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Final
Quality Assurance Project Plan
for
Pre-Design Investigation Sediment Sampling
at
Site 13 – Defense Property Disposal Office Yard

Naval Weapons Station Earle
Colts Neck, New Jersey

Engineering Field Activity Northeast
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0851

February 2005

TETRA TECH NUS, INC.

REVISION 3
FEBRUARY 2005

QUALITY ASSURANCE PROJECT PLAN
FOR
PRE-DESIGN INVESTIGATION
SEDIMENT SAMPLING
AT
SITE 13 – DEFENSE PROPERTY DISPOSAL OFFICE YARD

NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
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Naval Facilities Engineering Command
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LIST OF ACRONYMS AND ABBREVIATIONS

%R	Percent recovery
µg/kg	micrograms per kilogram
bgs	below ground surface
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
COC	chain of custody
CTO	Contract Task Order
CVAA	cold vapor atomic absorption
DPDO	Defense Property Disposal Office
DQO	data quality objectives
ER-M	effects range-medium
ESQD	explosive safety quantity distance
FOL	Field Operations Leader
FS	Feasibility Study
FTMR	Field Task Modification Request
GC	gas chromatograph
HASP	Health and Safety Plan
HSM	Health and Safety Manager
ICP	inductively coupled plasma
IDL	instrument detection limit
IDW	investigation-derived waste
IR	Installation Restoration
LCS	laboratory control sample
mg/kg	milligram per kilogram
MS/MSD	matrix spike / matrix spike duplicate
msl	mean sea level
NFSEC	Naval Facilities Engineering Service Center
NIST	National Institute of Standards and Technology
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NWS	Naval Weapons Station
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response

PARCC	precision, accuracy, representativeness, comparability, and completeness
PCB	polychlorinated biphenyl
PDF	printable data format
PM	Project Manager
PPE	personal protection equipment
PQL	practical quantitation limit
QA	quality assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
RDL	required detection limit
RI	Remedial Investigation
ROD	Record of Decision
RPD	relative percent difference
RPM	Remedial Project Manager
RQL	required quantitation limit
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SSO	Site Safety Officer
SVOC	semivolatile organic compound
TAL	Target Analyte List
TCL	Target Compound List
TtNUS	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
WP	Work Plan

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by Tetra Tech NUS (TtNUS) on behalf of the United States Navy Engineering Field Activity Northeast and the Naval Weapons Station (NWS) Earle, Colts Neck, New Jersey under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62467-94-D-0888, Contract Task Order (CTO) 0851. This QAPP includes sections that constitute the Work Plan and Sampling and Analysis Plan (WP/SAP). The QAPP and Health and Safety Plan (HASP) together constitute the project planning documents for the Pre-Design Investigation sediment sampling to be performed at the Defense Property Disposal Office (DPDO) Yard (Site 13) NWS Earle. Other pre-design field actions including test trenching, collection of geotechnical data, wetland delineation, and surveying were described in a separate letter work plan that did not require regulatory review. This sediment investigation will be used to delineate the extent of sediment contamination requiring excavation.

This QAPP presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures for the site investigation. Specific protocols for sampling, sample handling and storage, chain of custody (COC), and laboratory and field analyses are described within this document. All QA/QC procedures are structured in accordance with applicable technical standards, the Naval Facilities Engineering Service Center (NFESC) guidance document Navy Installation Restoration Laboratory Quality Assurance Guide (1996), and United States Environmental Protection Agency (USEPA) Region II and New Jersey Department of Environmental Protection (NJDEP) requirements, regulations, guidance, and technical standards.

1.2 FACILITY DESCRIPTION

NWS Earle is located in Monmouth County in east-central New Jersey (see Figure 1-1). It is situated on approximately 11,134 acres and includes a Mainside area, which is approximately 10 miles inland from the Atlantic Ocean at Sandy Hook Bay, and a Waterfront area, which includes an ammunition depot and associated piers. The Mainside and Waterfront areas are linked by a narrow tract of land that serves as a right-of-way for a government road and railroad. Site 13 is located in the Mainside area.

The main entrance to NWS Earle is located off State Route 34, and the entrance to the Waterfront area is located adjacent to State Route 36.

Land use at the Mainside area includes residences, office buildings, workshops and warehouses, recreational areas, open space, and undeveloped land. The majority of the land at the Mainside area is undeveloped and is associated with ordnance operations, production, and storage facilities; the undeveloped land is encumbered by explosive safety quantity distance (ESQD) arcs. The area around the Mainside portion of the Facility includes agricultural areas, vacant land, and low-density residential land.

1.3 SITE DESCRIPTION

This section summarizes pertinent surface features, geology, and hydrogeology information for NWS Earle and Site 13. This information was obtained from the Feasibility Study (FS) for Site 13 at NWS Earle (TtNUS, 2000). Figure 1-2 shows the Mainside area Installation Restoration (IR) program sites, including Site 13.

NWS Earle is located in the coastal lowlands of Monmouth County, New Jersey within the Atlantic Coastal Plain Physiographic Province. The Mainside area, which includes Site 13, lies in the outer Coastal Plain approximately 10 miles inland from the Atlantic Ocean. The Mainside area is relatively flat, with elevations ranging from approximately 100 to 300 feet above mean sea level (msl). The most significant topographic relief within the Mainside area is Hominy Hills, a northeast-southwest-trending group of low hills located near the center of NWS Earle.

Site 13 is located at least partially within ESQD arcs; therefore, future development at this site is severely restricted.

Site 13 is an area of fill material extending into a marsh near the rail classification yards (Figure 1-3). Site 13 is located in the northern end of the DPDO Yard and extends past the fence which surrounds the DPDO Yard. Activities at the site included storage of scrap metals and batteries and the burial of material such as cars, trucks, electronic equipment, clothing/shoes, sheet metal, furniture, scrap metal, and batteries. Additionally, batteries were broken open at the site for lead recovery, and acid was drained onto the ground. Because the primary function of this site was scrap metal storage, unexploded ordnance (UXO) is not expected to be present in the fill material; however, ordinance "shapes" have been encountered at this site during previous intrusive activities. Obvious fill material is present at the ground surface at several places across the site. A partial removal of exposed debris was performed by NWS Earle public works employees in the summer of 1997.

Hydrology

The rivers and streams draining NWS Earle ultimately discharge to the Atlantic Ocean, which is located approximately 10 miles east of the Mainside area. The headwaters and drainage basins of three major Coastal Plain rivers (Swimming, Manasquan, and Shark) originate on the Mainside area. The northern half of the Mainside is in the drainage basin of the Swimming River, and tributaries include Mine Brook, Hockhockson Brook, and Pine Brook. The southwestern portion of the Mainside area drains to the Manasquan River via either Marsh Bog Brook or Mingamahone Brook. The southeastern corner of the Mainside area drains to the Shark River. Both the Swimming River and the Shark River supply reservoirs used for public water supplies.

Runoff from the site drains north to the marsh and west to a perennial drainage channel that flows to Hockhockson Brook. A fence surrounds the DPDO Yard but is not located at the edge of the landfill. The extent of fill material was not clearly defined to the east by previous investigations. The toe of the landfill extends north of the DPDO yard fence into the marsh area and is clearly defined by an abrupt decrease in elevation of several feet between the top of the landfill slope and the marsh. Based on the site topography, it is thought that the depth of waste is less than 10 feet below ground surface.

G ology

NWS Earle is situated in the Coastal Plain Physiographic Province of New Jersey. The New Jersey Coastal Plain is a seaward-dipping wedge of unconsolidated Cretaceous to Quaternary sediments deposited on a pