICP-MS	EPA 6020 / 6020A	Barium
ICP-MS	EPA 6020 / 6020A	Beryllium
ICP-MS	EPA 6020 / 6020A	Boron
ICP-MS	EPA 6020 / 6020A	Cadmium
ICP-MS	EPA 6020 / 6020A	Calcium
ICP-MS	EPA 6020 / 6020A	Chromium
ICP-MS	EPA 6020 / 6020A	Cobalt
ICP-MS	EPA 6020 / 6020A	Copper
ICP-MS	EPA 6020 / 6020A	Iron
ICP-MS	EPA 6020 / 6020A	Lead
ICP-MS	EPA 6020 / 6020A	Magnesium
ICP-MS	EPA 6020 / 6020A	Manganese
ICP-MS	EPA 6020 / 6020A	Molybdenum
ICP-MS	EPA 6020 / 6020A	Nickel
ICP-MS	EPA 6020 / 6020A	Potassium
ICP-MS	EPA 6020 / 6020A	Selenium
ICP-MS	EPA 6020 / 6020A	Silica
ICP-MS	EPA 6020 / 6020A	Silicon
ICP-MS	EPA 6020 / 6020A	Silver

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-MS	EPA 6020 / 6020A	Sodium
ICP-MS	EPA 6020 / 6020A	Strontium
ICP-MS	EPA 6020 / 6020A	Thallium
ICP-MS	EPA 6020 / 6020A	Tin
ICP-MS	EPA 6020 / 6020A	Titanium
ICP-MS	EPA 6020 / 6020A	Vanadium
ICP-MS	EPA 6020 / 6020A	Zinc
CVAA	EPA 7470A	Mercury
Spectrophotometer	EPA 7196A	Hexavalent Chromium
Kone Lab	EPA 9012A / EPA 9012B EPA 9010B / EPA 9010C	Total Cyanide
IC	EPA 9056A	Bromide
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate
IC	EPA 9056A	Nitrite
IC	EPA 9056A	Phosphate
IC	EPA 9056A	Sulfate
Gravimetric	EPA 1664A / 9070A	Oil and Grease
GC	EPA 8081A / 8081B	4,4'-DDD
GC	EPA 8081A / 8081B	4,4'-DDE
GC	EPA 8081A / 8081B	4,4'-DDT
GC	EPA 8081A / 8081B	Aldrin
GC	EPA 8081A / 8081B	alpha-BHC
GC	EPA 8081A / 8081B	alpha-Chlordane
GC	EPA 8081A / 8081B	beta-BHC
GC	EPA 8081A / 8081B	Chlordane (Technical)
GC	EPA 8081A / 8081B	delta-BHC
GC	EPA 8081A / 8081B	Dieldrin
GC	EPA 8081A / 8081B	Endosulfan I
GC	EPA 8081A / 8081B	Endosulfan II
GC	EPA 8081A / 8081B	Endosulfan sulfate
GC	EPA 8081A / 8081B	Endrin
GC	EPA 8081A / 8081B	Endrin aldehyde
GC	EPA 8081A / 8081B	Endrin ketone
GC	EPA 8081A / 8081B	gamma-BHC (Lindane)
GC	EPA 8081A / 8081B	gamma-Chlordane
GC	EPA 8081A / 8081B	Heptachlor
GC	EPA 8081A / 8081B	Heptachlor epoxide
GC	EPA 8081A / 8081B	Methoxychlor

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 8081A / 8081B	Toxaphene
GC	EPA 8082 / 8082A	Aroclor 1016
GC	EPA 8082 / 8082A	Aroclor 1221
GC	EPA 8082 / 8082A	Aroclor 1232
GC	EPA 8082 / 8082A	Aroclor 1242
GC	EPA 8082 / 8082A	Aroclor 1248
GC	EPA 8082 / 8082A	Aroclor 1254
GC	EPA 8082 / 8082A	Aroclor 1260
GC	EPA 8082 / 8082A	Aroclor 1262
GC	EPA 8082 / 8082A	Aroclor 1268
GC	EPA 8082 / 8082A	Aroclor 1016/1260
GC	EPA 8141A / 8141B	Azinphos-methyl
GC	EPA 8141A / 8141B	Bolstar (Sulprofos)
GC	EPA 8141A / 8141B	Chlorpyrifos
GC	EPA 8141A / 8141B	Coumaphos
GC	EPA 8141A / 8141B	Demeton-O
GC	EPA 8141A / 8141B	Demeton-S
GC	EPA 8141A / 8141B	Demeton (total)
GC	EPA 8141A / 8141B	Diazinon
GC	EPA 8141A / 8141B	Dichlorvos (DDVP)
GC	EPA 8141A / 8141B	Disulfoton
GC	EPA 8141A / 8141B	Ethoprop
GC	EPA 8141A / 8141B	Dimethoate
GC	EPA 8141A / 8141B	EPN
GC	EPA 8141A / 8141B	Ethyl parathion (Parathion)
GC	EPA 8141A / 8141B	Famphur
GC	EPA 8141A / 8141B	Fensulfothion
GC	EPA 8141A / 8141B	Fenthion
GC	EPA 8141A / 8141B	Malathion
GC	EPA 8141A / 8141B	Mevinphos
GC	EPA 8141A / 8141B	O,O,O-Triethyl phosphorothioate
GC	EPA 8141A / 8141B	Parathion, methyl
GC	EPA 8141A / 8141B	Phorate
GC	EPA 8141A / 8141B	Ronnel
GC	EPA 8141A / 8141B	Sulfotepp (Tetraethyldithiopyrophosphate)
GC	EPA 8141A / 8141B	Stirophos (Tetrachlorovinphos)
GC	EPA 8141A / 8141B	Thionazin
GC	EPA 8141A / 8141B	Tokuthion (Protothiofos)
GC	EPA 8141A / 8141B	Trichlornate
GC	EPA 8151A	2,4,5-T
GC	EPA 8151A	2,4,5-TP (Silvex)
GC	EPA 8151A	2,4-D

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 8151A	2,4-DB
GC	EPA 8151A	Dalapon
GC	EPA 8151A	Dicamba
GC	EPA 8151A	Dichlorprop
GC	EPA 8151A	Dinoseb
GC	EPA 8151A	MCPA
GC	EPA 8151A	MCPP
GC	EPA 8151A	Pentachlorophenol
GC-MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,1-Trichloroethane
GC-MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,2-Trichloroethane
GC-MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane
GC-MS	EPA 8260B	1,1-Dichloroethane
GC-MS	EPA 8260B	1,1-Dichloroethene
GC-MS	EPA 8260B	1,1-Dichloropropene
GC-MS	EPA 8260B	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B	1,2,3-Trichloropropane
GC-MS	EPA 8260B	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC-MS	EPA 8260B	1,2-Dibromoethane (EDB)
GC-MS	EPA 8260B	1,2-Dichlorobenzene
GC-MS	EPA 8260B	1,2-Dichloroethane
GC-MS	EPA 8260B	1,2-Dichloropropane
GC-MS	EPA 8260B	1,2-Dichloroethene (total)
GC-MS	EPA 8260B	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B	1,3-Dichlorobenzene
GC-MS	EPA 8260B	1,3-Dichloropropane
GC-MS	EPA 8260B	1,4-Dichlorobenzene
GC-MS	EPA 8260B	2,2-Dichloropropane
GC-MS	EPA 8260B	2-Butanone (MEK)
GC-MS	EPA 8260B	2-Chlorotoluene
GC-MS	EPA 8260B	2-Hexanone
GC-MS	EPA 8260B	4-Chlorotoluene
GC-MS	EPA 8260B	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B	Acetone
GC-MS	EPA 8260B	Benzene
GC-MS	EPA 8260B	Bromobenzene
GC-MS	EPA 8260B	Bromochloromethane
GC-MS	EPA 8260B	Bromodichloromethane
GC-MS	8260B	Bromoform

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	8260B	Bromomethane
GC-MS	8260B	Carbon disulfide
GC-MS	8260B	Carbon tetrachloride
GC-MS	8260B	Chlorobenzene
GC-MS	8260B	Chloroethane
GC-MS	8260B	Chloroform
GC-MS	8260B	Chloromethane
GC-MS	8260B	cis-1,2-Dichloroethene
GC-MS	8260B	cis-1,3-Dichloropropene
GC-MS	8260B	Cyclohexane
GC-MS	8260B	Dibromochloromethane
GC-MS	8260B	Dibromomethane
GC-MS	8260B	Dichlorodifluoromethane
GC-MS	8260B	Ethylbenzene
GC-MS	8260B	Hexachlorobutadiene
GC-MS	8260B	Isopropylbenzene
GC-MS	8260B	m&p-Xylenes
GC-MS	8260B	Methylene chloride
GC-MS	8260B	Methyl-tert-butyl-ether (MTBE)
GC-MS	8260B	Methyl acetate
GC-MS	8260B	Methylcyclohexane
GC-MS	8260B	Naphthalene
GC-MS	8260B	n-Butylbenzene
GC-MS	8260B	n-Propylbenzene
GC-MS	8260B	o-Xylene
GC-MS	8260B	p-Isopropyltoluene
GC-MS	8260B	Sec-Butylbenzene
GC-MS	8260B	Styrene
GC-MS	8260B	Tert-Butylbenzene
GC-MS	8260B	Tetrachloroethene
GC-MS	8260B	Toluene
GC-MS	8260B	trans-1,2-Dichloroethene
GC-MS	8260B	trans-1,3-Dichloropropene
GC-MS	8260B	Trichloroethene
GC-MS	8260B	Trichlorofluoromethane
GC-MS	8260B	Vinyl chloride
GC-MS	8260B	Total Xylenes
GC-MS	EPA 8270C / 8270D	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	1,1'-Biphenyl
GC-MS	EPA 8270C / 8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C / 8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,2-Diphenylhydrazine

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	1,3-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	2,2-oxybis (1-chloropropane)
GC-MS	EPA 8270C / 8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5,6-Tetrachlorophenol
GC-MS	EPA 8270C / 8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	2,6-Dichlorophenol
GC-MS	EPA 8270C / 8270D	2,6-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	2-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	2-Chlorophenol
GC-MS	EPA 8270C / 8270D	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	2-Methylphenol (o-cresol)
GC-MS	EPA 8270C / 8270D	2-Nitroaniline
GC-MS	EPA 8270C / 8270D	2-Nitrophenol
GC-MS	EPA 8270C / 8270D	3,3-Dichlorobenzidine
GC-MS	EPA 8270C / 8270D	3-Methylphenol
GC-MS	EPA 8270C / 8270D	4-Methylphenol
GC-MS	EPA 8270C / 8270D	3/4-Methylphenol (m/p-cresol)
GC-MS	EPA 8270C / 8270D	3-Nitroaniline
GC-MS	EPA 8270C / 8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C / 8270D	4-Bromophenyl phenyl ether
GC-MS	EPA 8270C / 8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D	4-Chloroaniline
GC-MS	EPA 8270C / 8270D	4-Chlorophenyl phenyl ether
GC-MS	EPA 8270C / 8270D	4-Nitroaniline
GC-MS	EPA 8270C / 8270D	4-Nitrophenol
GC-MS	EPA 8270C / 8270D	Acenaphthene
GC-MS	EPA 8270C / 8270D	Acenaphthylene
GC-MS	EPA 8270C / 8270D	Acetophenone
GC-MS	EPA 8270C / 8270D	Aniline
GC-MS	EPA 8270C / 8270D	Anthracene
GC-MS	EPA 8270C / 8270D	Atrazine
GC-MS	EPA 8270C / 8270D	Benzaldehyde
GC-MS	EPA 8270C / 8270D	Benzidine
GC-MS	EPA 8270C / 8270D	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D	Benzo(a)pyrene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzo(ghi)perylene
GC-MS	EPA 8270C / 8270D	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzoic Acid
GC-MS	EPA 8270C / 8270D	Benzyl alcohol
GC-MS	EPA 8270C / 8270D	Bis(2-chloroethoxy)methane
GC-MS	EPA 8270C / 8270D	Bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D	Bis(2-ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D	Bis(2-chloroisopropyl)ether
GC-MS	EPA 8270C / 8270D	Butyl benzyl phthalate
GC-MS	EPA 8270C / 8270D	Carbazole
GC-MS	EPA 8270C / 8270D	Caprolactam
GC-MS	EPA 8270C / 8270D	Chrysene
GC-MS	EPA 8270C / 8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D	Dibenzofuran
GC-MS	EPA 8270C / 8270D	Diethyl phthalate
GC-MS	EPA 8270C / 8270D	Dimethyl phthalate
GC-MS	EPA 8270C / 8270D	Di-n-butyl phthalate
GC-MS	EPA 8270C / 8270D	Di-n-octyl phthalate
GC-MS	EPA 8270C / 8270D	Fluoranthene
GC-MS	EPA 8270C / 8270D	Fluorene
GC-MS	EPA 8270C / 8270D	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D	Hexachlorobutadiene
GC-MS	EPA 8270C / 8270D	Hexachlorocylcopentadiene
GC-MS	EPA 8270C / 8270D	Hexachloroethane
GC-MS	EPA 8270C / 8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D	Isophorone
GC-MS	EPA 8270C / 8270D	Naphthalene
GC-MS	EPA 8270C / 8270D	Nitrobenzene
GC-MS	EPA 8270C / 8270D	N-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D	N-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosodiphenylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosopyrrolidine
GC-MS	EPA 8270C / 8270D	Pentachlorophenol
GC-MS	EPA 8270C / 8270D	Phenanthrene
GC-MS	EPA 8270C / 8270D	Phenol
GC-MS	EPA 8270C / 8270D	Pyrene
GC-MS	EPA 8270C / 8270D	Pyridine
TOC Analyzer	EPA 9060 / 9060A	Total Organic Carbon
GC	EPA 8011	EDB and DBCP
Titration	EPA 9030B / 9034	Sulfide

Non-Potable Water

Technology	Method	Analyte
pH	EPA 9040B / 9040C	pH
Setaflash Closed Tester	EPA 1020B / ASTM D3278 - 96	Flashpoint
Pensky-Martens Closed Flash Tester	EPA 1010A / ASTM D93 - 08	Flashpoint
Preparation	**Method**	**Type**
Preparation	EPA 3005A	Acid Digestion
Preparation	EPA 3010A	Acid Digestion
Purge and Trap	EPA 5030B	Purge-and-Trap
Extraction	EPA 3510C	Liquid-Liquid Extraction
Extraction	EPA 3520C	Continuous Liquid-Liquid Extraction
Cleanup	EPA 3660B	Sulfur Cleanup
Cleanup	EPA 3640A	Gel Permeation Cleanup
Leaching	EPA 1311	TCLP Toxicity Leaching
Distillation	EPA 9010B / 9010C/ 9013	Cyanide Distillation

Solid and Chemical Materials

Technology	Method	Analyte
ICP-AES	EPA 6010B / 6010C	Aluminum
ICP-AES	EPA 6010B / 6010C	Antimony
ICP-AES	EPA 6010B / 6010C	Arsenic
ICP-AES	EPA 6010B / 6010C	Barium
ICP-AES	EPA 6010B / 6010C	Beryllium
ICP-AES	EPA 6010B / 6010C	Boron
ICP-AES	EPA 6010B / 6010C	Cadmium
ICP-AES	EPA 6010B / 6010C	Calcium
ICP-AES	EPA 6010B / 6010C	Chromium
ICP-AES	EPA 6010B / 6010C	Cobalt
ICP-AES	EPA 6010B / 6010C	Copper
ICP-AES	EPA 6010B / 6010C	Iron
ICP-AES	EPA 6010B / 6010C	Lead
ICP-AES	EPA 6010B / 6010C	Lithium
ICP-AES	EPA 6010B / 6010C	Magnesium
ICP-AES	EPA 6010B / 6010C	Manganese
ICP-AES	EPA 6010B / 6010C	Molybdenum
ICP-AES	EPA 6010B / 6010C	Nickel

Solid and Chemical Materials

Technology	Method	Analyte
ICP-AES	EPA 6010B / 6010C	Potassium
ICP-AES	EPA 6010B / 6010C	Selenium
ICP-AES	EPA 6010B / 6010C	Silica
ICP-AES	EPA 6010B / 6010C	Silicon
ICP-AES	EPA 6010B / 6010C	Silver
ICP-AES	EPA 6010B / 6010C	Sodium
ICP-AES	EPA 6010B / 6010C	Strontium
ICP-AES	EPA 6010B / 6010C	Thallium
ICP-AES	EPA 6010B / 6010C	Tin
ICP-AES	EPA 6010B / 6010C	Titanium
ICP-AES	EPA 6010B / 6010C	Vanadium
ICP-AES	EPA 6010B / 6010C	Zinc
ICP-MS	EPA 6020 / 6020A	Aluminum
ICP-MS	EPA 6020 / 6020A	Antimony
ICP-MS	EPA 6020 / 6020A	Arsenic
ICP-MS	EPA 6020 / 6020A	Barium
ICP-MS	EPA 6020 / 6020A	Beryllium
ICP-MS	EPA 6020 / 6020A	Boron
ICP-MS	EPA 6020 / 6020A	Cadmium
ICP-MS	EPA 6020 / 6020A	Calcium
ICP-MS	EPA 6020 / 6020A	Chromium
ICP-MS	EPA 6020 / 6020A	Cobalt
ICP-MS	EPA 6020 / 6020A	Copper
ICP-MS	EPA 6020 / 6020A	Iron
ICP-MS	EPA 6020 / 6020A	Lead
ICP-MS	EPA 6020 / 6020A	Magnesium
ICP-MS	EPA 6020 / 6020A	Manganese
ICP-MS	EPA 6020 / 6020A	Molybdenum
ICP-MS	EPA 6020 / 6020A	Nickel
ICP-MS	EPA 6020 / 6020A	Potassium
ICP-MS	EPA 6020 / 6020A	Selenium
ICP-MS	EPA 6020 / 6020A	Silica
ICP-MS	EPA 6020 / 6020A	Silicon
ICP-MS	EPA 6020 / 6020A	Silver
ICP-MS	EPA 6020 / 6020A	Sodium
ICP-MS	EPA 6020 / 6020A	Strontium

Solid and Chemical Materials

Technology	Method	Analyte
ICP-MS	EPA 6020 / 6020A	Thallium
ICP-MS	EPA 6020 / 6020A	Tin
ICP-MS	EPA 6020 / 6020A	Titanium
ICP-MS	EPA 6020 / 6020A	Vanadium
ICP-MS	EPA 6020 / 6020A	Zinc
CVAA	EPA 7471A / 7471B	Mercury
Spectrophotometer	EPA 7196A	Hexavalent Chromium with Alkaline Digestion
Kone Lab	EPA 9012A / 9012B 9010B / 9010C / 9013	Total Cyanide
IC	EPA 9056A	Bromide
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate
IC	EPA 9056A	Nitrite
IC	EPA 9056A	Phosphate
IC	EPA 9056A	Sulfate
Gravimetric	EPA 9071B	Oil and Grease
GC	EPA 8081A / 8081B	4,4'-DDD
GC	EPA 8081A / 8081B	4,4'-DDE
GC	EPA 8081A / 8081B	4,4'-DDT
GC	EPA 8081A / 8081B	Aldrin
GC	EPA 8081A / 8081B	alpha-BHC
GC	EPA 8081A / 8081B	alpha-Chlordane
GC	EPA 8081A / 8081B	beta-BHC
GC	EPA 8081A / 8081B	Chlordane (Technical)
GC	EPA 8081A / 8081B	delta-BHC
GC	EPA 8081A / 8081B	Dieldrin
GC	EPA 8081A / 8081B	Endosulfan I
GC	EPA 8081A / 8081B	Endosulfan II
GC	EPA 8081A / 8081B	Endosulfan sulfate
GC	EPA 8081A / 8081B	Endrin
GC	EPA 8081A / 8081B	Endrin aldehyde
GC	EPA 8081A / 8081B	Endrin ketone
GC	EPA 8081A / 8081B	gamma-BHC (Lindane)
GC	EPA 8081A / 8081B	gamma-Chlordane
GC	EPA 8081A / 8081B	Heptachlor
GC	EPA 8081A / 8081B	Heptachlor epoxide
GC	EPA 8081A / 8081B	Methoxychlor
GC	EPA 8081A / 8081B	Toxaphene
GC	EPA 8082 / 8082A	Aroclor 1016
GC	EPA 8082 / 8082A	Aroclor 1221
GC	EPA 8082 / 8082A	Aroclor 1232
GC	EPA 8082 / 8082A	Aroclor 1242
GC	EPA 8082 / 8082A	Aroclor 1248
GC	EPA 8082 / 8082A	Aroclor 1254

Solid and Chemical Materials

Technology	Method	Analyte
GC	EPA 8082 / 8082A	Aroclor 1260
GC	EPA 8082 / 8082A	Aroclor 1262
GC	EPA 8082 / 8082A	Aroclor 1268
GC	EPA 8082 / 8082A	Aroclor 1016/1260
GC	EPA 8141A / 8141B	Azinphos-methyl
GC	EPA 8141A / 8141B	Bolstar (Sulprofos)
GC	EPA 8141A / 8141B	Chlorpyrifos
GC	EPA 8141A / 8141B	Coumaphos
GC	EPA 8141A / 8141B	Demeton-O
GC	EPA 8141A / 8141B	Demeton-S
GC	EPA 8141A / 8141B	Demeton (total)
GC	EPA 8141A / 8141B	Diazinon
GC	EPA 8141A / 8141B	Dichlorvos (DDVP)
GC	EPA 8141A / 8141B	Disulfoton
GC	EPA 8141A / 8141B	Ethoprop
GC	EPA 8141A / 8141B	Dimethoate
GC	EPA 8141A / 8141B	EPN
GC	EPA 8141A / 8141B	Ethyl parathion (Parathion)
GC	EPA 8141A / 8141B	Famphur
GC	EPA 8141A / 8141B	Fensulfothion
GC	EPA 8141A / 8141B	Fenthion
GC	EPA 8141A / 8141B	Malathion
GC	EPA 8141A / 8141B	Mevinphos
GC	EPA 8141A / 8141B	O,O,O-Triethyl phosphorothioate
GC	EPA 8141A / 8141B	Parathion, methyl
GC	EPA 8141A / 8141B	Phorate
GC	EPA 8141A / 8141B	Ronnel
GC	EPA 8141A / 8141B	Sulfotepp (Tetraethyldithiopyrophosphate)
GC	EPA 8141A / 8141B	Stirophos (Tetrachlorovinphos)
GC	EPA 8141A / 8141B	Thionazin
GC	EPA 8141A / 8141B	Tokuthion (Protothiofos)
GC	EPA 8141A / 8141B	Trichlornate
GC	EPA 8151A	2,4,5-T
GC	EPA 8151A	2,4,5-TP (Silvex)
GC	EPA 8151A	2,4-D
GC	EPA 8151A	2,4-DB
GC	EPA 8151A	Dalapon
GC	EPA 8151A	Dicamba
GC	EPA 8151A	Dichlorprop
GC	EPA 8151A	Dinoseb
GC	EPA 8151A	MCPA
GC	EPA 8151A	MCPP
GC	EPA 8151A	Pentachlorophenol
GC-MS	EPA 8260B	1,1,1,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,1-Trichloroethane
GC-MS	EPA 8260B	1,1,2,2-Tetrachloroethane
GC-MS	EPA 8260B	1,1,2-Trichloroethane

Solid and Chemical Materials

Technology	Method	Analyte
GC-MS	EPA 8260B	1,1,2-Trichloro-1,2,2-trifluoroethane
GC-MS	EPA 8260B	1,1-Dichloroethane
GC-MS	EPA 8260B	1,1-Dichloroethene
GC-MS	EPA 8260B	1,1-Dichloropropene
GC-MS	EPA 8260B	1,2,3-Trichlorobenzene
GC-MS	EPA 8260B	1,2,3-Trichloropropane
GC-MS	EPA 8260B	1,2,4-Trichlorobenzene
GC-MS	EPA 8260B	1,2,4-Trimethylbenzene
GC-MS	EPA 8260B	1,2-Dibromo-3-chloropropane (DBCP)
GC-MS	EPA 8260B	1,2-Dibromoethane (EDB)
GC-MS	EPA 8260B	1,2-Dichlorobenzene
GC-MS	EPA 8260B	1,2-Dichloroethane
GC-MS	EPA 8260B	1,2-Dichloropropane
GC-MS	EPA 8260B	1,2-Dichloroethene (total)
GC-MS	EPA 8260B	1,3,5-Trimethylbenzene
GC-MS	EPA 8260B	1,3-Dichlorobenzene
GC-MS	EPA 8260B	1,3-Dichloropropane
GC-MS	EPA 8260B	1,4-Dichlorobenzene
GC-MS	EPA 8260B	2,2-Dichloropropane
GC-MS	EPA 8260B	2-Butanone (MEK)
GC-MS	EPA 8260B	2-Chlorotoluene
GC-MS	EPA 8260B	2-Hexanone
GC-MS	EPA 8260B	4-Chlorotoluene
GC-MS	EPA 8260B	4-Methyl-2-pentanone (MIBK)
GC-MS	EPA 8260B	Acetone
GC-MS	EPA 8260B	Benzene
GC-MS	EPA 8260B	Bromobenzene
GC-MS	EPA 8260B	Bromochloromethane
GC-MS	EPA 8260B	Bromodichloromethane
GC-MS	EPA 8260B	Bromoform
GC-MS	EPA 8260B	Bromomethane
GC-MS	EPA 8260B	Carbon disulfide
GC-MS	EPA 8260B	Carbon tetrachloride
GC-MS	EPA 8260B	Chlorobenzene
GC-MS	EPA 8260B	Chloroethane
GC-MS	EPA 8260B	Chloroform
GC-MS	EPA 8260B	Chloromethane
GC-MS	EPA 8260B	cis-1,2-Dichloroethene
GC-MS	EPA 8260B	cis-1,3-Dichloropropene
GC-MS	EPA 8260B	Cyclohexane
GC-MS	EPA 8260B	Dibromochloromethane
GC-MS	EPA 8260B	Dibromomethane
GC-MS	EPA 8260B	Dichlorodifluoromethane
GC-MS	EPA 8260B	Ethylbenzene
GC-MS	EPA 8260B	Hexachlorobutadiene
GC-MS	EPA 8260B	Isopropylbenzene
GC-MS	EPA 8260B	m&p-Xylenes

Solid and Chemical Materials

Technology	Method	Analyte
GC-MS	EPA 8260B	Methylene chloride
GC-MS	EPA 8260B	Methyl-tert-butyl-ether (MTBE)
GC-MS	EPA 8260B	Methyl acetate
GC-MS	EPA 8260B	Methylcyclohexane
GC-MS	EPA 8260B	Naphthalene
GC-MS	EPA 8260B	n-Butylbenzene
GC-MS	EPA 8260B	n-Propylbenzene
GC-MS	EPA 8260B	o-Xylene
GC-MS	EPA 8260B	p-Isopropyltoluene
GC-MS	EPA 8260B	Sec-Butylbenzene
GC-MS	EPA 8260B	Styrene
GC-MS	EPA 8260B	Tert-Butylbenzene
GC-MS	EPA 8260B	Tetrachloroethene
GC-MS	EPA 8260B	Toluene
GC-MS	EPA 8260B	trans-1,2-Dichloroethene
GC-MS	EPA 8260B	trans-1,3-Dichloropropene
GC-MS	EPA 8260B	Trichloroethene
GC-MS	EPA 8260B	Trichlorofluoromethane
GC-MS	EPA 8260B	Vinyl chloride
GC-MS	EPA 8260B	Total Xylenes
GC-MS	EPA 8270C / 8270D	1-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	1,1'-Biphenyl
GC-MS	EPA 8270C / 8270D	1,2,4-Trichlorobenzene
GC-MS	EPA 8270C / 8270D	1,2-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,2-Diphenylhydrazine
GC-MS	EPA 8270C / 8270D	1,3-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dichlorobenzene
GC-MS	EPA 8270C / 8270D	1,4-Dioxane
GC-MS	EPA 8270C / 8270D	2,2-oxybis (1-chloropropane)
GC-MS	EPA 8270C / 8270D	2,3,4,6-Tetrachlorophenol
GC-MS	EPA 8270C / 8270D	2,3,5,6-Tetrachlorophenol
GC-MS	EPA 8270C / 8270D	2,4,5-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4,6-Trichlorophenol
GC-MS	EPA 8270C / 8270D	2,4-Dichlorophenol
GC-MS	EPA 8270C / 8270D	2,4-Dimethylphenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrophenol
GC-MS	EPA 8270C / 8270D	2,4-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	2,6-Dichlorophenol
GC-MS	EPA 8270C / 8270D	2,6-Dinitrotoluene
GC-MS	EPA 8270C / 8270D	2-Chloronaphthalene
GC-MS	EPA 8270C / 8270D	2-Chlorophenol
GC-MS	EPA 8270C / 8270D	2-Methylnaphthalene
GC-MS	EPA 8270C / 8270D	2-Methylphenol (o-cresol)
GC-MS	EPA 8270C / 8270D	2-Nitroaniline
GC-MS	EPA 8270C / 8270D	2-Nitrophenol
GC-MS	EPA 8270C / 8270D	3,3-Dichlorobenzidine
GC-MS	EPA 8270C / 8270D	3-Methylphenol

Solid and Chemical Materials

Technology	Method	Analyte
GC-MS	EPA 8270C / 8270D	4-Methylphenol
GC-MS	EPA 8270C / 8270D	3/4-Methylphenol (m/p-cresol)
GC-MS	EPA 8270C / 8270D	3-Nitroaniline
GC-MS	EPA 8270C / 8270D	4,6-Dinitro-2-methylphenol
GC-MS	EPA 8270C / 8270D	4-Bromophenyl phenyl ether
GC-MS	EPA 8270C / 8270D	4-Chloro-3-methylphenol
GC-MS	EPA 8270C / 8270D	4-Chloroaniline
GC-MS	EPA 8270C / 8270D	4-Chlorophenyl phenyl ether
GC-MS	EPA 8270C / 8270D	4-Nitroaniline
GC-MS	EPA 8270C / 8270D	4-Nitrophenol
GC-MS	EPA 8270C / 8270D	Acenaphthene
GC-MS	EPA 8270C / 8270D	Acenaphthylene
GC-MS	EPA 8270C / 8270D	Acetophenone
GC-MS	EPA 8270C / 8270D	Aniline
GC-MS	EPA 8270C / 8270D	Anthracene
GC-MS	EPA 8270C / 8270D	Atrazine
GC-MS	EPA 8270C / 8270D	Benzaldehyde
GC-MS	EPA 8270C / 8270D	Benzidine
GC-MS	EPA 8270C / 8270D	Benzo(a)anthracene
GC-MS	EPA 8270C / 8270D	Benzo(a)pyrene
GC-MS	EPA 8270C / 8270D	Benzo(b)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzo(ghi)perylene
GC-MS	EPA 8270C / 8270D	Benzo(k)fluoranthene
GC-MS	EPA 8270C / 8270D	Benzoic Acid
GC-MS	EPA 8270C / 8270D	Benzyl alcohol
GC-MS	EPA 8270C / 8270D	Bis(2-chloroethoxy)methane
GC-MS	EPA 8270C / 8270D	Bis(2-chloroethyl)ether
GC-MS	EPA 8270C / 8270D	Bis(2-ethylhexyl)phthalate
GC-MS	EPA 8270C / 8270D	Bis(2-chloroisopropyl)ether
GC-MS	EPA 8270C / 8270D	Butyl benzyl phthalate
GC-MS	EPA 8270C / 8270D	Carbazole
GC-MS	EPA 8270C / 8270D	Caprolactam
GC-MS	EPA 8270C / 8270D	Chrysene
GC-MS	EPA 8270C / 8270D	Dibenzo(a,h)anthracene
GC-MS	EPA 8270C / 8270D	Dibenzofuran
GC-MS	EPA 8270C / 8270D	Diethyl phthalate
GC-MS	EPA 8270C / 8270D	Dimethyl phthalate
GC-MS	EPA 8270C / 8270D	Di-n-butyl phthalate
GC-MS	EPA 8270C / 8270D	Di-n-octyl phthalate
GC-MS	EPA 8270C / 8270D	Fluoranthene
GC-MS	EPA 8270C / 8270D	Fluorene
GC-MS	EPA 8270C / 8270D	Hexachlorobenzene
GC-MS	EPA 8270C / 8270D	Hexachlorobutadiene
GC-MS	EPA 8270C / 8270D	Hexachlorocylcopentadiene
GC-MS	EPA 8270C / 8270D	Hexachloroethane
GC-MS	EPA 8270C / 8270D	Indeno(1,2,3-cd)pyrene
GC-MS	EPA 8270C / 8270D	Isophorone

LABORATORY ACCREDITATION BUREAU

Certificate # L2314

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-MS	EPA 8270C / 8270D	Naphthalene
GC-MS	EPA 8270C / 8270D	Nitrobenzene
GC-MS	EPA 8270C / 8270D	N-Nitrosodimethylamine
GC-MS	EPA 8270C / 8270D	N-Nitroso-di-n-propylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosodiphenylamine
GC-MS	EPA 8270C / 8270D	N-Nitrosopyrrolidine
GC-MS	EPA 8270C / 8270D	Pentachlorophenol
GC-MS	EPA 8270C / 8270D	Phenanthrene
GC-MS	EPA 8270C / 8270D	Phenol
GC-MS	EPA 8270C / 8270D	Pyrene
GC-MS	EPA 8270C / 8270D	Pyridine
TOC Analyzer	Lloyd Kahn (MOD)	Total Organic Carbon
Titration	EPA 9030B / 9034	Sulfide
pH Meter	EPA 9045C / 9045D	pH
Setaflash closed tester	EPA 1020B / ASTM D3278-96	Flashpoint
Pensky-Martens Closed Flash Tester	EPA 1010 / 1010A / ASTM D93-08	Flashpoint
Balance	SM 2540G	Percent Moisture / Percent Solids
Speciated Isotope Dilution - Mass Spectrometry	EPA 6800	Hexavalent Chromium
Preparation	**Method**	**Type**
Digestion	EPA 3050B	Acid Digestion
Digestion	EPA 3060A	Alkaline Digestion
Purge-and-Trap	EPA 5035	Closed-system Purge-and-Trap
Dilution	EPA 3585	Waste Dilution
Extraction	EPA 3541	Automated Soxhlet Extraction
Extraction	EPA 3550C	Ultrasonic Extraction
Dilution	EPA 3580A	Waste Dilution
Cleanup	EPA 3660B	Sulfur Cleanup
Cleanup	EPA 3640A	Gel Permeation Cleanup
Leaching	EPA 1311	TCLP Toxicity Leaching
Distillation	EPA 9010B / 9010C / 9013	Cyanide Distillation

Notes:

1) This laboratory offers commercial testing service.

Approved by: _____ Date: February 24, 2012

R. Douglas Leonard
Chief Technical Officer

Issued: 02/24/12

pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF LABORATORIES

December 14, 2012

CERTIFIED MAIL NO. 7004 1160 0003 8219 4352

Ms. Debbie Lowe
TestAmerica Laboratories, Inc.
dba TestAmerica Pittsburgh
301 Alpha Dr.
Pittsburgh, PA 15238

Re: Laboratory Accreditation Status
DEP Lab ID# 02-00416

Dear Ms. Lowe:

The Laboratory Accreditation Program of the Pennsylvania Department of Environmental Protection ("Department") has evaluated its accreditation offerings and has determined that some of the methods for which your laboratory had previously applied for accreditation are not appropriate method designations based on the Code of Federal Registers (CFR). In response to this determination, the Department is issuing an amended Scope of Accreditation to your laboratory. The specific changes are identified in the table below. Please note that you will be required to report all analytical testing results, including results for proficiency testing studies, with the corrected method designation. These changes are effective immediately.

Matrix	Old Method	New Method	Analyte	Status
NPW	SM 4500-Cl- E	USGS I-1187-85	Chloride	Accredited
NPW	EPA 420.4 (discrete)	EPA 420.1	Total phenolics	Accredited
NPW/SCM	EPA 9066	EPA 9065	Total phenolics	Accredited
NPW	EPA 335.4 (discrete)	SM 4500-CN C/E	Cyanide	Accredited
NPW/SCM	EPA 9012 (discrete)	EPA 9014/9010 Total Cyanide	Total cyanide	Accredited
NPW/SCM	EPA 9012 A (discrete)	EPA 9014/9010 Total Cyanide	Total cyanide	Accredited
NPW/SCM	EPA 9012 B (discrete)	EPA 9014/9010 Total Cyanide	Total cyanide	Accredited

Your current status in the Pennsylvania NELAP Environmental Laboratory Accreditation Program is as shown on the attached listings. That list of accredited fields of testing replaces all previous lists.

Your laboratory shall not use this Scope of Accreditation to imply endorsement by the Department. In order to maintain accreditation, your laboratory must remain in compliance with Departmental regulations.

Any person aggrieved by this action may appeal, pursuant to Section 4 of the Environmental Hearing Board Act, 35 P.S. Section 7514, and the Administrative Agency Law, 2 Pa.C.S. Chapter 5A, to the Environmental Hearing Board, Second Floor, Rachel Carson State Office Building, 400 Market Street, P.O. Box 8457, Harrisburg, PA 17105-8457, 717-787-3483. TDD users may contact the Board through the Pennsylvania Relay Service, 800-654-5984. Appeals must be filed with the Environmental Hearing Board within 30 days of receipt of written notice of this action unless the appropriate statute provides a different time period. Copies of the appeal form and the Board's rules of practice and procedure may be obtained from the Board. The appeal form and the Board's rules of practice and procedure are also available in braille or on audiotape from the Secretary to the Board at 717-787-3483. This paragraph does not, in and of itself, create any right of appeal beyond that permitted by applicable statutes and decisional law.

IF YOU WANT TO CHALLENGE THIS ACTION, YOUR APPEAL MUST REACH THE BOARD WITHIN 30 DAYS. YOU DO NOT NEED A LAWYER TO FILE AN APPEAL WITH THE BOARD.

IMPORTANT LEGAL RIGHTS ARE AT STAKE, HOWEVER, SO YOU SHOULD SHOW THIS DOCUMENT TO A LAWYER AT ONCE. IF YOU CANNOT AFFORD A LAWYER, YOU MAY QUALIFY FOR FREE PRO BONO REPRESENTATION. CALL THE SECRETARY TO THE BOARD (717-787-3483) FOR MORE INFORMATION.

If you have any questions regarding your laboratory accreditation status, please contact Eric Nkurunziza at 717-346-8201.

Sincerely,

Aaren S. Alger, Chief
Laboratory Accreditation Program

Enclosure

Attachment to Certificate of Accreditation 009, expiration date April 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
ASTM D5057-90	Apparent specific gravity	NELAP	PA	9/27/2010
ASTM D5057-90	Bulk density	NELAP	PA	9/27/2010
EPA 1010	Ignitability	NELAP	PA	8/26/2006
EPA 120.1	Conductivity	NELAP	PA	11/15/2011
EPA 1310A	Extraction procedure (EP) toxicity test method	NELAP	PA	8/26/2006
EPA 160.4	Residue, volatile	NELAP	PA	4/7/2005
EPA 1664 Rev A	Non-polar material	NELAP	PA	8/24/2005
EPA 1664 Rev A	Oil and grease	NELAP	PA	4/7/2005
EPA 180.1	Turbidity	NELAP	PA	8/26/2006
EPA 200.7	Aluminum	NELAP	PA	4/7/2005
EPA 200.7	Antimony	NELAP	PA	4/7/2005
EPA 200.7	Arsenic	NELAP	PA	4/7/2005
EPA 200.7	Barium	NELAP	PA	4/7/2005
EPA 200.7	Beryllium	NELAP	PA	4/7/2005
EPA 200.7	Boron	NELAP	PA	4/7/2005
EPA 200.7	Cadmium	NELAP	PA	4/7/2005
EPA 200.7	Calcium	NELAP	PA	4/7/2005
EPA 200.7	Chromium	NELAP	PA	4/7/2005
EPA 200.7	Cobalt	NELAP	PA	4/7/2005
EPA 200.7	Copper	NELAP	PA	4/7/2005
EPA 200.7	Iron	NELAP	PA	4/7/2005
EPA 200.7	Lead	NELAP	PA	4/7/2005
EPA 200.7	Lithium	NELAP	PA	9/5/2012
EPA 200.7	Magnesium	NELAP	PA	4/7/2005
EPA 200.7	Manganese	NELAP	PA	4/7/2005
EPA 200.7	Molybdenum	NELAP	PA	4/7/2005
EPA 200.7	Nickel	NELAP	PA	4/7/2005
EPA 200.7	Potassium	NELAP	PA	4/7/2005
EPA 200.7	Selenium	NELAP	PA	4/7/2005
EPA 200.7	Silica, as SiO2	NELAP	PA	8/24/2005
EPA 200.7	Silver	NELAP	PA	4/7/2005
EPA 200.7	Sodium	NELAP	PA	4/7/2005
EPA 200.7	Thallium	NELAP	PA	4/7/2005
EPA 200.7	Tin	NELAP	PA	4/7/2005
EPA 200.7	Titanium	NELAP	PA	4/7/2005
EPA 200.7	Vanadium	NELAP	PA	4/7/2005

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 200.7	Zinc	NELAP	PA	4/7/2005
EPA 200.7-Extended	Cesium	NELAP	PA	4/18/2006
EPA 200.7-Extended	Strontium	NELAP	PA	3/1/2007
EPA 200.8	Aluminum	NELAP	PA	4/7/2005
EPA 200.8	Antimony	NELAP	PA	4/7/2005
EPA 200.8	Arsenic	NELAP	PA	3/21/2012
EPA 200.8	Barium	NELAP	PA	4/7/2005
EPA 200.8	Beryllium	NELAP	PA	4/7/2005
EPA 200.8	Boron	NELAP	PA	8/24/2005
EPA 200.8	Cadmium	NELAP	PA	4/7/2005
EPA 200.8	Calcium	NELAP	PA	8/24/2005
EPA 200.8	Chromium	NELAP	PA	4/7/2005
EPA 200.8	Cobalt	NELAP	PA	4/7/2005
EPA 200.8	Copper	NELAP	PA	11/15/2011
EPA 200.8	Iron	NELAP	PA	8/24/2005
EPA 200.8	Lead	NELAP	PA	4/7/2005
EPA 200.8	Magnesium	NELAP	PA	8/24/2005
EPA 200.8	Manganese	NELAP	PA	1/22/2007
EPA 200.8	Molybdenum	NELAP	PA	4/7/2005
EPA 200.8	Nickel	NELAP	PA	4/7/2005
EPA 200.8	Potassium	NELAP	PA	8/24/2005
EPA 200.8	Selenium	NELAP	PA	4/7/2005
EPA 200.8	Silver	NELAP	PA	4/7/2005
EPA 200.8	Sodium	NELAP	PA	8/24/2005
EPA 200.8	Thallium	NELAP	PA	4/7/2005
EPA 200.8	Tin	NELAP	PA	8/24/2005
EPA 200.8	Titanium	NELAP	PA	8/24/2005
EPA 200.8	Vanadium	NELAP	PA	4/7/2005
EPA 200.8	Zinc	NELAP	PA	4/7/2005
EPA 200.8-Extended	Cesium	NELAP	PA	4/18/2006
EPA 200.8-Extended	Phosphorus, total	NELAP	PA	1/21/2010
EPA 200.8-Extended	Silica, as SiO2	NELAP	PA	4/18/2006
EPA 200.8-Extended	Strontium	NELAP	PA	3/1/2007
EPA 245.1	Mercury	NELAP	PA	4/7/2005
EPA 300.0	Bromide	NELAP	PA	8/24/2005
EPA 300.0	Chloride	NELAP	PA	4/7/2005

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 300.0	Fluoride	NELAP	PA	8/24/2005
EPA 300.0	Nitrate as N	NELAP	PA	4/7/2005
EPA 300.0	Nitrite as N	NELAP	PA	4/7/2005
EPA 300.0	Orthophosphate as P	NELAP	PA	4/7/2005
EPA 300.0	Sulfate	NELAP	PA	4/7/2005
EPA 3005A	Preconcentration under acid	NELAP	PA	8/26/2006
EPA 3010A	Hot plate acid digestion (HNO3 + HCl)	NELAP	PA	8/26/2006
EPA 3060A	Alkaline digestion of Cr(VI)	NELAP	PA	8/26/2006
EPA 350.1	Ammonia as N	NELAP	PA	4/7/2005
EPA 3500B	Organics extraction and sample preparation	NELAP	PA	8/26/2006
EPA 3510C	Separatory funnel liquid-liquid extraction	NELAP	PA	8/26/2006
EPA 3520C	Continuous liquid-liquid extraction	NELAP	PA	8/26/2006
EPA 353.2	Nitrate as N	NELAP	PA	11/8/2011
EPA 353.2	Nitrite as N	NELAP	PA	11/30/2011
EPA 353.2	Total nitrate-nitrite	NELAP	PA	8/26/2006
EPA 3535A	Solid-phase extraction (SPE)	NELAP	PA	4/13/2009
EPA 3620B	Florisil cleanup	NELAP	PA	8/26/2006
EPA 3620C	Florisil cleanup	NELAP	PA	3/16/2009
EPA 3640A	Gel permeation cleanup (GPC)	NELAP	PA	8/26/2006
EPA 3660B	Sulfur cleanup	NELAP	PA	8/26/2006
EPA 410.4	Chemical oxygen demand (COD)	NELAP	PA	4/7/2005
EPA 420.1	Total phenolics	NELAP	PA	4/8/2008
EPA 5030	Aqueous-phase purge-and-trap	NELAP	PA	4/20/2011
EPA 6010	Aluminum	NELAP	PA	8/26/2006
EPA 6010	Antimony	NELAP	PA	8/26/2006
EPA 6010	Arsenic	NELAP	PA	8/26/2006
EPA 6010	Barium	NELAP	PA	8/26/2006
EPA 6010	Beryllium	NELAP	PA	8/26/2006
EPA 6010	Boron	NELAP	PA	8/26/2006
EPA 6010	Cadmium	NELAP	PA	8/26/2006
EPA 6010	Calcium	NELAP	PA	8/26/2006
EPA 6010	Chromium	NELAP	PA	8/26/2006
EPA 6010	Cobalt	NELAP	PA	8/26/2006
EPA 6010	Copper	NELAP	PA	8/26/2006
EPA 6010	Iron	NELAP	PA	8/26/2006
EPA 6010	Lead	NELAP	PA	8/26/2006

Attachment to Certificate of Accreditation 009, expiration date April 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010	Lithium	NELAP	PA	8/26/2006
EPA 6010	Magnesium	NELAP	PA	8/26/2006
EPA 6010	Manganese	NELAP	PA	8/26/2006
EPA 6010	Molybdenum	NELAP	PA	8/26/2006
EPA 6010	Nickel	NELAP	PA	8/26/2006
EPA 6010	Potassium	NELAP	PA	8/26/2006
EPA 6010	Selenium	NELAP	PA	8/26/2006
EPA 6010	Silica, as SiO2	NELAP	PA	4/18/2006
EPA 6010	Silicon	NELAP	PA	6/3/2010
EPA 6010	Silver	NELAP	PA	8/26/2006
EPA 6010	Sodium	NELAP	PA	8/26/2006
EPA 6010	Strontium	NELAP	PA	8/26/2006
EPA 6010	Thallium	NELAP	PA	8/26/2006
EPA 6010	Tin	NELAP	PA	8/26/2006
EPA 6010	Titanium	NELAP	PA	8/26/2006
EPA 6010	Vanadium	NELAP	PA	8/26/2006
EPA 6010	Zinc	NELAP	PA	8/26/2006
EPA 6010-Extended	Cesium	NELAP	PA	4/18/2006
EPA 6010B	Metals by ICP/AES	NELAP	PA	4/8/2009
EPA 6010C	Metals by ICP/AES	NELAP	PA	3/16/2009
EPA 6020	Aluminum	NELAP	PA	8/26/2006
EPA 6020	Antimony	NELAP	PA	8/26/2006
EPA 6020	Arsenic	NELAP	PA	3/21/2012
EPA 6020	Barium	NELAP	PA	8/26/2006
EPA 6020	Beryllium	NELAP	PA	8/26/2006
EPA 6020	Boron	NELAP	PA	8/26/2006
EPA 6020	Cadmium	NELAP	PA	8/26/2006
EPA 6020	Calcium	NELAP	PA	8/26/2006
EPA 6020	Chromium	NELAP	PA	8/26/2006
EPA 6020	Cobalt	NELAP	PA	8/26/2006
EPA 6020	Copper	NELAP	PA	11/15/2011
EPA 6020	Iron	NELAP	PA	8/26/2006
EPA 6020	Lead	NELAP	PA	8/26/2006
EPA 6020	Magnesium	NELAP	PA	8/26/2006
EPA 6020	Manganese	NELAP	PA	1/22/2007
EPA 6020	Nickel	NELAP	PA	8/26/2006

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6020	Potassium	NELAP	PA	8/26/2006
EPA 6020	Silver	NELAP	PA	8/26/2006
EPA 6020	Sodium	NELAP	PA	8/26/2006
EPA 6020	Thallium	NELAP	PA	8/26/2006
EPA 6020	Zinc	NELAP	PA	8/26/2006
EPA 6020-Extended	Cesium	NELAP	PA	4/18/2006
EPA 6020-Extended	Molybdenum	NELAP	PA	8/26/2006
EPA 6020-Extended	Phosphorus, total	NELAP	PA	1/21/2010
EPA 6020-Extended	Selenium	NELAP	PA	8/26/2006
EPA 6020-Extended	Silica, as SiO2	NELAP	PA	4/18/2006
EPA 6020-Extended	Silicon	NELAP	PA	6/3/2010
EPA 6020-Extended	Strontium	NELAP	PA	8/26/2006
EPA 6020-Extended	Tin	NELAP	PA	8/26/2006
EPA 6020-Extended	Titanium	NELAP	PA	8/26/2006
EPA 6020-Extended	Vanadium	NELAP	PA	8/26/2006
EPA 6020A	Metals by ICP/MS	NELAP	PA	3/16/2009
EPA 608	4,4'-DDD	NELAP	PA	4/7/2005
EPA 608	4,4'-DDE	NELAP	PA	4/7/2005
EPA 608	4,4'-DDT	NELAP	PA	4/7/2005
EPA 608	Aldrin (HHDN)	NELAP	PA	4/7/2005
EPA 608	Aroclor-1016 (PCB-1016)	NELAP	PA	4/7/2005
EPA 608	Aroclor-1221 (PCB-1221)	NELAP	PA	4/7/2005
EPA 608	Aroclor-1232 (PCB-1232)	NELAP	PA	4/7/2005
EPA 608	Aroclor-1242 (PCB-1242)	NELAP	PA	4/7/2005
EPA 608	Aroclor-1248 (PCB-1248)	NELAP	PA	4/7/2005
EPA 608	Aroclor-1254 (PCB-1254)	NELAP	PA	4/7/2005
EPA 608	Aroclor-1260 (PCB-1260)	NELAP	PA	4/7/2005
EPA 608	Chlordane (tech.)	NELAP	PA	4/7/2005
EPA 608	Dieldrin	NELAP	PA	4/7/2005
EPA 608	Endosulfan I	NELAP	PA	4/7/2005
EPA 608	Endosulfan II	NELAP	PA	4/7/2005
EPA 608	Endosulfan sulfate	NELAP	PA	4/7/2005
EPA 608	Endrin	NELAP	PA	4/7/2005
EPA 608	Endrin aldehyde	NELAP	PA	11/7/2006
EPA 608	Heptachlor	NELAP	PA	4/7/2005
EPA 608	Heptachlor epoxide	NELAP	PA	4/7/2005

Attachment to Certificate of Accreditation 009, expiration date April 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

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Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 608	Methoxychlor	NELAP	PA	4/18/2006
EPA 608	Toxaphene (Chlorinated camphene)	NELAP	PA	4/7/2005
EPA 608	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 608	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 608	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 608	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 608-Extended	Aroclor-1262 (PCB-1262)	NELAP	PA	4/8/2009
EPA 608-Extended	Aroclor-1268 (PCB-1268)	NELAP	PA	4/8/2009
EPA 608-Extended	Endrin ketone	NELAP	PA	3/1/2007
EPA 608-Extended	alpha-Chlordane	NELAP	PA	4/18/2006
EPA 608-Extended	gamma-Chlordane	NELAP	PA	4/18/2006
EPA 624	1,1,1-Trichloroethane	NELAP	PA	4/7/2005
EPA 624	1,1,2,2-Tetrachloroethane	NELAP	PA	4/7/2005
EPA 624	1,1,2-Trichloroethane	NELAP	PA	4/7/2005
EPA 624	1,1-Dichloroethane	NELAP	PA	4/7/2005
EPA 624	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	4/7/2005
EPA 624	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 624	1,2-Dichloroethane	NELAP	PA	4/7/2005
EPA 624	1,2-Dichloropropane	NELAP	PA	4/7/2005
EPA 624	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 624	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 624	2-Chloroethyl vinyl ether	NELAP	PA	4/7/2005
EPA 624	Acrolein (Propenal)	NELAP	PA	4/7/2005
EPA 624	Acrylonitrile	NELAP	PA	4/7/2005
EPA 624	Benzene	NELAP	PA	4/7/2005
EPA 624	Bromodichloromethane	NELAP	PA	4/7/2005
EPA 624	Bromoform	NELAP	PA	4/7/2005
EPA 624	Carbon tetrachloride	NELAP	PA	4/7/2005
EPA 624	Chlorobenzene	NELAP	PA	4/7/2005
EPA 624	Chloroethane	NELAP	PA	4/7/2005
EPA 624	Chloroform	NELAP	PA	4/7/2005
EPA 624	Dibromochloromethane	NELAP	PA	4/7/2005
EPA 624	Ethylbenzene	NELAP	PA	4/7/2005
EPA 624	Methyl bromide (Bromomethane)	NELAP	PA	11/7/2006
EPA 624	Methyl chloride (Chloromethane)	NELAP	PA	4/7/2005
EPA 624	Methylene chloride (Dichloromethane)	NELAP	PA	4/7/2005

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 624	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	4/7/2005
EPA 624	Toluene	NELAP	PA	4/7/2005
EPA 624	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	4/7/2005
EPA 624	Trichlorofluoromethane (Freon 11)	NELAP	PA	4/7/2005
EPA 624	Vinyl chloride (Chloroethene)	NELAP	PA	4/7/2005
EPA 624	Xylenes, total	NELAP	PA	4/7/2005
EPA 624	cis-1,3-Dichloropropene	NELAP	PA	4/7/2005
EPA 624	m+p-Xylene	NELAP	PA	8/24/2005
EPA 624	o-Xylene	NELAP	PA	8/24/2005
EPA 624	trans-1,2-Dichloroethene	NELAP	PA	4/7/2005
EPA 624	trans-1,3-Dichloropropene	NELAP	PA	4/7/2005
EPA 624-Extended	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	4/8/2009
EPA 624-Extended	1,1-Dichloropropene	NELAP	PA	4/8/2009
EPA 624-Extended	1,2,3-Trichlorobenzene	NELAP	PA	4/8/2009
EPA 624-Extended	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	4/8/2009
EPA 624-Extended	1,2,4-Trichlorobenzene	NELAP	PA	4/8/2009
EPA 624-Extended	1,2,4-Trimethylbenzene	NELAP	PA	4/8/2009
EPA 624-Extended	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	4/8/2009
EPA 624-Extended	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	4/8/2009
EPA 624-Extended	1,3,5-Trichlorobenzene	NELAP	PA	4/8/2009
EPA 624-Extended	1,3,5-Trimethylbenzene	NELAP	PA	4/8/2009
EPA 624-Extended	1,3-Dichloropropane	NELAP	PA	4/8/2009
EPA 624-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/8/2009
EPA 624-Extended	2,2-Dichloropropane	NELAP	PA	4/8/2009
EPA 624-Extended	2,3,6-Trichlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	2,3-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	2,4,5-Trichlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	2,4-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624-Extended	2,4-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	2,5-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624-Extended	2,5-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	2,6-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	3/1/2007
EPA 624-Extended	2-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624-Extended	2-Hexanone	NELAP	PA	4/8/2008
EPA 624-Extended	3,4-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 624-Extended	3,4-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	3-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624-Extended	3-Chlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	4-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 624-Extended	4-Chlorotoluene	NELAP	PA	4/8/2009
EPA 624-Extended	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	4/8/2009
EPA 624-Extended	4-Methyl-2-pentanone (MIBK)	NELAP	PA	4/8/2009
EPA 624-Extended	Acetone	NELAP	PA	4/8/2008
EPA 624-Extended	Acetonitrile	NELAP	PA	4/8/2009
EPA 624-Extended	Bromobenzene	NELAP	PA	4/8/2009
EPA 624-Extended	Bromochloromethane	NELAP	PA	3/1/2007
EPA 624-Extended	Carbon disulfide	NELAP	PA	4/8/2009
EPA 624-Extended	Cyclohexane	NELAP	PA	4/8/2009
EPA 624-Extended	Cyclohexanol	NELAP	PA	4/8/2009
EPA 624-Extended	Dibromomethane	NELAP	PA	4/8/2009
EPA 624-Extended	Dichlorodifluoromethane (Freon 12)	NELAP	PA	4/8/2009
EPA 624-Extended	Ethyl methacrylate	NELAP	PA	4/8/2009
EPA 624-Extended	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/8/2009
EPA 624-Extended	Hexane	NELAP	PA	4/20/2011
EPA 624-Extended	Iodomethane (Methyl iodide)	NELAP	PA	4/8/2009
EPA 624-Extended	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	4/8/2009
EPA 624-Extended	Isopropylbenzene (Cumene)	NELAP	PA	4/8/2009
EPA 624-Extended	Methacrylonitrile	NELAP	PA	4/8/2009
EPA 624-Extended	Methyl acetate	NELAP	PA	4/8/2009
EPA 624-Extended	Methyl isobutyl ketone (MIBK, 4-Methyl-2-pentanone)	NELAP	PA	4/8/2008
EPA 624-Extended	Methyl tert-butyl ether (MTBE)	NELAP	PA	4/8/2008
EPA 624-Extended	Methylcyclohexane	NELAP	PA	4/8/2009
EPA 624-Extended	Methylmethacrylate	NELAP	PA	4/8/2009
EPA 624-Extended	Naphthalene	NELAP	PA	4/8/2009
EPA 624-Extended	Propionitrile (Ethyl cyanide)	NELAP	PA	4/8/2009
EPA 624-Extended	Styrene	NELAP	PA	4/8/2009
EPA 624-Extended	Vinyl acetate	NELAP	PA	4/8/2009
EPA 624-Extended	cis-1,2-Dichloroethene	NELAP	PA	4/8/2009
EPA 624-Extended	n-Butylbenzene	NELAP	PA	4/8/2009
EPA 624-Extended	n-Propylbenzene	NELAP	PA	4/8/2009
EPA 624-Extended	sec-Butylbenzene	NELAP	PA	4/8/2009

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 624-Extended	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/8/2009
EPA 624-Extended	tert-Butylbenzene	NELAP	PA	4/8/2009
EPA 624-Extended	trans-1,4-Dichloro-2-butene	NELAP	PA	4/8/2009
EPA 625	1,2,4-Trichlorobenzene	NELAP	PA	4/7/2005
EPA 625	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 625	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 625	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 625	2,4,5-Trichlorophenol	NELAP	PA	8/24/2005
EPA 625	2,4,6-Trichlorophenol	NELAP	PA	4/7/2005
EPA 625	2,4-Dichlorophenol	NELAP	PA	4/7/2005
EPA 625	2,4-Dimethylphenol	NELAP	PA	4/7/2005
EPA 625	2,4-Dinitrophenol	NELAP	PA	4/7/2005
EPA 625	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	4/7/2005
EPA 625	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	4/7/2005
EPA 625	2-Chloronaphthalene	NELAP	PA	4/7/2005
EPA 625	2-Chlorophenol	NELAP	PA	4/7/2005
EPA 625	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	4/7/2005
EPA 625	2-Nitrophenol	NELAP	PA	4/7/2005
EPA 625	3,3'-Dichlorobenzidine	NELAP	PA	4/7/2005
EPA 625	4-Bromophenyl phenyl ether	NELAP	PA	4/7/2005
EPA 625	4-Chloro-3-methylphenol	NELAP	PA	4/7/2005
EPA 625	4-Chlorophenyl phenyl ether	NELAP	PA	4/7/2005
EPA 625	4-Nitrophenol	NELAP	PA	4/7/2005
EPA 625	Acenaphthene	NELAP	PA	4/7/2005
EPA 625	Acenaphthylene	NELAP	PA	10/27/2010
EPA 625	Acetophenone	NELAP	PA	8/24/2005
EPA 625	Anthracene	NELAP	PA	4/7/2005
EPA 625	Benzidine	NELAP	PA	4/7/2005
EPA 625	Benzo[a]anthracene	NELAP	PA	4/7/2005
EPA 625	Benzo[a]pyrene	NELAP	PA	4/7/2005
EPA 625	Benzo[b]fluoranthene	NELAP	PA	11/15/2011
EPA 625	Benzo[ghi]perylene	NELAP	PA	4/7/2005
EPA 625	Benzo[k]fluoranthene	NELAP	PA	11/15/2011
EPA 625	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	4/7/2005
EPA 625	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	4/7/2005
EPA 625	Cresols (total)	NELAP	PA	4/18/2006

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625	Di-n-butyl phthalate	NELAP	PA	4/7/2005
EPA 625	Di-n-octyl phthalate	NELAP	PA	11/15/2011
EPA 625	Dibenzo[a,h]anthracene	NELAP	PA	4/7/2005
EPA 625	Diethyl phthalate	NELAP	PA	4/7/2005
EPA 625	Dimethyl phthalate	NELAP	PA	4/7/2005
EPA 625	Fluoranthene	NELAP	PA	4/7/2005
EPA 625	Fluorene	NELAP	PA	4/7/2005
EPA 625	Hexachlorobenzene	NELAP	PA	4/7/2005
EPA 625	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/7/2005
EPA 625	Hexachlorocyclopentadiene	NELAP	PA	4/7/2005
EPA 625	Hexachloroethane	NELAP	PA	4/7/2005
EPA 625	Indeno(1,2,3-cd)pyrene	NELAP	PA	4/7/2005
EPA 625	Isophorone	NELAP	PA	4/7/2005
EPA 625	N-Nitrosodi-n-propylamine	NELAP	PA	4/7/2005
EPA 625	N-Nitrosodimethylamine	NELAP	PA	4/7/2005
EPA 625	N-Nitrosodiphenylamine	NELAP	PA	4/7/2005
EPA 625	Naphthalene	NELAP	PA	4/7/2005
EPA 625	Nitrobenzene	NELAP	PA	4/7/2005
EPA 625	Pentachlorophenol (PCP)	NELAP	PA	4/7/2005
EPA 625	Phenanthrene	NELAP	PA	4/7/2005
EPA 625	Phenol	NELAP	PA	4/7/2005
EPA 625	Pyrene	NELAP	PA	4/7/2005
EPA 625	bis(2-Chloroethoxy)methane	NELAP	PA	4/7/2005
EPA 625	bis(2-Chloroethyl) ether	NELAP	PA	4/7/2005
EPA 625	bis(2-Chloroisopropyl) ether	NELAP	PA	4/7/2005
EPA 625	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	4/7/2005
EPA 625-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/8/2009
EPA 625-Extended	1,2,3,4-Tetrahydronaphthalene	NELAP	PA	4/8/2009
EPA 625-Extended	1,2,4,5-Tetrachlorobenzene	NELAP	PA	4/8/2009
EPA 625-Extended	1,2-Diphenylhydrazine	NELAP	PA	4/8/2009
EPA 625-Extended	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	4/8/2009
EPA 625-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/8/2009
EPA 625-Extended	1-Methylnaphthalene	NELAP	PA	4/8/2009
EPA 625-Extended	2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	4/8/2009
EPA 625-Extended	2,3,4,6-Tetrachlorophenol	NELAP	PA	4/8/2009
EPA 625-Extended	2,3,5,6-Tetrachlorophenol	NELAP	PA	4/8/2009

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Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625-Extended	2,3-Dichloroaniline	NELAP	PA	4/8/2009
EPA 625-Extended	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	4/8/2009
EPA 625-Extended	2-Bromonaphthalene	NELAP	PA	4/8/2009
EPA 625-Extended	2-Methylnaphthalene	NELAP	PA	8/24/2005
EPA 625-Extended	2-Methylphenol (o-Cresol)	NELAP	PA	4/18/2006
EPA 625-Extended	2-Nitroaniline	NELAP	PA	4/18/2006
EPA 625-Extended	3+4-Methylphenol (m+p-Cresol)	NELAP	PA	4/8/2009
EPA 625-Extended	3-Chloroaniline	NELAP	PA	4/8/2009
EPA 625-Extended	3-Nitroaniline	NELAP	PA	4/18/2006
EPA 625-Extended	4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	4/8/2009
EPA 625-Extended	4-Chloroaniline	NELAP	PA	4/8/2009
EPA 625-Extended	4-Methylphenol (p-Cresol)	NELAP	PA	3/1/2007
EPA 625-Extended	4-Nitroaniline	NELAP	PA	4/18/2006
EPA 625-Extended	4-Nitrobiphenyl	NELAP	PA	4/8/2009
EPA 625-Extended	6-Methylchrysene	NELAP	PA	4/8/2009
EPA 625-Extended	Aniline	NELAP	PA	8/24/2005
EPA 625-Extended	Aramite	NELAP	PA	4/8/2009
EPA 625-Extended	Atrazine	NELAP	PA	4/8/2009
EPA 625-Extended	Benzaldehyde	NELAP	PA	4/8/2009
EPA 625-Extended	Benzoic acid	NELAP	PA	4/8/2009
EPA 625-Extended	Benzotrichloride	NELAP	PA	4/8/2009
EPA 625-Extended	Benzyl alcohol	NELAP	PA	4/8/2009
EPA 625-Extended	Caprolactam	NELAP	PA	4/8/2009
EPA 625-Extended	Carbaryl (Sevin)	NELAP	PA	4/8/2009
EPA 625-Extended	Carbazole	NELAP	PA	4/8/2009
EPA 625-Extended	Diallate (cis or trans)	NELAP	PA	4/8/2009
EPA 625-Extended	Dibenz[a,h]acridine	NELAP	PA	4/8/2009
EPA 625-Extended	Dibenzofuran	NELAP	PA	4/8/2009
EPA 625-Extended	Dimethoate	NELAP	PA	4/8/2009
EPA 625-Extended	Ethyl parathion	NELAP	PA	4/8/2009
EPA 625-Extended	Hexachlorophene	NELAP	PA	4/8/2009
EPA 625-Extended	Isodrin	NELAP	PA	4/8/2009
EPA 625-Extended	Kepone	NELAP	PA	4/8/2009
EPA 625-Extended	Methyl parathion (Parathion, methyl)	NELAP	PA	4/8/2009
EPA 625-Extended	N-Nitrosodiethylamine	NELAP	PA	4/8/2009
EPA 625-Extended	Pentachlorobenzene	NELAP	PA	4/8/2009

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Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 625-Extended	Pyridine	NELAP	PA	4/8/2009
EPA 625-Extended	Trifluralin (Treflan)	NELAP	PA	4/8/2009
EPA 625-Extended	n-Octadecane	NELAP	PA	4/8/2009
EPA 625-Extended	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	4/8/2009
EPA 7196A	Chromium VI	NELAP	PA	8/26/2006
EPA 7470A	Mercury	NELAP	PA	8/26/2006
EPA 8011	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	4/18/2006
EPA 8011	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	4/18/2006
EPA 8011-Extended	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	4/22/2010
EPA 8015	Ethylene glycol	NELAP	PA	4/20/2011
EPA 8015B	Nonhalogenated organics by GC/FID	NELAP	PA	3/7/2012
EPA 8015C	Nonhalogenated organics by GC/FID	NELAP	PA	3/7/2012
EPA 8081	4,4'-DDD	NELAP	PA	8/26/2006
EPA 8081	4,4'-DDE	NELAP	PA	8/26/2006
EPA 8081	4,4'-DDT	NELAP	PA	8/26/2006
EPA 8081	Aldrin (HHDN)	NELAP	PA	8/26/2006
EPA 8081	Chlordane (tech.)	NELAP	PA	8/26/2006
EPA 8081	Chlorobenzilate	NELAP	PA	8/26/2006
EPA 8081	Diallate (cis or trans)	NELAP	PA	8/26/2006
EPA 8081	Dieldrin	NELAP	PA	8/26/2006
EPA 8081	Endosulfan I	NELAP	PA	8/26/2006
EPA 8081	Endosulfan II	NELAP	PA	8/26/2006
EPA 8081	Endosulfan sulfate	NELAP	PA	8/26/2006
EPA 8081	Endrin	NELAP	PA	8/26/2006
EPA 8081	Endrin aldehyde	NELAP	PA	11/7/2006
EPA 8081	Endrin ketone	NELAP	PA	1/6/2006
EPA 8081	Heptachlor	NELAP	PA	8/26/2006
EPA 8081	Heptachlor epoxide	NELAP	PA	8/26/2006
EPA 8081	Hexachlorobenzene	NELAP	PA	5/20/2011
EPA 8081	Hexachlorocyclopentadiene	NELAP	PA	8/26/2006
EPA 8081	Isodrin	NELAP	PA	8/26/2006
EPA 8081	Methoxychlor	NELAP	PA	1/6/2006
EPA 8081	Mirex	NELAP	PA	8/26/2006
EPA 8081	Toxaphene (Chlorinated camphene)	NELAP	PA	8/26/2006
EPA 8081	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	8/26/2006
EPA 8081	alpha-Chlordane	NELAP	PA	1/6/2006

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8081	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	8/26/2006
EPA 8081	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	8/26/2006
EPA 8081	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	8/26/2006
EPA 8081	gamma-Chlordane	NELAP	PA	1/6/2006
EPA 8081-Extended	2,4'-DDD	NELAP	PA	4/18/2006
EPA 8081-Extended	2,4'-DDE	NELAP	PA	4/18/2006
EPA 8081-Extended	2,4'-DDT	NELAP	PA	4/18/2006
EPA 8081-Extended	Chlorbenside	NELAP	PA	4/18/2006
EPA 8081-Extended	Dacthal (DCPA)	NELAP	PA	8/26/2006
EPA 8081-Extended	Oxychlordane	NELAP	PA	4/8/2009
EPA 8081-Extended	cis-Nonachlor	NELAP	PA	4/18/2006
EPA 8081-Extended	trans-Nonachlor	NELAP	PA	4/18/2006
EPA 8081A	Organochlorine pesticides by GC/ECD	NELAP	PA	4/8/2009
EPA 8081B	Organochlorine pesticides by GC/ECD	NELAP	PA	4/8/2009
EPA 8082	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	NELAP	PA	8/26/2006
EPA 8082	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	NELAP	PA	8/26/2006
EPA 8082	2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	NELAP	PA	8/26/2006
EPA 8082	2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	NELAP	PA	8/26/2006
EPA 8082	2,2',5-Trichlorobiphenyl (BZ 18)	NELAP	PA	8/26/2006
EPA 8082	2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	NELAP	PA	8/26/2006
EPA 8082	Aroclor-1016 (PCB-1016)	NELAP	PA	8/26/2006
EPA 8082	Aroclor-1221 (PCB-1221)	NELAP	PA	8/26/2006
EPA 8082	Aroclor-1232 (PCB-1232)	NELAP	PA	8/26/2006
EPA 8082	Aroclor-1242 (PCB-1242)	NELAP	PA	8/26/2006
EPA 8082	Aroclor-1248 (PCB-1248)	NELAP	PA	8/26/2006
EPA 8082	Aroclor-1254 (PCB-1254)	NELAP	PA	8/26/2006
EPA 8082	Aroclor-1260 (PCB-1260)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ 209)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	NELAP	PA	4/13/2009

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Program Non-Potable Water

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EPA 8082-Extended	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,4'-Dichlorobiphenyl (BZ 8)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,4,4'-Trichlorobiphenyl (BZ 28)	NELAP	PA	4/13/2009
EPA 8082-Extended	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	NELAP	PA	4/13/2009
EPA 8082-Extended	3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	NELAP	PA	9/6/2012
EPA 8082-Extended	3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	NELAP	PA	4/13/2009
EPA 8082-Extended	Aroclor-1262 (PCB-1262)	NELAP	PA	4/8/2008
EPA 8082-Extended	Aroclor-1268 (PCB-1268)	NELAP	PA	4/8/2008
EPA 8082A	PCBs by GC/ECD	NELAP	PA	4/8/2009
EPA 8141	Azinphos-methyl (Guthion)	NELAP	PA	8/26/2006
EPA 8141	Bolstar (Sulprofos)	NELAP	PA	8/26/2006
EPA 8141	Chlorpyrifos	NELAP	PA	8/26/2006
EPA 8141	Coumaphos	NELAP	PA	8/26/2006
EPA 8141	Demeton	NELAP	PA	4/8/2009
EPA 8141	Demeton-O	NELAP	PA	8/26/2006
EPA 8141	Demeton-S	NELAP	PA	8/26/2006
EPA 8141	Diazinon (Spectracide)	NELAP	PA	8/26/2006
EPA 8141	Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	8/26/2006
EPA 8141	Dimethoate	NELAP	PA	8/26/2006
EPA 8141	Disulfoton	NELAP	PA	8/26/2006
EPA 8141	EPN (Santox)	NELAP	PA	8/26/2006
EPA 8141	Ethoprop (Prophos)	NELAP	PA	8/26/2006
EPA 8141	Famphur	NELAP	PA	8/26/2006
EPA 8141	Fensulfothion	NELAP	PA	8/26/2006
EPA 8141	Fenthion	NELAP	PA	8/26/2006
EPA 8141	Malathion	NELAP	PA	8/26/2006
EPA 8141	Methyl parathion (Parathion, methyl)	NELAP	PA	8/26/2006
EPA 8141	Mevinphos	NELAP	PA	8/26/2006
EPA 8141	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	8/26/2006
EPA 8141	Phorate (Thimet)	NELAP	PA	8/26/2006
EPA 8141	Ronnel	NELAP	PA	8/26/2006

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EPA 8141	Stirophos (Tetrachlorovinphos)	NELAP	PA	8/26/2006
EPA 8141	Sulfotepp (Tetraethyl dithiopyrophosphate)	NELAP	PA	8/26/2006
EPA 8141	Thionazine (Thionazin, Zinophos)	NELAP	PA	8/26/2006
EPA 8141	Tokuthion (Prothiophos)	NELAP	PA	8/26/2006
EPA 8141	Trichloronate	NELAP	PA	8/26/2006
EPA 8141-Extended	O,O,O-Triethyl phosphorothioate	NELAP	PA	3/1/2007
EPA 8141-Extended	Triphenyl phosphate	NELAP	PA	4/22/2010
EPA 8141A	Organophosphorus compounds by GC/NPD	NELAP	PA	4/8/2009
EPA 8141B	Organophosphorus compounds by GC/NPD	NELAP	PA	4/8/2009
EPA 8151	2,4,5-T	NELAP	PA	8/26/2006
EPA 8151	2,4,5-TP (Silvex)	NELAP	PA	8/26/2006
EPA 8151	2,4-D	NELAP	PA	8/26/2006
EPA 8151	2,4-DB (Butoxon)	NELAP	PA	8/26/2006
EPA 8151	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	8/26/2006
EPA 8151	Dicamba	NELAP	PA	8/26/2006
EPA 8151	Dichloroprop (Dichlorprop)	NELAP	PA	8/26/2006
EPA 8151	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	8/26/2006
EPA 8151	MCPA	NELAP	PA	8/26/2006
EPA 8151	MCPP (Mecoprop)	NELAP	PA	8/26/2006
EPA 8151	Pentachlorophenol (PCP)	NELAP	PA	8/26/2006
EPA 8151A	Chlorinated herbicides by GC/ECD	NELAP	PA	4/8/2009
EPA 8260	1,1,1,2-Tetrachloroethane	NELAP	PA	4/18/2006
EPA 8260	1,1,1-Trichloroethane	NELAP	PA	8/26/2006
EPA 8260	1,1,2,2-Tetrachloroethane	NELAP	PA	8/26/2006
EPA 8260	1,1,2-Trichloroethane	NELAP	PA	8/26/2006
EPA 8260	1,1-Dichloroethane	NELAP	PA	8/26/2006
EPA 8260	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	8/26/2006
EPA 8260	1,1-Dichloropropene	NELAP	PA	8/26/2006
EPA 8260	1,2,3-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8260	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	8/26/2006
EPA 8260	1,2,4-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8260	1,2,4-Trimethylbenzene	NELAP	PA	8/26/2006
EPA 8260	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	4/18/2006
EPA 8260	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	8/26/2006
EPA 8260	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8260	1,2-Dichloroethane	NELAP	PA	8/26/2006

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Program Non-Potable Water

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EPA 8260	1,2-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260	1,3,5-Trimethylbenzene	NELAP	PA	8/26/2006
EPA 8260	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8260	1,3-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8260	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	8/26/2006
EPA 8260	2,2-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	4/18/2006
EPA 8260	2-Chloroethyl vinyl ether	NELAP	PA	8/26/2006
EPA 8260	2-Chlorotoluene	NELAP	PA	8/26/2006
EPA 8260	2-Hexanone	NELAP	PA	1/6/2006
EPA 8260	2-Nitropropane	NELAP	PA	8/26/2006
EPA 8260	4-Chlorotoluene	NELAP	PA	8/26/2006
EPA 8260	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	8/26/2006
EPA 8260	4-Methyl-2-pentanone (MIBK)	NELAP	PA	1/6/2006
EPA 8260	Acetone	NELAP	PA	1/6/2006
EPA 8260	Acetonitrile	NELAP	PA	8/26/2006
EPA 8260	Acrolein (Propenal)	NELAP	PA	8/26/2006
EPA 8260	Acrylonitrile	NELAP	PA	8/26/2006
EPA 8260	Allyl chloride (3-Chloropropene)	NELAP	PA	8/26/2006
EPA 8260	Benzene	NELAP	PA	8/26/2006
EPA 8260	Benzyl chloride	NELAP	PA	8/26/2006
EPA 8260	Bromoacetone	NELAP	PA	8/26/2006
EPA 8260	Bromobenzene	NELAP	PA	8/26/2006
EPA 8260	Bromochloromethane	NELAP	PA	8/26/2006
EPA 8260	Bromodichloromethane	NELAP	PA	8/26/2006
EPA 8260	Bromoform	NELAP	PA	8/26/2006
EPA 8260	Carbon disulfide	NELAP	PA	1/6/2006
EPA 8260	Carbon tetrachloride	NELAP	PA	8/26/2006
EPA 8260	Chlorobenzene	NELAP	PA	8/26/2006
EPA 8260	Chloroethane	NELAP	PA	8/26/2006
EPA 8260	Chloroform	NELAP	PA	8/26/2006
EPA 8260	Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	8/26/2006
EPA 8260	Dibromochloromethane	NELAP	PA	8/26/2006
EPA 8260	Dibromofluoromethane	NELAP	PA	8/26/2006
EPA 8260	Dibromomethane	NELAP	PA	4/18/2006

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Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Dichlorodifluoromethane (Freon 12)	NELAP	PA	8/26/2006
EPA 8260	Diethyl ether (Ethyl ether)	NELAP	PA	8/26/2006
EPA 8260	Ethyl methacrylate	NELAP	PA	4/18/2006
EPA 8260	Ethylbenzene	NELAP	PA	8/26/2006
EPA 8260	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	8/26/2006
EPA 8260	Iodomethane (Methyl iodide)	NELAP	PA	8/26/2006
EPA 8260	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	8/26/2006
EPA 8260	Isopropylbenzene (Cumene)	NELAP	PA	8/26/2006
EPA 8260	Methacrylonitrile	NELAP	PA	8/26/2006
EPA 8260	Methyl bromide (Bromomethane)	NELAP	PA	8/26/2006
EPA 8260	Methyl chloride (Chloromethane)	NELAP	PA	8/26/2006
EPA 8260	Methyl tert-butyl ether (MTBE)	NELAP	PA	8/26/2006
EPA 8260	Methylene chloride (Dichloromethane)	NELAP	PA	8/26/2006
EPA 8260	Methylmethacrylate	NELAP	PA	4/18/2006
EPA 8260	Naphthalene	NELAP	PA	8/26/2006
EPA 8260	Propionitrile (Ethyl cyanide)	NELAP	PA	4/18/2006
EPA 8260	Styrene	NELAP	PA	1/6/2006
EPA 8260	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	8/26/2006
EPA 8260	Toluene	NELAP	PA	8/26/2006
EPA 8260	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	8/26/2006
EPA 8260	Trichlorofluoromethane (Freon 11)	NELAP	PA	8/26/2006
EPA 8260	Vinyl acetate	NELAP	PA	1/6/2006
EPA 8260	Vinyl chloride (Chloroethene)	NELAP	PA	8/26/2006
EPA 8260	Xylenes, total	NELAP	PA	3/30/2006
EPA 8260	cis-1,2-Dichloroethene	NELAP	PA	8/26/2006
EPA 8260	cis-1,3-Dichloropropene	NELAP	PA	8/26/2006
EPA 8260	m+p-Xylene	NELAP	PA	8/24/2005
EPA 8260	m-Xylene	NELAP	PA	8/26/2006
EPA 8260	n-Butylbenzene	NELAP	PA	8/26/2006
EPA 8260	n-Propylbenzene	NELAP	PA	8/26/2006
EPA 8260	o-Xylene	NELAP	PA	8/24/2005
EPA 8260	p-Xylene	NELAP	PA	8/26/2006
EPA 8260	sec-Butylbenzene	NELAP	PA	8/26/2006
EPA 8260	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/8/2008
EPA 8260	tert-Butylbenzene	NELAP	PA	8/26/2006
EPA 8260	trans-1,2-Dichloroethene	NELAP	PA	8/26/2006

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EPA 8260	trans-1,3-Dichloropropene	NELAP	PA	8/26/2006
EPA 8260	trans-1,4-Dichloro-2-butene	NELAP	PA	8/26/2006
EPA 8260-Extended	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	4/18/2006
EPA 8260-Extended	1,2-Dichloroethene (total)	NELAP	PA	3/1/2007
EPA 8260-Extended	1,3,5-Trichlorobenzene	NELAP	PA	4/8/2009
EPA 8260-Extended	2,2,4-Trimethylpentane (Iso-octane)	NELAP	PA	12/5/2007
EPA 8260-Extended	2,3,6-Trichlorotoluene	NELAP	PA	4/8/2009
EPA 8260-Extended	2,3-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260-Extended	2,4,5-Trichlorotoluene	NELAP	PA	4/8/2009
EPA 8260-Extended	2,4-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260-Extended	2,4-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260-Extended	2,5-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260-Extended	2,5-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260-Extended	2,6-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260-Extended	2-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260-Extended	3,4-Dichlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260-Extended	3,4-Dichlorotoluene	NELAP	PA	4/8/2009
EPA 8260-Extended	3-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260-Extended	3-Chlorotoluene	NELAP	PA	4/22/2010
EPA 8260-Extended	4-Chlorobenzotrifluoride	NELAP	PA	4/8/2009
EPA 8260-Extended	Cyclohexane	NELAP	PA	4/18/2006
EPA 8260-Extended	Cyclohexanol	NELAP	PA	4/8/2009
EPA 8260-Extended	Dichlorofluoromethane (Freon 21)	NELAP	PA	4/8/2009
EPA 8260-Extended	Ethyl acrylate	NELAP	PA	12/5/2007
EPA 8260-Extended	Heptane	NELAP	PA	4/18/2006
EPA 8260-Extended	Hexane	NELAP	PA	12/5/2007
EPA 8260-Extended	Isopropyl alcohol (2-Propanol)	NELAP	PA	8/26/2006
EPA 8260-Extended	Methyl acetate	NELAP	PA	4/18/2006
EPA 8260-Extended	Methyl isobutyl ketone (MIBK, 4-Methyl-2-pentanone)	NELAP	PA	8/26/2006
EPA 8260-Extended	Methylcyclohexane	NELAP	PA	4/18/2006
EPA 8260-Extended	Tetrahydrofuran (THF)	NELAP	PA	4/22/2010
EPA 8260-Extended	Vinyl bromide (Bromoethene)	NELAP	PA	12/5/2007
EPA 8260B	VOCs by GC/MS	NELAP	PA	4/8/2009
EPA 8270	1,2,4,5-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270	1,2,4-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8270	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	8/26/2006

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EPA 8270	1,2-Dinitrobenzene (1,2-DNB)	NELAP	PA	8/26/2006
EPA 8270	1,2-Diphenylhydrazine	NELAP	PA	4/18/2006
EPA 8270	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	8/26/2006
EPA 8270	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8270	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	8/26/2006
EPA 8270	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	8/26/2006
EPA 8270	1,4-Naphthoquinone	NELAP	PA	8/26/2006
EPA 8270	1,4-Phenylenediamine	NELAP	PA	8/26/2006
EPA 8270	1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	8/26/2006
EPA 8270	2,3,4,6-Tetrachlorophenol	NELAP	PA	4/18/2006
EPA 8270	2,4,5-Trichlorophenol	NELAP	PA	8/26/2006
EPA 8270	2,4,6-Trichlorophenol	NELAP	PA	8/26/2006
EPA 8270	2,4-Dichlorophenol	NELAP	PA	8/26/2006
EPA 8270	2,4-Dimethylphenol	NELAP	PA	8/26/2006
EPA 8270	2,4-Dinitrophenol	NELAP	PA	8/26/2006
EPA 8270	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	8/26/2006
EPA 8270	2,6-Dichlorophenol	NELAP	PA	4/18/2006
EPA 8270	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	8/26/2006
EPA 8270	2-Acetylaminofluorene	NELAP	PA	8/26/2006
EPA 8270	2-Chloronaphthalene	NELAP	PA	8/26/2006
EPA 8270	2-Chlorophenol	NELAP	PA	8/26/2006
EPA 8270	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	4/18/2006
EPA 8270	2-Methylnaphthalene	NELAP	PA	8/26/2006
EPA 8270	2-Methylphenol (o-Cresol)	NELAP	PA	1/6/2006
EPA 8270	2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	8/26/2006
EPA 8270	2-Nitroaniline	NELAP	PA	1/6/2006
EPA 8270	2-Nitrophenol	NELAP	PA	8/26/2006
EPA 8270	2-Picoline (2-Methylpyridine)	NELAP	PA	4/18/2006
EPA 8270	3+4-Methylphenol (m+p-Cresol)	NELAP	PA	3/1/2007
EPA 8270	3,3'-Dichlorobenzidine	NELAP	PA	8/26/2006
EPA 8270	3,3'-Dimethylbenzidine	NELAP	PA	4/18/2006
EPA 8270	3-Methylphenol (m-Cresol)	NELAP	PA	4/18/2006
EPA 8270	3-Nitroaniline	NELAP	PA	4/18/2006
EPA 8270	4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	4/18/2006
EPA 8270	4,4'-Methylenebis(N N-dimethylaniline)	NELAP	PA	8/26/2006
EPA 8270	4-Aminobiphenyl	NELAP	PA	8/26/2006

Attachment to Certificate of Accreditation 009, expiration date April 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	4-Bromophenyl phenyl ether	NELAP	PA	8/26/2006
EPA 8270	4-Chloro-3-methylphenol	NELAP	PA	8/26/2006
EPA 8270	4-Chloroaniline	NELAP	PA	1/6/2006
EPA 8270	4-Chlorophenyl phenyl ether	NELAP	PA	8/26/2006
EPA 8270	4-Dimethylaminoazobenzene (Dimethylaminoazobenzene)	NELAP	PA	8/26/2006
EPA 8270	4-Methylphenol (p-Cresol)	NELAP	PA	1/6/2006
EPA 8270	4-Nitroaniline	NELAP	PA	4/18/2006
EPA 8270	4-Nitrobiphenyl	NELAP	PA	8/26/2006
EPA 8270	4-Nitrophenol	NELAP	PA	8/26/2006
EPA 8270	4-Nitroquinoline-1-oxide	NELAP	PA	4/18/2006
EPA 8270	5-Nitro-o-toluidine	NELAP	PA	8/26/2006
EPA 8270	7,12-Dimethylbenz(a)anthracene	NELAP	PA	8/26/2006
EPA 8270	Acenaphthene	NELAP	PA	8/26/2006
EPA 8270	Acenaphthylene	NELAP	PA	10/27/2010
EPA 8270	Acetophenone	NELAP	PA	8/26/2006
EPA 8270	Aminoazobenzene	NELAP	PA	8/26/2006
EPA 8270	Aniline	NELAP	PA	8/26/2006
EPA 8270	Anthracene	NELAP	PA	8/26/2006
EPA 8270	Aramite	NELAP	PA	4/18/2006
EPA 8270	Azinphos-methyl (Guthion)	NELAP	PA	8/26/2006
EPA 8270	Benzidine	NELAP	PA	8/26/2006
EPA 8270	Benzo[a]anthracene	NELAP	PA	8/26/2006
EPA 8270	Benzo[a]pyrene	NELAP	PA	8/26/2006
EPA 8270	Benzo[b]fluoranthene	NELAP	PA	11/15/2011
EPA 8270	Benzo[ghi]perylene	NELAP	PA	8/26/2006
EPA 8270	Benzo[k]fluoranthene	NELAP	PA	11/15/2011
EPA 8270	Benzoic acid	NELAP	PA	8/26/2006
EPA 8270	Benzyl alcohol	NELAP	PA	8/26/2006
EPA 8270	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	8/26/2006
EPA 8270	Carbaryl (Sevin)	NELAP	PA	12/5/2007
EPA 8270	Carbazole	NELAP	PA	1/6/2006
EPA 8270	Chlorobenzilate	NELAP	PA	4/18/2006
EPA 8270	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	8/26/2006
EPA 8270	Cresols (total)	NELAP	PA	4/18/2006
EPA 8270	Di-n-butyl phthalate	NELAP	PA	8/26/2006
EPA 8270	Di-n-octyl phthalate	NELAP	PA	11/15/2011

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Diallate (cis or trans)	NELAP	PA	4/18/2006
EPA 8270	Dibenzo[a,h]anthracene	NELAP	PA	8/26/2006
EPA 8270	Dibenzofuran	NELAP	PA	1/6/2006
EPA 8270	Diethyl phthalate	NELAP	PA	8/26/2006
EPA 8270	Dimethoate	NELAP	PA	8/26/2006
EPA 8270	Dimethyl phthalate	NELAP	PA	8/26/2006
EPA 8270	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	8/26/2006
EPA 8270	Disulfoton	NELAP	PA	8/26/2006
EPA 8270	Ethyl methanesulfonate	NELAP	PA	8/26/2006
EPA 8270	Famphur	NELAP	PA	8/26/2006
EPA 8270	Fluoranthene	NELAP	PA	8/26/2006
EPA 8270	Fluorene	NELAP	PA	8/26/2006
EPA 8270	Hexachlorobenzene	NELAP	PA	8/26/2006
EPA 8270	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	8/26/2006
EPA 8270	Hexachlorocyclopentadiene	NELAP	PA	8/26/2006
EPA 8270	Hexachloroethane	NELAP	PA	8/26/2006
EPA 8270	Hexachlorophene	NELAP	PA	8/26/2006
EPA 8270	Hexachloropropene	NELAP	PA	4/18/2006
EPA 8270	Indeno(1,2,3-cd)pyrene	NELAP	PA	8/26/2006
EPA 8270	Isodrin	NELAP	PA	8/26/2006
EPA 8270	Isophorone	NELAP	PA	8/26/2006
EPA 8270	Isosafrole	NELAP	PA	8/26/2006
EPA 8270	Kepone	NELAP	PA	4/18/2006
EPA 8270	Methapyrilene	NELAP	PA	8/26/2006
EPA 8270	Methyl methanesulfonate	NELAP	PA	8/26/2006
EPA 8270	Methyl parathion (Parathion, methyl)	NELAP	PA	4/18/2006
EPA 8270	N-Nitrosodi-n-butylamine	NELAP	PA	4/18/2006
EPA 8270	N-Nitrosodi-n-propylamine	NELAP	PA	8/26/2006
EPA 8270	N-Nitrosodiethylamine	NELAP	PA	8/26/2006
EPA 8270	N-Nitrosodimethylamine	NELAP	PA	8/26/2006
EPA 8270	N-Nitrosodiphenylamine	NELAP	PA	8/26/2006
EPA 8270	N-Nitrosomethylethylamine	NELAP	PA	4/18/2006
EPA 8270	N-Nitrosomorpholine	NELAP	PA	8/26/2006
EPA 8270	N-Nitrosopiperidine	NELAP	PA	8/26/2006
EPA 8270	N-Nitrosopyrrolidine	NELAP	PA	8/26/2006
EPA 8270	Naphthalene	NELAP	PA	8/26/2006

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Nitrobenzene	NELAP	PA	8/26/2006
EPA 8270	Nitroquinoline-1-oxide	NELAP	PA	8/26/2006
EPA 8270	O,O,O-Triethyl phosphorothioate	NELAP	PA	8/26/2006
EPA 8270	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	4/18/2006
EPA 8270	Pentachlorobenzene	NELAP	PA	4/18/2006
EPA 8270	Pentachloronitrobenzene (PCNB)	NELAP	PA	4/18/2006
EPA 8270	Pentachlorophenol (PCP)	NELAP	PA	8/26/2006
EPA 8270	Phenacetin	NELAP	PA	8/26/2006
EPA 8270	Phenanthrene	NELAP	PA	8/26/2006
EPA 8270	Phenol	NELAP	PA	8/26/2006
EPA 8270	Phorate (Thimet)	NELAP	PA	8/26/2006
EPA 8270	Pronamide (Kerb)	NELAP	PA	4/18/2006
EPA 8270	Pyrene	NELAP	PA	8/26/2006
EPA 8270	Pyridine	NELAP	PA	4/18/2006
EPA 8270	Safrole	NELAP	PA	8/26/2006
EPA 8270	Sulfotepp (Tetraethyl dithiopyrophosphate)	NELAP	PA	8/26/2006
EPA 8270	Thionazine (Thionazin, Zinophos)	NELAP	PA	8/26/2006
EPA 8270	a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	4/18/2006
EPA 8270	bis(2-Chloroethoxy)methane	NELAP	PA	8/26/2006
EPA 8270	bis(2-Chloroethyl) ether	NELAP	PA	8/26/2006
EPA 8270	bis(2-Chloroisopropyl) ether	NELAP	PA	8/26/2006
EPA 8270	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	8/26/2006
EPA 8270	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	4/18/2006
EPA 8270 SIM	2,4-Dichlorophenol	NELAP	PA	4/8/2008
EPA 8270 SIM	2-Chloronaphthalene	NELAP	PA	4/8/2008
EPA 8270 SIM	2-Methylnaphthalene	NELAP	PA	4/8/2008
EPA 8270 SIM	3,3'-Dichlorobenzidine	NELAP	PA	4/8/2008
EPA 8270 SIM	Acenaphthene	NELAP	PA	4/8/2008
EPA 8270 SIM	Acenaphthylene	NELAP	PA	10/27/2010
EPA 8270 SIM	Anthracene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[a]anthracene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[a]pyrene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[b]fluoranthene	NELAP	PA	11/15/2011
EPA 8270 SIM	Benzo[ghi]perylene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[k]fluoranthene	NELAP	PA	11/15/2011
EPA 8270 SIM	Carbazole	NELAP	PA	4/8/2008

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	4/8/2008
EPA 8270 SIM	Dibenzo[a,h]anthracene	NELAP	PA	4/8/2008
EPA 8270 SIM	Fluoranthene	NELAP	PA	4/8/2008
EPA 8270 SIM	Fluorene	NELAP	PA	4/8/2008
EPA 8270 SIM	Hexachlorobenzene	NELAP	PA	4/8/2008
EPA 8270 SIM	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/8/2008
EPA 8270 SIM	Indeno(1,2,3-cd)pyrene	NELAP	PA	4/8/2008
EPA 8270 SIM	N-Nitrosodi-n-propylamine	NELAP	PA	4/8/2008
EPA 8270 SIM	Naphthalene	NELAP	PA	4/8/2008
EPA 8270 SIM	Pentachlorophenol (PCP)	NELAP	PA	4/8/2008
EPA 8270 SIM	Phenanthrene	NELAP	PA	4/8/2008
EPA 8270 SIM	Phenol	NELAP	PA	4/8/2008
EPA 8270 SIM	Pyrene	NELAP	PA	4/8/2008
EPA 8270 SIM	bis(2-Chloroethyl) ether	NELAP	PA	4/8/2008
EPA 8270 SIM	bis(2-Chloroisopropyl) ether	NELAP	PA	4/8/2008
EPA 8270 SIM-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/8/2009
EPA 8270 SIM-Extended	1-Methylnaphthalene	NELAP	PA	4/8/2008
EPA 8270 SIM-Extended	2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	4/8/2009
EPA 8270-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/18/2006
EPA 8270-Extended	1,2,3,4-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270-Extended	1,2,3,5-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270-Extended	1,3,5-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8270-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/18/2006
EPA 8270-Extended	1,4-Phenylenediamine	NELAP	PA	12/5/2007
EPA 8270-Extended	1-Methylnaphthalene	NELAP	PA	4/8/2009
EPA 8270-Extended	2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	4/18/2006
EPA 8270-Extended	2,3,5,6-Tetrachlorophenol	NELAP	PA	8/26/2006
EPA 8270-Extended	2,3,7,8-TCDD (Dioxin) (screen)	NELAP	PA	8/26/2006
EPA 8270-Extended	2,3-Dichlorophenol (Dichlorophenol)	NELAP	PA	12/5/2007
EPA 8270-Extended	2,4,6-Tribromophenol	NELAP	PA	4/8/2009
EPA 8270-Extended	2,5-Dichlorophenol	NELAP	PA	12/5/2007
EPA 8270-Extended	2-Phenylphenol	NELAP	PA	4/8/2009
EPA 8270-Extended	3-Methylcholanthrene	NELAP	PA	8/26/2006
EPA 8270-Extended	3-Nitrotoluene	NELAP	PA	8/26/2006
EPA 8270-Extended	4-Chlorophenol	NELAP	PA	8/26/2006

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270-Extended	4-Nitrotoluene	NELAP	PA	8/26/2006
EPA 8270-Extended	6-Methylchrysene	NELAP	PA	12/5/2007
EPA 8270-Extended	Atrazine	NELAP	PA	4/18/2006
EPA 8270-Extended	Benzaldehyde	NELAP	PA	8/26/2006
EPA 8270-Extended	Caprolactam	NELAP	PA	4/18/2006
EPA 8270-Extended	Dibenz[a,h]acridine	NELAP	PA	12/5/2007
EPA 8270-Extended	Indene	NELAP	PA	4/8/2009
EPA 8270-Extended	Octachlorocyclopentene (Perchlorocyclopentene)	NELAP	PA	12/5/2007
EPA 8270-Extended	Octachlorostyrene	NELAP	PA	12/5/2007
EPA 8270-Extended	Pentachloroethane	NELAP	PA	8/26/2006
EPA 8270-Extended	bis(2-Hydroxyphenyl) methane (2,2'-Methylenediphenol)	NELAP	PA	12/5/2007
EPA 8270-Extended	bis(4-Hydroxyphenyl) methane	NELAP	PA	12/5/2007
EPA 8270-Extended	n-Octadecane	NELAP	PA	4/8/2009
EPA 8270-Extended	p-(Dimethylamino)azobenzene	NELAP	PA	4/8/2009
EPA 8270-Extended	p-Chlorobenzilate (Ethyl 4,4'-dichlorobenzilate)	NELAP	PA	12/5/2007
EPA 8270-Extended	p-Phenylenediamine	NELAP	PA	4/8/2009
EPA 8270C	SOCs by GC/MS	NELAP	PA	4/8/2009
EPA 8270D	SOCs by GC/MS	NELAP	PA	4/8/2009
EPA 9010	Total cyanide	NELAP	PA	12/14/2012
EPA 9014	Total cyanide	NELAP	PA	12/14/2012
EPA 9030B	Sulfide	NELAP	PA	11/15/2011
EPA 9034	Sulfide	NELAP	PA	11/15/2011
EPA 9040B	pH	NELAP	PA	4/18/2006
EPA 9040C	Corrosivity (pH)	NELAP	PA	8/26/2006
EPA 9050	Conductivity	NELAP	PA	11/15/2011
EPA 9050A	Conductivity	NELAP	PA	3/16/2009
EPA 9056	Bromide	NELAP	PA	8/26/2006
EPA 9056	Chloride	NELAP	PA	8/26/2006
EPA 9056	Fluoride	NELAP	PA	8/26/2006
EPA 9056	Nitrate as N	NELAP	PA	8/26/2006
EPA 9056	Nitrite as N	NELAP	PA	8/26/2006
EPA 9056	Orthophosphate as P	NELAP	PA	8/26/2006
EPA 9056	Sulfate	NELAP	PA	8/26/2006
EPA 9056A	Anions by IC	NELAP	PA	3/16/2009
EPA 9060	Total organic carbon (TOC)	NELAP	PA	8/26/2006
EPA 9060A	Total organic carbon (TOC)	NELAP	PA	4/22/2010

Attachment to Certificate of Accreditation 009, expiration date April 30, 2013. This listing of accredited analytes should be used only when associated with a valid certificate of accreditation.

State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 9065	Total phenolics	NELAP	PA	4/8/2008
EPA 9070A	Oil and grease	NELAP	PA	4/4/2007
HACH 8000	Chemical oxygen demand (COD)	NELAP	PA	12/5/2007
OIA 1677	Available cyanide	NELAP	PA	8/24/2005
RSK-175	Acetylene (Ethyne)	NELAP	PA	1/10/2012
RSK-175	Ethane	NELAP	PA	1/10/2012
RSK-175	Ethene	NELAP	PA	1/10/2012
RSK-175	Isobutane (2-Methylpropane)	NELAP	PA	3/20/2012
RSK-175	Methane	NELAP	PA	1/10/2012
RSK-175	Pentane	NELAP	PA	3/20/2012
RSK-175	Propane	NELAP	PA	1/10/2012
RSK-175	Propene	NELAP	PA	1/10/2012
RSK-175	n-Butane	NELAP	PA	1/10/2012
SM 2120 B	Color	NELAP	PA	4/10/2007
SM 2310 B	Acidity as CaCO3	NELAP	PA	1/22/2007
SM 2320 B	Alkalinity as CaCO3	NELAP	PA	1/22/2007
SM 2340 C	Total hardness as CaCO3	NELAP	PA	1/22/2007
SM 2510 B	Conductivity	NELAP	PA	4/21/2010
SM 2520 B	Salinity	NELAP	PA	4/8/2008
SM 2540 B	Residue, total	NELAP	PA	4/10/2007
SM 2540 C	Residue, filterable (TDS)	NELAP	PA	10/13/2010
SM 2540 D	Residue, nonfilterable (TSS)	NELAP	PA	4/10/2007
SM 2540 E	Fixed suspended solids	NELAP	PA	4/13/2009
SM 2540 E	Volatile suspended solids	NELAP	PA	4/13/2009
SM 2540 F	Residue, settleable	NELAP	PA	4/10/2007
SM 2540 G	Residue, volatile	NELAP	PA	8/26/2006
SM 2580B	Oxidation-reduction potential	NELAP	PA	5/4/2009
SM 3500-Cr B (20th & 21st ed.)	Chromium VI	NELAP	PA	8/24/2005
SM 4500-CN- C/E	Cyanide	NELAP	PA	12/14/2012
SM 4500-Cl G	Total residual chlorine	NELAP	PA	4/8/2008
SM 4500-H+ B	pH	NELAP	PA	4/10/2007
SM 4500-O G	Oxygen (dissolved)	NELAP	PA	3/16/2009
SM 4500-S F	Sulfide	NELAP	PA	11/15/2011
SM 5210 B	Biochemical oxygen demand (BOD)	NELAP	PA	6/24/2008
SM 5210 B	Carbonaceous BOD (CBOD)	NELAP	PA	8/26/2006
SM 5310 C	Dissolved organic carbon (DOC)	NELAP	PA	7/12/2010

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Program Non-Potable Water

Method	Analyte	Accreditation Type	Primary	Effective Date
SM 5310 C	Total organic carbon (TOC)	NELAP	PA	7/12/2010
SM 5540 C	Surfactants as MBAS	NELAP	PA	10/24/2012
SOP (00416) GC-001	Diethylene glycol, diethyl ether	NELAP	PA	4/13/2009
SOP (00416) GC-001	Diethylene glycol, dimethyl ether	NELAP	PA	4/13/2009
SOP (00416) GC-001	Ethylene glycol, dimethyl ether	NELAP	PA	4/13/2009
SOP (00416) GC-001	Ethylene glycol, monobutyl ether acetate	NELAP	PA	4/13/2009
SOP (00416) GC-001	Ethylene glycol, monoethyl ether acetate	NELAP	PA	4/13/2009
SOP (00416) GC-001	Ethylene glycol, monomethyl ether acetate	NELAP	PA	4/13/2009
USGS I-1187-85	Chloride	NELAP	PA	12/14/2012

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
ASTM D2216-05	Percent moisture in soil	NELAP	PA	4/13/2009
ASTM D2974-00	Ash content	NELAP	PA	12/5/2007
ASTM D2974-00	Moisture	NELAP	PA	12/5/2007
ASTM D2974-00	Organic matter	NELAP	PA	12/5/2007
ASTM D2974-84	Ash content	NELAP	PA	4/9/2009
ASTM D2974-84	Organic matter	NELAP	PA	4/9/2009
ASTM D3987-85	Shake extraction of solid waste with water	NELAP	PA	12/5/2007
ASTM D5057-90	Apparent specific gravity	NELAP	PA	9/27/2010
ASTM D5057-90	Bulk density	NELAP	PA	9/27/2010
ASTM D5384-95	Total chlorine	NELAP	PA	4/9/2009
EPA 1010	Ignitability	NELAP	PA	4/7/2005
EPA 1010A	Ignitability	NELAP	PA	4/9/2009
EPA 1020A	Ignitability	NELAP	PA	4/7/2005
EPA 1020B	Ignitability	NELAP	PA	4/9/2009
EPA 1310A	Extraction procedure (EP) toxicity test method	NELAP	PA	4/7/2005
EPA 1311	Toxicity characteristic leaching procedure (TCLP)	NELAP	PA	4/7/2005
EPA 1312	Synthetic precipitation leaching procedure (SPLP)	NELAP	PA	4/18/2006
EPA 1320	Multiple extraction procedure	NELAP	PA	12/5/2007
EPA 300.0	Bromide	NELAP	PA	4/20/2011
EPA 300.0	Chloride	NELAP	PA	4/20/2011
EPA 300.0	Fluoride	NELAP	PA	4/20/2011
EPA 300.0	Nitrate as N	NELAP	PA	4/20/2011
EPA 300.0	Nitrite as N	NELAP	PA	4/20/2011
EPA 300.0	Orthophosphate as P	NELAP	PA	4/20/2011
EPA 300.0	Sulfate	NELAP	PA	4/20/2011
EPA 3005A	Preconcentration under acid	NELAP	PA	4/7/2005
EPA 3010A	Hot plate acid digestion (HNO3 + HCl)	NELAP	PA	4/7/2005
EPA 3050B	Acid digestion of solids	NELAP	PA	4/7/2005
EPA 3060A	Alkaline digestion of Cr(VI)	NELAP	PA	4/7/2005
EPA 350.1	Ammonia as N	NELAP	PA	8/26/2006
EPA 3510C	Separatory funnel liquid-liquid extraction	NELAP	PA	4/7/2005
EPA 3520C	Continuous liquid-liquid extraction	NELAP	PA	4/7/2005
EPA 353.2	Nitrate as N	NELAP	PA	12/14/2012
EPA 353.2	Nitrite as N	NELAP	PA	3/20/2012
EPA 353.2	Total nitrate-nitrite	NELAP	PA	4/20/2011
EPA 3541	Automated soxhlet extraction	NELAP	PA	4/7/2005

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 3550B	Ultrasonic extraction	NELAP	PA	4/7/2005
EPA 3550C	Ultrasonic extraction	NELAP	PA	4/9/2009
EPA 3580A	Waste dilution	NELAP	PA	4/7/2005
EPA 3585	Waste dilution for VOCs	NELAP	PA	4/7/2005
EPA 3620B	Florisil cleanup	NELAP	PA	4/18/2006
EPA 3620C	Florisil cleanup	NELAP	PA	4/9/2009
EPA 3640A	Gel permeation cleanup (GPC)	NELAP	PA	4/18/2006
EPA 3660B	Sulfur cleanup	NELAP	PA	4/18/2006
EPA 3665A	Sulfuric acid/permanganate clean-up	NELAP	PA	4/18/2006
EPA 410.4	Chemical oxygen demand (COD)	NELAP	PA	8/26/2006
EPA 5030	Bulk purge-and-trap (methanol)	NELAP	PA	4/20/2011
EPA 5035	Closed-system purge-and-trap (bisulfate option)	NELAP	PA	4/7/2005
EPA 5035	Closed-system purge-and-trap (methanol option)	NELAP	PA	4/7/2005
EPA 5035	Closed-system purge-and-trap (unpreserved)	NELAP	PA	8/24/2005
EPA 5035A	Closed-system purge-and-trap (freezing option)	NELAP	PA	6/15/2012
EPA 5035A	Closed-system purge-and-trap (methanol option)	NELAP	PA	6/15/2012
EPA 5035A	Closed-system purge-and-trap (unpreserved)	NELAP	PA	6/15/2012
EPA 6010	Aluminum	NELAP	PA	8/24/2005
EPA 6010	Antimony	NELAP	PA	4/7/2005
EPA 6010	Arsenic	NELAP	PA	4/7/2005
EPA 6010	Barium	NELAP	PA	4/7/2005
EPA 6010	Beryllium	NELAP	PA	4/7/2005
EPA 6010	Boron	NELAP	PA	4/7/2005
EPA 6010	Cadmium	NELAP	PA	4/7/2005
EPA 6010	Calcium	NELAP	PA	4/7/2005
EPA 6010	Chromium	NELAP	PA	4/7/2005
EPA 6010	Cobalt	NELAP	PA	4/7/2005
EPA 6010	Copper	NELAP	PA	4/7/2005
EPA 6010	Iron	NELAP	PA	4/7/2005
EPA 6010	Lead	NELAP	PA	4/7/2005
EPA 6010	Lithium	NELAP	PA	4/22/2010
EPA 6010	Magnesium	NELAP	PA	4/7/2005
EPA 6010	Manganese	NELAP	PA	4/7/2005
EPA 6010	Molybdenum	NELAP	PA	4/7/2005
EPA 6010	Nickel	NELAP	PA	4/7/2005
EPA 6010	Potassium	NELAP	PA	4/7/2005

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6010	Selenium	NELAP	PA	4/7/2005
EPA 6010	Silica, as SiO2	NELAP	PA	4/7/2005
EPA 6010	Silicon	NELAP	PA	6/3/2010
EPA 6010	Silver	NELAP	PA	4/7/2005
EPA 6010	Sodium	NELAP	PA	4/7/2005
EPA 6010	Strontium	NELAP	PA	4/7/2005
EPA 6010	Thallium	NELAP	PA	4/7/2005
EPA 6010	Tin	NELAP	PA	4/7/2005
EPA 6010	Titanium	NELAP	PA	4/7/2005
EPA 6010	Vanadium	NELAP	PA	4/7/2005
EPA 6010	Zinc	NELAP	PA	4/7/2005
EPA 6010-Extended	Cesium	NELAP	PA	4/18/2006
EPA 6010B	Metals by ICP/AES	NELAP	PA	4/8/2009
EPA 6010C	Metals by ICP/AES	NELAP	PA	4/9/2009
EPA 6020	Aluminum	NELAP	PA	4/7/2005
EPA 6020	Antimony	NELAP	PA	4/7/2005
EPA 6020	Arsenic	NELAP	PA	4/7/2005
EPA 6020	Barium	NELAP	PA	4/7/2005
EPA 6020	Beryllium	NELAP	PA	4/7/2005
EPA 6020	Cadmium	NELAP	PA	4/7/2005
EPA 6020	Chromium	NELAP	PA	4/7/2005
EPA 6020	Cobalt	NELAP	PA	4/7/2005
EPA 6020	Copper	NELAP	PA	4/7/2005
EPA 6020	Lead	NELAP	PA	4/7/2005
EPA 6020	Manganese	NELAP	PA	4/7/2005
EPA 6020	Metals by ICP/MS	NELAP	PA	4/9/2009
EPA 6020	Nickel	NELAP	PA	4/7/2005
EPA 6020	Silver	NELAP	PA	4/7/2005
EPA 6020	Thallium	NELAP	PA	4/7/2005
EPA 6020	Zinc	NELAP	PA	4/7/2005
EPA 6020-Extended	Boron	NELAP	PA	8/24/2005
EPA 6020-Extended	Calcium	NELAP	PA	8/24/2005
EPA 6020-Extended	Cesium	NELAP	PA	4/18/2006
EPA 6020-Extended	Iron	NELAP	PA	8/24/2005
EPA 6020-Extended	Magnesium	NELAP	PA	8/24/2005
EPA 6020-Extended	Molybdenum	NELAP	PA	4/7/2005

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 6020-Extended	Potassium	NELAP	PA	8/24/2005
EPA 6020-Extended	Selenium	NELAP	PA	4/7/2005
EPA 6020-Extended	Silica, as SiO2	NELAP	PA	4/18/2006
EPA 6020-Extended	Silicon	NELAP	PA	6/3/2010
EPA 6020-Extended	Sodium	NELAP	PA	8/24/2005
EPA 6020-Extended	Strontium	NELAP	PA	4/7/2005
EPA 6020-Extended	Tin	NELAP	PA	8/24/2005
EPA 6020-Extended	Titanium	NELAP	PA	8/24/2005
EPA 6020-Extended	Vanadium	NELAP	PA	4/7/2005
EPA 6020A	Metals by ICP/MS	NELAP	PA	4/9/2009
EPA 6800	Chromium VI	NELAP	PA	11/8/2007
EPA 7196A	Chromium VI	NELAP	PA	4/7/2005
EPA 7470A	Mercury	NELAP	PA	8/26/2006
EPA 7471A	Mercury	NELAP	PA	4/7/2005
EPA 7471B	Mercury	NELAP	PA	4/9/2009
EPA 8015	Ethylene glycol	NELAP	PA	4/20/2011
EPA 8015B	Nonhalogenated organics by GC/FID	NELAP	PA	3/7/2012
EPA 8015C	Nonhalogenated organics by GC/FID	NELAP	PA	3/7/2012
EPA 8081	4,4'-DDD	NELAP	PA	4/7/2005
EPA 8081	4,4'-DDE	NELAP	PA	4/7/2005
EPA 8081	4,4'-DDT	NELAP	PA	4/7/2005
EPA 8081	Aldrin (HHDN)	NELAP	PA	4/7/2005
EPA 8081	Chlordane (tech.)	NELAP	PA	4/7/2005
EPA 8081	Chlorobenzilate	NELAP	PA	8/26/2006
EPA 8081	Diallate (cis or trans)	NELAP	PA	8/26/2006
EPA 8081	Dieldrin	NELAP	PA	4/7/2005
EPA 8081	Endosulfan I	NELAP	PA	4/7/2005
EPA 8081	Endosulfan II	NELAP	PA	4/7/2005
EPA 8081	Endosulfan sulfate	NELAP	PA	4/7/2005
EPA 8081	Endrin	NELAP	PA	4/7/2005
EPA 8081	Endrin aldehyde	NELAP	PA	4/7/2005
EPA 8081	Endrin ketone	NELAP	PA	4/7/2005
EPA 8081	Heptachlor	NELAP	PA	4/7/2005
EPA 8081	Heptachlor epoxide	NELAP	PA	4/7/2005
EPA 8081	Hexachlorobenzene	NELAP	PA	5/12/2011
EPA 8081	Hexachlorocyclopentadiene	NELAP	PA	8/26/2006

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8081	Isodrin	NELAP	PA	8/24/2005
EPA 8081	Methoxychlor	NELAP	PA	4/7/2005
EPA 8081	Mirex	NELAP	PA	8/24/2005
EPA 8081	Toxaphene (Chlorinated camphene)	NELAP	PA	4/7/2005
EPA 8081	alpha-BHC (alpha-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 8081	alpha-Chlordane	NELAP	PA	4/7/2005
EPA 8081	beta-BHC (beta-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 8081	delta-BHC (delta-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 8081	gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	NELAP	PA	4/7/2005
EPA 8081	gamma-Chlordane	NELAP	PA	4/7/2005
EPA 8081-Extended	2,4'-DDD	NELAP	PA	4/18/2006
EPA 8081-Extended	2,4'-DDE	NELAP	PA	4/18/2006
EPA 8081-Extended	2,4'-DDT	NELAP	PA	4/18/2006
EPA 8081-Extended	Chlorbenside	NELAP	PA	4/18/2006
EPA 8081-Extended	Dacthal (DCPA)	NELAP	PA	8/26/2006
EPA 8081-Extended	Oxychlordane	NELAP	PA	4/9/2009
EPA 8081-Extended	cis-Nonachlor	NELAP	PA	4/18/2006
EPA 8081-Extended	trans-Nonachlor	NELAP	PA	4/18/2006
EPA 8081A	Organochlorine pesticides by GC/ECD	NELAP	PA	4/8/2009
EPA 8081B	Organochlorine pesticides by GC/ECD	NELAP	PA	4/9/2009
EPA 8082	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	NELAP	PA	8/26/2006
EPA 8082	2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	NELAP	PA	8/26/2006
EPA 8082	2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	NELAP	PA	8/26/2006
EPA 8082	2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	NELAP	PA	8/26/2006
EPA 8082	2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	NELAP	PA	8/26/2006
EPA 8082	2,2',5-Trichlorobiphenyl (BZ 18)	NELAP	PA	8/26/2006
EPA 8082	2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	NELAP	PA	8/26/2006
EPA 8082	2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	NELAP	PA	8/26/2006
EPA 8082	2,4',5-Trichlorobiphenyl (BZ 31)	NELAP	PA	8/26/2006
EPA 8082	2-Chlorobiphenyl (BZ 1)	NELAP	PA	8/26/2006

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8082	Aroclor-1016 (PCB-1016)	NELAP	PA	11/8/2007
EPA 8082	Aroclor-1016 (in oil)	NELAP	PA	3/20/2012
EPA 8082	Aroclor-1221 (PCB-1221)	NELAP	PA	11/8/2007
EPA 8082	Aroclor-1221 (in oil)	NELAP	PA	3/20/2012
EPA 8082	Aroclor-1232 (PCB-1232)	NELAP	PA	11/8/2007
EPA 8082	Aroclor-1232 (in oil)	NELAP	PA	3/20/2012
EPA 8082	Aroclor-1242 (PCB-1242)	NELAP	PA	11/8/2007
EPA 8082	Aroclor-1242 (in oil)	NELAP	PA	3/20/2012
EPA 8082	Aroclor-1248 (PCB-1248)	NELAP	PA	11/8/2007
EPA 8082	Aroclor-1248 (in oil)	NELAP	PA	3/20/2012
EPA 8082	Aroclor-1254 (PCB-1254)	NELAP	PA	11/8/2007
EPA 8082	Aroclor-1254 (in oil)	NELAP	PA	3/20/2012
EPA 8082	Aroclor-1260 (PCB-1260)	NELAP	PA	11/8/2007
EPA 8082	Aroclor-1260 (in oil)	NELAP	PA	3/20/2012
EPA 8082	PCBs as congeners	NELAP	PA	8/26/2006
EPA 8082	PCBs by GC/ECD	NELAP	PA	4/9/2009
EPA 8082	Total Aroclors	NELAP	PA	4/9/2009
EPA 8082-Extended	2,2',3,3',4,4',5,5',6,6'-Decachlorobiphenyl (BZ 209)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	NELAP	PA	8/26/2006
EPA 8082-Extended	2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,4'-Dichlorobiphenyl (BZ 8)	NELAP	PA	4/13/2009
EPA 8082-Extended	2,4,4'-Trichlorobiphenyl (BZ 28)	NELAP	PA	4/13/2009
EPA 8082-Extended	3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	NELAP	PA	4/13/2009
EPA 8082-Extended	3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	NELAP	PA	4/13/2009
EPA 8082-Extended	3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	NELAP	PA	4/13/2009
EPA 8082-Extended	Aroclor-1262 (PCB-1262)	NELAP	PA	4/8/2008
EPA 8082-Extended	Aroclor-1268 (PCB-1268)	NELAP	PA	4/8/2008
EPA 8082A	PCBs by GC/ECD	NELAP	PA	4/9/2009
EPA 8141	Azinphos-methyl (Guthion)	NELAP	PA	4/7/2005
EPA 8141	Bolstar (Sulprofos)	NELAP	PA	4/18/2006
EPA 8141	Chlorpyrifos	NELAP	PA	8/24/2005

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8141	Coumaphos	NELAP	PA	8/24/2005
EPA 8141	Demeton	NELAP	PA	4/9/2009
EPA 8141	Demeton-O	NELAP	PA	4/7/2005
EPA 8141	Demeton-S	NELAP	PA	4/7/2005
EPA 8141	Diazinon (Spectracide)	NELAP	PA	4/7/2005
EPA 8141	Dichlorovos (DDVP, Dichlorvos)	NELAP	PA	8/24/2005
EPA 8141	Dimethoate	NELAP	PA	8/24/2005
EPA 8141	Disulfoton	NELAP	PA	4/7/2005
EPA 8141	EPN (Santox)	NELAP	PA	8/24/2005
EPA 8141	Ethoprop (Prophos)	NELAP	PA	8/24/2005
EPA 8141	Famphur	NELAP	PA	8/24/2005
EPA 8141	Fensulfothion	NELAP	PA	8/24/2005
EPA 8141	Fenthion	NELAP	PA	8/24/2005
EPA 8141	Malathion	NELAP	PA	4/7/2005
EPA 8141	Methyl parathion (Parathion, methyl)	NELAP	PA	4/7/2005
EPA 8141	Mevinphos	NELAP	PA	8/24/2005
EPA 8141	Parathion (Ethyl parathion)	NELAP	PA	4/7/2005
EPA 8141	Phorate (Thimet)	NELAP	PA	8/24/2005
EPA 8141	Ronnel	NELAP	PA	4/18/2006
EPA 8141	Stirophos (Tetrachlorovinphos)	NELAP	PA	4/18/2006
EPA 8141	Sulfotepp (Tetraethyl dithiopyrophosphate)	NELAP	PA	8/26/2006
EPA 8141	Thionazine (Thionazin, Zinophos)	NELAP	PA	4/18/2006
EPA 8141	Tokuthion (Prothiophos)	NELAP	PA	4/18/2006
EPA 8141	Trichloronate	NELAP	PA	4/18/2006
EPA 8141-Extended	O,O,O-Triethyl phosphorothioate	NELAP	PA	4/18/2006
EPA 8141-Extended	Triphenyl phosphate	NELAP	PA	4/18/2006
EPA 8141A	Organophosphorus compounds by GC/NPD	NELAP	PA	4/8/2009
EPA 8141B	Organophosphorus compounds by GC/NPD	NELAP	PA	4/9/2009
EPA 8151	2,4,5-T	NELAP	PA	4/7/2005
EPA 8151	2,4,5-TP (Silvex)	NELAP	PA	4/7/2005
EPA 8151	2,4-D	NELAP	PA	4/7/2005
EPA 8151	2,4-DB (Butoxon)	NELAP	PA	4/7/2005
EPA 8151	Dalapon (2,2-Dichloropropionic acid)	NELAP	PA	8/24/2005
EPA 8151	Dicamba	NELAP	PA	4/7/2005
EPA 8151	Dichloroprop (Dichlorprop)	NELAP	PA	4/7/2005
EPA 8151	MCPA	NELAP	PA	4/7/2005

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8151	MCPP (Mecoprop)	NELAP	PA	4/7/2005
EPA 8151	Pentachlorophenol (PCP)	NELAP	PA	4/7/2005
EPA 8151A	Chlorinated herbicides by GC/ECD	NELAP	PA	4/8/2009
EPA 8260	1,1,1,2-Tetrachloroethane	NELAP	PA	8/24/2005
EPA 8260	1,1,1-Trichloroethane	NELAP	PA	4/7/2005
EPA 8260	1,1,2,2-Tetrachloroethane	NELAP	PA	4/7/2005
EPA 8260	1,1,2-Trichloroethane	NELAP	PA	4/7/2005
EPA 8260	1,1-Dichloroethane	NELAP	PA	4/7/2005
EPA 8260	1,1-Dichloroethene (1,1-Dichloroethylene)	NELAP	PA	4/7/2005
EPA 8260	1,1-Dichloropropene	NELAP	PA	8/26/2006
EPA 8260	1,2,3-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8260	1,2,3-Trichloropropane (1,2,3-TCP)	NELAP	PA	4/7/2005
EPA 8260	1,2,4-Trichlorobenzene	NELAP	PA	4/7/2005
EPA 8260	1,2,4-Trimethylbenzene	NELAP	PA	8/26/2006
EPA 8260	1,2-Dibromo-3-chloropropane (DBCP, Dibromochloropropane)	NELAP	PA	8/24/2005
EPA 8260	1,2-Dibromoethane (EDB, Ethylene dibromide)	NELAP	PA	4/7/2005
EPA 8260	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8260	1,2-Dichloroethane	NELAP	PA	4/7/2005
EPA 8260	1,2-Dichloropropane	NELAP	PA	4/7/2005
EPA 8260	1,3,5-Trimethylbenzene	NELAP	PA	8/26/2006
EPA 8260	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8260	1,3-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8260	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	8/24/2005
EPA 8260	2,2-Dichloropropane	NELAP	PA	8/26/2006
EPA 8260	2-Butanone (Methyl ethyl ketone, MEK)	NELAP	PA	8/24/2005
EPA 8260	2-Chloroethyl vinyl ether	NELAP	PA	4/7/2005
EPA 8260	2-Chlorotoluene	NELAP	PA	4/7/2005
EPA 8260	2-Hexanone	NELAP	PA	8/24/2005
EPA 8260	2-Nitropropane	NELAP	PA	8/26/2006
EPA 8260	4-Chlorotoluene	NELAP	PA	4/7/2005
EPA 8260	4-Isopropyltoluene (p-Isopropyltoluene)	NELAP	PA	8/26/2006
EPA 8260	4-Methyl-2-pentanone (MIBK)	NELAP	PA	4/7/2005
EPA 8260	Acetone	NELAP	PA	4/7/2005
EPA 8260	Acetonitrile	NELAP	PA	4/7/2005
EPA 8260	Acrolein (Propenal)	NELAP	PA	4/7/2005

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Acrylonitrile	NELAP	PA	4/7/2005
EPA 8260	Allyl chloride (3-Chloropropene)	NELAP	PA	8/26/2006
EPA 8260	Benzene	NELAP	PA	4/7/2005
EPA 8260	Benzyl chloride	NELAP	PA	8/26/2006
EPA 8260	Bromobenzene	NELAP	PA	4/7/2005
EPA 8260	Bromochloromethane	NELAP	PA	8/24/2005
EPA 8260	Bromodichloromethane	NELAP	PA	4/7/2005
EPA 8260	Bromoform	NELAP	PA	4/7/2005
EPA 8260	Carbon disulfide	NELAP	PA	8/24/2005
EPA 8260	Carbon tetrachloride	NELAP	PA	4/7/2005
EPA 8260	Chlorobenzene	NELAP	PA	4/7/2005
EPA 8260	Chloroethane	NELAP	PA	4/7/2005
EPA 8260	Chloroform	NELAP	PA	4/7/2005
EPA 8260	Chloroprene (2-Chloro-1,3-butadiene)	NELAP	PA	8/26/2006
EPA 8260	Dibromochloromethane	NELAP	PA	4/7/2005
EPA 8260	Dibromofluoromethane	NELAP	PA	8/26/2006
EPA 8260	Dibromomethane	NELAP	PA	8/24/2005
EPA 8260	Dichlorodifluoromethane (Freon 12)	NELAP	PA	4/7/2005
EPA 8260	Diethyl ether (Ethyl ether)	NELAP	PA	8/26/2006
EPA 8260	Ethyl methacrylate	NELAP	PA	8/24/2005
EPA 8260	Ethylbenzene	NELAP	PA	4/7/2005
EPA 8260	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	8/24/2005
EPA 8260	Iodomethane (Methyl iodide)	NELAP	PA	8/26/2006
EPA 8260	Isobutyl alcohol (2-Methyl-1-propanol)	NELAP	PA	8/26/2006
EPA 8260	Isopropylbenzene (Cumene)	NELAP	PA	4/7/2005
EPA 8260	Methacrylonitrile	NELAP	PA	8/26/2006
EPA 8260	Methyl bromide (Bromomethane)	NELAP	PA	4/7/2005
EPA 8260	Methyl chloride (Chloromethane)	NELAP	PA	4/7/2005
EPA 8260	Methyl tert-butyl ether (MTBE)	NELAP	PA	4/7/2005
EPA 8260	Methylacrylate	NELAP	PA	8/26/2006
EPA 8260	Methylene chloride (Dichloromethane)	NELAP	PA	4/7/2005
EPA 8260	Methylmethacrylate	NELAP	PA	8/24/2005
EPA 8260	Naphthalene	NELAP	PA	4/7/2005
EPA 8260	Propionitrile (Ethyl cyanide)	NELAP	PA	8/24/2005
EPA 8260	Styrene	NELAP	PA	4/7/2005
EPA 8260	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	4/7/2005

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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260	Toluene	NELAP	PA	4/7/2005
EPA 8260	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	4/7/2005
EPA 8260	Trichlorofluoromethane (Freon 11)	NELAP	PA	4/7/2005
EPA 8260	Vinyl acetate	NELAP	PA	4/7/2005
EPA 8260	Vinyl chloride (Chloroethene)	NELAP	PA	4/7/2005
EPA 8260	Xylenes, total	NELAP	PA	4/7/2005
EPA 8260	cis-1,2-Dichloroethene	NELAP	PA	4/7/2005
EPA 8260	cis-1,3-Dichloropropene	NELAP	PA	4/7/2005
EPA 8260	m+p-Xylene	NELAP	PA	8/26/2006
EPA 8260	m-Xylene	NELAP	PA	4/9/2009
EPA 8260	n-Butylbenzene	NELAP	PA	4/7/2005
EPA 8260	n-Propylbenzene	NELAP	PA	4/7/2005
EPA 8260	o-Xylene	NELAP	PA	8/26/2006
EPA 8260	p-Xylene	NELAP	PA	4/9/2009
EPA 8260	sec-Butylbenzene	NELAP	PA	4/7/2005
EPA 8260	tert-Butyl alcohol (2-Methyl-2-propanol)	NELAP	PA	4/8/2008
EPA 8260	tert-Butylbenzene	NELAP	PA	4/7/2005
EPA 8260	trans-1,2-Dichloroethene	NELAP	PA	4/7/2005
EPA 8260	trans-1,3-Dichloropropene	NELAP	PA	4/7/2005
EPA 8260	trans-1,4-Dichloro-2-butene	NELAP	PA	4/7/2005
EPA 8260-Extended	1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	NELAP	PA	4/18/2006
EPA 8260-Extended	1,2-Dibromochloroethene (total)	NELAP	PA	4/18/2006
EPA 8260-Extended	1,2-Dichloroethene (total)	NELAP	PA	3/1/2007
EPA 8260-Extended	1,3,5-Trichlorobenzene	NELAP	PA	4/9/2009
EPA 8260-Extended	2,2,4-Trimethylpentane (Iso-octane)	NELAP	PA	12/5/2007
EPA 8260-Extended	2,3,6-Trichlorotoluene	NELAP	PA	4/9/2009
EPA 8260-Extended	2,3-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260-Extended	2,4,5-Trichlorotoluene	NELAP	PA	4/9/2009
EPA 8260-Extended	2,4-Dichlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260-Extended	2,4-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260-Extended	2,5-Dichlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260-Extended	2,5-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260-Extended	2,6-Dichlorotoluene	NELAP	PA	4/9/2009
EPA 8260-Extended	2-Chlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260-Extended	3,4-Dichlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260-Extended	3,4-Dichlorotoluene	NELAP	PA	4/9/2009

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8260-Extended	3-Chlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260-Extended	4-Chlorobenzotrifluoride	NELAP	PA	4/9/2009
EPA 8260-Extended	Cyclohexane	NELAP	PA	4/18/2006
EPA 8260-Extended	Dichloroethyl ether	NELAP	PA	4/9/2009
EPA 8260-Extended	Heptane	NELAP	PA	4/18/2006
EPA 8260-Extended	Hexane	NELAP	PA	12/5/2007
EPA 8260-Extended	Isopropyl alcohol (2-Propanol)	NELAP	PA	8/26/2006
EPA 8260-Extended	Methyl acetate	NELAP	PA	4/18/2006
EPA 8260-Extended	Methyl isobutyl ketone (MIBK, 4-Methyl-2-pentanone)	NELAP	PA	8/26/2006
EPA 8260-Extended	Methylcyclohexane	NELAP	PA	4/18/2006
EPA 8260-Extended	Tetrahydrofuran (THF)	NELAP	PA	4/22/2010
EPA 8260-Extended	Trichlorotrifluoroethane (Freon 113)	NELAP	PA	8/24/2005
EPA 8260-Extended	Vinyl bromide (Bromoethene)	NELAP	PA	12/5/2007
EPA 8260B	VOCs by GC/MS	NELAP	PA	4/8/2009
EPA 8270	1,2,4,5-Tetrachlorobenzene	NELAP	PA	4/7/2005
EPA 8270	1,2,4-Trichlorobenzene	NELAP	PA	4/7/2005
EPA 8270	1,2-Dichlorobenzene (o-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8270	1,2-Dinitrobenzene (1,2-DNB)	NELAP	PA	8/26/2006
EPA 8270	1,2-Diphenylhydrazine	NELAP	PA	4/18/2006
EPA 8270	1,3,5-Trinitrobenzene (1,3,5-TNB)	NELAP	PA	8/26/2006
EPA 8270	1,3-Dichlorobenzene (m-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8270	1,3-Dinitrobenzene (1,3-DNB)	NELAP	PA	8/26/2006
EPA 8270	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/7/2005
EPA 8270	1,4-Naphthoquinone	NELAP	PA	8/26/2006
EPA 8270	1,4-Phenylenediamine	NELAP	PA	8/26/2006
EPA 8270	1-Chloronaphthalene	NELAP	PA	8/26/2006
EPA 8270	1-Naphthylamine (alpha-Naphthylamine)	NELAP	PA	8/26/2006
EPA 8270	2,3,4,6-Tetrachlorophenol	NELAP	PA	8/24/2005
EPA 8270	2,4,5-Trichlorophenol	NELAP	PA	4/7/2005
EPA 8270	2,4,6-Trichlorophenol	NELAP	PA	4/7/2005
EPA 8270	2,4-Dichlorophenol	NELAP	PA	4/7/2005
EPA 8270	2,4-Dimethylphenol	NELAP	PA	4/7/2005
EPA 8270	2,4-Dinitrophenol	NELAP	PA	4/7/2005
EPA 8270	2,4-Dinitrotoluene (2,4-DNT)	NELAP	PA	4/7/2005
EPA 8270	2,6-Dichlorophenol	NELAP	PA	8/24/2005
EPA 8270	2,6-Dinitrotoluene (2,6-DNT)	NELAP	PA	4/7/2005

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	2-Acetylaminofluorene	NELAP	PA	8/26/2006
EPA 8270	2-Chloronaphthalene	NELAP	PA	10/13/2010
EPA 8270	2-Chlorophenol	NELAP	PA	4/7/2005
EPA 8270	2-Methyl-4,6-dinitrophenol (4,6-Dinitro-2-methylphenol)	NELAP	PA	4/7/2005
EPA 8270	2-Methylnaphthalene	NELAP	PA	4/7/2005
EPA 8270	2-Methylphenol (o-Cresol)	NELAP	PA	4/7/2005
EPA 8270	2-Naphthylamine (beta-Naphthylamine)	NELAP	PA	8/26/2006
EPA 8270	2-Nitroaniline	NELAP	PA	4/7/2005
EPA 8270	2-Nitrophenol	NELAP	PA	4/7/2005
EPA 8270	2-Picoline (2-Methylpyridine)	NELAP	PA	4/18/2006
EPA 8270	3,3'-Dichlorobenzidine	NELAP	PA	4/7/2005
EPA 8270	3,3'-Dimethylbenzidine	NELAP	PA	8/24/2005
EPA 8270	3-Methylphenol (m-Cresol)	NELAP	PA	4/7/2005
EPA 8270	3-Nitroaniline	NELAP	PA	4/7/2005
EPA 8270	4,4'-Methylenebis(2-chloroaniline)	NELAP	PA	8/24/2005
EPA 8270	4,4'-Methylenebis(N N-dimethylaniline)	NELAP	PA	8/26/2006
EPA 8270	4-Aminobiphenyl	NELAP	PA	8/26/2006
EPA 8270	4-Bromophenyl phenyl ether	NELAP	PA	4/7/2005
EPA 8270	4-Chloro-3-methylphenol	NELAP	PA	4/7/2005
EPA 8270	4-Chloroaniline	NELAP	PA	4/7/2005
EPA 8270	4-Chlorophenyl phenyl ether	NELAP	PA	4/7/2005
EPA 8270	4-Dimethylaminoazobenzene (Dimethylaminoazobenzene)	NELAP	PA	8/26/2006
EPA 8270	4-Methylphenol (p-Cresol)	NELAP	PA	4/7/2005
EPA 8270	4-Nitroaniline	NELAP	PA	4/7/2005
EPA 8270	4-Nitrobiphenyl	NELAP	PA	8/26/2006
EPA 8270	4-Nitrophenol	NELAP	PA	4/7/2005
EPA 8270	4-Nitroquinoline-1-oxide	NELAP	PA	4/18/2006
EPA 8270	5-Nitro-o-toluidine	NELAP	PA	8/26/2006
EPA 8270	7,12-Dimethylbenz(a)anthracene	NELAP	PA	8/26/2006
EPA 8270	Acenaphthene	NELAP	PA	4/7/2005
EPA 8270	Acenaphthylene	NELAP	PA	4/7/2005
EPA 8270	Acetophenone	NELAP	PA	8/26/2006
EPA 8270	Aminoazobenzene	NELAP	PA	8/26/2006
EPA 8270	Aniline	NELAP	PA	4/7/2005
EPA 8270	Anthracene	NELAP	PA	4/7/2005

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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Aramite	NELAP	PA	8/24/2005
EPA 8270	Azinphos-methyl (Guthion)	NELAP	PA	3/1/2007
EPA 8270	Benzidine	NELAP	PA	4/7/2005
EPA 8270	Benzo[a]anthracene	NELAP	PA	4/7/2005
EPA 8270	Benzo[a]pyrene	NELAP	PA	4/7/2005
EPA 8270	Benzo[b]fluoranthene	NELAP	PA	4/7/2005
EPA 8270	Benzo[ghi]perylene	NELAP	PA	4/7/2005
EPA 8270	Benzo[k]fluoranthene	NELAP	PA	4/7/2005
EPA 8270	Benzoic acid	NELAP	PA	4/7/2005
EPA 8270	Benzyl alcohol	NELAP	PA	8/24/2005
EPA 8270	Butyl benzyl phthalate (Benzyl butyl phthalate)	NELAP	PA	4/7/2005
EPA 8270	Carbaryl (Sevin)	NELAP	PA	12/5/2007
EPA 8270	Carbazole	NELAP	PA	4/7/2005
EPA 8270	Chlorobenzilate	NELAP	PA	8/24/2005
EPA 8270	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	4/7/2005
EPA 8270	Cresols (total)	NELAP	PA	4/18/2006
EPA 8270	Di-n-butyl phthalate	NELAP	PA	4/7/2005
EPA 8270	Di-n-octyl phthalate	NELAP	PA	4/7/2005
EPA 8270	Diallate (cis or trans)	NELAP	PA	4/18/2006
EPA 8270	Dibenzo[a,h]anthracene	NELAP	PA	4/7/2005
EPA 8270	Dibenzofuran	NELAP	PA	4/7/2005
EPA 8270	Diethyl phthalate	NELAP	PA	4/7/2005
EPA 8270	Dimethoate	NELAP	PA	8/26/2006
EPA 8270	Dimethyl phthalate	NELAP	PA	4/7/2005
EPA 8270	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	NELAP	PA	8/26/2006
EPA 8270	Dioxathion	NELAP	PA	8/26/2006
EPA 8270	Disulfoton	NELAP	PA	8/26/2006
EPA 8270	Ethyl methanesulfonate	NELAP	PA	8/26/2006
EPA 8270	Famphur	NELAP	PA	8/26/2006
EPA 8270	Fluoranthene	NELAP	PA	4/7/2005
EPA 8270	Fluorene	NELAP	PA	4/7/2005
EPA 8270	Hexachlorobenzene	NELAP	PA	4/7/2005
EPA 8270	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/7/2005
EPA 8270	Hexachlorocyclopentadiene	NELAP	PA	4/7/2005
EPA 8270	Hexachloroethane	NELAP	PA	4/7/2005
EPA 8270	Hexachlorophene	NELAP	PA	8/26/2006

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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Hexachloropropene	NELAP	PA	8/24/2005
EPA 8270	Indeno(1,2,3-cd)pyrene	NELAP	PA	4/7/2005
EPA 8270	Isodrin	NELAP	PA	8/26/2006
EPA 8270	Isophorone	NELAP	PA	4/7/2005
EPA 8270	Isosafrole	NELAP	PA	8/26/2006
EPA 8270	Kepone	NELAP	PA	4/18/2006
EPA 8270	Malathion	NELAP	PA	3/1/2007
EPA 8270	Methapyrilene	NELAP	PA	12/5/2007
EPA 8270	Methyl methanesulfonate	NELAP	PA	8/26/2006
EPA 8270	Methyl parathion (Parathion, methyl)	NELAP	PA	8/24/2005
EPA 8270	N-Nitrosodi-n-butylamine	NELAP	PA	8/24/2005
EPA 8270	N-Nitrosodi-n-propylamine	NELAP	PA	4/7/2005
EPA 8270	N-Nitrosodiethylamine	NELAP	PA	4/7/2005
EPA 8270	N-Nitrosodimethylamine	NELAP	PA	4/7/2005
EPA 8270	N-Nitrosodiphenylamine	NELAP	PA	4/7/2005
EPA 8270	N-Nitrosomethylethylamine	NELAP	PA	8/24/2005
EPA 8270	N-Nitrosomorpholine	NELAP	PA	8/26/2006
EPA 8270	N-Nitrosopiperidine	NELAP	PA	8/26/2006
EPA 8270	N-Nitrosopyrrolidine	NELAP	PA	4/7/2005
EPA 8270	Naphthalene	NELAP	PA	4/7/2005
EPA 8270	Nitrobenzene	NELAP	PA	4/7/2005
EPA 8270	Nitroquinoline-1-oxide	NELAP	PA	8/26/2006
EPA 8270	O,O,O-Triethyl phosphorothioate	NELAP	PA	8/26/2006
EPA 8270	Parathion, ethyl (Ethyl parathion, Parathion)	NELAP	PA	8/24/2005
EPA 8270	Pentachlorobenzene	NELAP	PA	8/24/2005
EPA 8270	Pentachloronitrobenzene (PCNB)	NELAP	PA	8/24/2005
EPA 8270	Pentachlorophenol (PCP)	NELAP	PA	4/7/2005
EPA 8270	Phenacetin	NELAP	PA	8/26/2006
EPA 8270	Phenanthrene	NELAP	PA	4/7/2005
EPA 8270	Phenol	NELAP	PA	4/7/2005
EPA 8270	Phorate (Thimet)	NELAP	PA	8/26/2006
EPA 8270	Pronamide (Kerb)	NELAP	PA	8/24/2005
EPA 8270	Pyrene	NELAP	PA	4/7/2005
EPA 8270	Pyridine	NELAP	PA	4/18/2006
EPA 8270	Safrole	NELAP	PA	8/26/2006
EPA 8270	Sulfotepp (Tetraethyl dithiopyrophosphate)	NELAP	PA	8/26/2006

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TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
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Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270	Thionazine (Thionazin, Zinophos)	NELAP	PA	8/26/2006
EPA 8270	a,a-Dimethylphenethylamine (Phentermine)	NELAP	PA	8/24/2005
EPA 8270	bis(2-Chloroethoxy)methane	NELAP	PA	4/7/2005
EPA 8270	bis(2-Chloroethyl) ether	NELAP	PA	4/7/2005
EPA 8270	bis(2-Chloroisopropyl) ether	NELAP	PA	4/7/2005
EPA 8270	bis(2-Ethylhexyl) phthalate (DEHP)	NELAP	PA	4/7/2005
EPA 8270	o-Toluidine (2-Toluidine, 2-Methylaniline)	NELAP	PA	8/24/2005
EPA 8270 SIM	2,4-Dichlorophenol	NELAP	PA	4/8/2008
EPA 8270 SIM	2-Chloronaphthalene	NELAP	PA	10/13/2010
EPA 8270 SIM	2-Methylnaphthalene	NELAP	PA	4/8/2008
EPA 8270 SIM	3,3'-Dichlorobenzidine	NELAP	PA	4/8/2008
EPA 8270 SIM	Acenaphthene	NELAP	PA	4/8/2008
EPA 8270 SIM	Acenaphthylene	NELAP	PA	4/8/2008
EPA 8270 SIM	Anthracene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[a]anthracene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[a]pyrene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[b]fluoranthene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[ghi]perylene	NELAP	PA	4/8/2008
EPA 8270 SIM	Benzo[k]fluoranthene	NELAP	PA	4/8/2008
EPA 8270 SIM	Carbazole	NELAP	PA	4/8/2008
EPA 8270 SIM	Chrysene (Benzo[a]phenanthrene)	NELAP	PA	4/8/2008
EPA 8270 SIM	Dibenzo[a,h]anthracene	NELAP	PA	4/8/2008
EPA 8270 SIM	Fluoranthene	NELAP	PA	4/8/2008
EPA 8270 SIM	Fluorene	NELAP	PA	4/8/2008
EPA 8270 SIM	Hexachlorobenzene	NELAP	PA	4/8/2008
EPA 8270 SIM	Hexachlorobutadiene (1,3-Hexachlorobutadiene)	NELAP	PA	4/8/2008
EPA 8270 SIM	Indeno(1,2,3-cd)pyrene	NELAP	PA	4/8/2008
EPA 8270 SIM	N-Nitrosodi-n-propylamine	NELAP	PA	4/8/2008
EPA 8270 SIM	Naphthalene	NELAP	PA	4/8/2008
EPA 8270 SIM	Pentachlorophenol (PCP)	NELAP	PA	4/8/2008
EPA 8270 SIM	Phenanthrene	NELAP	PA	4/8/2008
EPA 8270 SIM	Phenol	NELAP	PA	4/8/2008
EPA 8270 SIM	Pyrene	NELAP	PA	4/8/2008
EPA 8270 SIM	bis(2-Chloroethyl) ether	NELAP	PA	4/8/2008
EPA 8270 SIM	bis(2-Chloroisopropyl) ether	NELAP	PA	4/8/2008
EPA 8270 SIM-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	4/9/2009

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State Laboratory ID: 2-00416 **EPA Lab Code: PA00164** **(412) 963-7058**

TestAmerica Laboratories Inc dba TestAmerica Pittsburgh
301 Alpha Drive
Pittsburgh, PA 15238

Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270 SIM-Extended	1-Methylnaphthalene	NELAP	PA	4/8/2008
EPA 8270 SIM-Extended	2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	4/9/2009
EPA 8270-Extended	1,1'-Biphenyl (Biphenyl, Lemonene)	NELAP	PA	4/18/2006
EPA 8270-Extended	1,2,3,4-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270-Extended	1,2,3,5-Tetrachlorobenzene	NELAP	PA	8/26/2006
EPA 8270-Extended	1,3,5-Trichlorobenzene	NELAP	PA	8/26/2006
EPA 8270-Extended	1,4-Dioxane (1,4-Diethyleneoxide)	NELAP	PA	8/24/2005
EPA 8270-Extended	1,4-Phenylenediamine	NELAP	PA	12/5/2007
EPA 8270-Extended	1-Methylnaphthalene	NELAP	PA	4/9/2009
EPA 8270-Extended	2,2'-Oxybis(1-chloropropane) (bis(2-Chloro-1-methylethyl) ether)	NELAP	PA	4/18/2006
EPA 8270-Extended	2,3,5,6-Tetrachlorophenol	NELAP	PA	8/26/2006
EPA 8270-Extended	2,3,7,8-TCDD (Dioxin) (screen)	NELAP	PA	8/26/2006
EPA 8270-Extended	2,3-Dichlorophenol (Dichlorophenol)	NELAP	PA	12/5/2007
EPA 8270-Extended	2,4,6-Tribromophenol	NELAP	PA	4/9/2009
EPA 8270-Extended	2,5-Dichlorophenol	NELAP	PA	12/5/2007
EPA 8270-Extended	2-Phenylphenol	NELAP	PA	4/9/2009
EPA 8270-Extended	3-Methylcholanthrene	NELAP	PA	8/26/2006
EPA 8270-Extended	4-Chlorophenol	NELAP	PA	8/26/2006
EPA 8270-Extended	4-Nitrotoluene	NELAP	PA	8/26/2006
EPA 8270-Extended	6-Methylchrysene	NELAP	PA	12/5/2007
EPA 8270-Extended	Atrazine	NELAP	PA	4/18/2006
EPA 8270-Extended	Benzaldehyde	NELAP	PA	8/26/2006
EPA 8270-Extended	Caprolactam	NELAP	PA	4/18/2006
EPA 8270-Extended	Dibenz[a,h]acridine	NELAP	PA	12/5/2007
EPA 8270-Extended	Indene	NELAP	PA	4/9/2009
EPA 8270-Extended	Octachlorocyclopentene (Perchlorocyclopentene)	NELAP	PA	12/5/2007
EPA 8270-Extended	Octachlorostyrene	NELAP	PA	12/5/2007
EPA 8270-Extended	Pentachloroethane	NELAP	PA	8/26/2006
EPA 8270-Extended	bis(2-Hydroxyphenyl) methane (2,2'-Methylenediphenol)	NELAP	PA	12/5/2007
EPA 8270-Extended	bis(4-Hydroxyphenyl) methane	NELAP	PA	12/5/2007
EPA 8270-Extended	n-Octadecane	NELAP	PA	4/9/2009
EPA 8270-Extended	p-(Dimethylamino)azobenzene	NELAP	PA	4/9/2009
EPA 8270-Extended	p-Chlorobenzilate (Ethyl 4,4'-dichlorobenzilate)	NELAP	PA	12/5/2007
EPA 8270-Extended	p-Phenylenediamine	NELAP	PA	4/9/2009
EPA 8270C	SOCs by GC/MS	NELAP	PA	4/8/2009

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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
EPA 8270D	SOCs by GC/MS	NELAP	PA	4/9/2009
EPA 9010	Total cyanide	NELAP	PA	12/14/2012
EPA 9013	Cyanide extraction for solids and oils	NELAP	PA	12/5/2007
EPA 9013A	Cyanide extraction for solids and oils	NELAP	PA	4/22/2010
EPA 9014	Total cyanide	NELAP	PA	12/14/2012
EPA 9030B	Sulfide	NELAP	PA	4/7/2005
EPA 9034	Sulfide	NELAP	PA	4/7/2005
EPA 9040B	Corrosivity (pH)	NELAP	PA	4/18/2006
EPA 9040B	pH	NELAP	PA	4/7/2005
EPA 9040C	Corrosivity (pH)	NELAP	PA	9/5/2012
EPA 9040C	pH	NELAP	PA	4/9/2009
EPA 9045C	pH	NELAP	PA	4/7/2005
EPA 9045D	pH	NELAP	PA	4/9/2009
EPA 9056	Bromide	NELAP	PA	8/26/2006
EPA 9056	Chloride	NELAP	PA	4/7/2005
EPA 9056	Fluoride	NELAP	PA	4/7/2005
EPA 9056	Nitrate as N	NELAP	PA	4/7/2005
EPA 9056	Nitrite as N	NELAP	PA	4/7/2005
EPA 9056	Orthophosphate as P	NELAP	PA	1/26/2009
EPA 9056	Sulfate	NELAP	PA	4/7/2005
EPA 9056	Total nitrate-nitrite	NELAP	PA	8/26/2006
EPA 9056A	Anions by IC	NELAP	PA	4/9/2009
EPA 9065	Total phenolics	NELAP	PA	12/5/2007
EPA 9071	Oil and grease	NELAP	PA	12/5/2007
EPA 9071B	Oil and grease	NELAP	PA	4/9/2009
EPA 9077	Total chlorine	NELAP	PA	4/9/2009
EPA 9095A	Paint filter liquids test	NELAP	PA	4/4/2007
EPA 9095B	Paint filter liquids test	NELAP	PA	4/9/2009
EPA AVS and SEM Procedure	Acid volatile sulfide (AVS)	NELAP	PA	5/4/2009
EPA AVS and SEM Procedure	Cadmium	NELAP	PA	5/4/2009
EPA AVS and SEM Procedure	Copper	NELAP	PA	5/4/2009
EPA AVS and SEM Procedure	Lead	NELAP	PA	5/4/2009
EPA AVS and SEM Procedure	Mercury	NELAP	PA	5/4/2009
EPA AVS and SEM Procedure	Nickel	NELAP	PA	5/4/2009
EPA AVS and SEM Procedure	Zinc	NELAP	PA	5/4/2009
EPA Lloyd Kahn Method	Total organic carbon (TOC)	NELAP	PA	9/27/2007

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Program Solid and Chemical Materials

Method	Analyte	Accreditation Type	Primary	Effective Date
OIA 1677	Available cyanide	NELAP	PA	4/18/2006
SM 2520 B	Salinity	NELAP	PA	4/8/2008
SM 2540 B	Residue, total	NELAP	PA	4/8/2008
SM 2540 G	Percent moisture in soil	NELAP	PA	4/13/2009
SM 2540 G	Residue, total	NELAP	PA	12/5/2007
SOP (00416) GC-001	1,1,1-Trichloroethane	NELAP	PA	4/13/2009
SOP (00416) GC-001	1,4-Dichlorobenzene (p-Dichlorobenzene)	NELAP	PA	4/13/2009
SOP (00416) GC-001	4-Bromochlorobenzene	NELAP	PA	4/13/2009
SOP (00416) GC-001	Methanol	NELAP	PA	4/13/2009
SOP (00416) GC-001	Methylene chloride (Dichloromethane)	NELAP	PA	4/13/2009
SOP (00416) GC-001	Tetrachloroethene (PCE, Perchloroethylene)	NELAP	PA	4/13/2009
SOP (00416) GC-001	Trichloroethene (TCE, Trichloroethylene)	NELAP	PA	4/13/2009
SOP (00416) GC-001	Triethylamine	NELAP	PA	4/13/2009
SOP (00416) OP-011	Percent lipids	NELAP	PA	4/13/2009
SOP (00416) WC-033	Water leach	NELAP	PA	9/5/2012
Walkley Black	Total organic carbon (TOC)	NELAP	PA	4/8/2008

Laboratory Status Summary

Organization

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Solid and Chemical Materials Certification

Method Code	Method Ref	Analyte	Status	Date Effective	Type	AA
238	EPA 8310-Extended	1-Methylnaphthalene	Withdrawn	11/29/2012	NELAP	PA
238	EPA 8310-Extended	2-Methylnaphthalene	Withdrawn	11/29/2012	NELAP	PA
238	EPA 8310-Extended	Carbazole	Withdrawn	11/29/2012	NELAP	PA
238	EPA 8310-Extended	Resorcinol (1,3-Dihydroxybenzene)	Withdrawn	11/29/2012	NELAP	PA
10183003	EPA 8151	Dinoseb (2-sec-Butyl-4,6-dinitrophenol, DNBP)	Suspended	12/10/2012	NELAP	PA
10187607	EPA 8310	Acenaphthene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Acenaphthylene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Anthracene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[a]anthracene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[a]pyrene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[b]fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[ghi]perylene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[k]fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Chrysene (Benzo[a]phenanthrene)	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Dibenzo[a,h]anthracene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Fluorene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Indeno(1,2,3-cd)pyrene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Naphthalene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Phenanthrene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Pyrene	Withdrawn	11/29/2012	NELAP	PA

Non-Potable Water Certification

Method Code	Method Ref	Analyte	Status	Date Effective	Type	AA
238	EPA 8310-Extended	1-Methylnaphthalene	Withdrawn	11/29/2012	NELAP	PA
238	EPA 8310-Extended	2-Methylnaphthalene	Withdrawn	11/29/2012	NELAP	PA
238	EPA 8310-Extended	Carbazole	Withdrawn	11/29/2012	NELAP	PA

Laboratory Status Summary

Organization

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Pittsburgh, PA 15238

Non-Potable Water Certification

Method Code	Method Ref	Analyte	Status	Date Effective	Type	AA
238	EPA 8310-Extended	Resorcinol (1,3-Dihydroxybenzene)	Withdrawn	11/29/2012	NELAP	PA
436	EPA 610-Extended	1-Methylnaphthalene	Withdrawn	11/29/2012	NELAP	PA
436	EPA 610-Extended	2-Methylnaphthalene	Withdrawn	11/29/2012	NELAP	PA
436	EPA 610-Extended	Carbazole	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Acenaphthene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Acenaphthylene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Anthracene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Benzo[a]anthracene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Benzo[a]pyrene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Benzo[b]fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Benzo[ghi]perylene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Benzo[k]fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Chrysene (Benzo[a]phenanthrene)	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Dibenzo[a,h]anthracene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Fluorene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Indeno(1,2,3-cd)pyrene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Naphthalene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Phenanthrene	Withdrawn	11/29/2012	NELAP	PA
10104402	EPA 610	Pyrene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Acenaphthene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Acenaphthylene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Anthracene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[a]anthracene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[a]pyrene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[b]fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Benzo[ghi]perylene	Withdrawn	11/29/2012	NELAP	PA

Laboratory Status Summary

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Non-Potable Water Certification

Method Code	Method Ref	Analyte	Status	Date Effective	Type	AA
10187607	EPA 8310	Benzo[k]fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Chrysene (Benzo[a]phenanthrene)	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Dibenzo[a,h]anthracene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Fluoranthene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Fluorene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Indeno(1,2,3-cd)pyrene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Naphthalene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Phenanthrene	Withdrawn	11/29/2012	NELAP	PA
10187607	EPA 8310	Pyrene	Withdrawn	11/29/2012	NELAP	PA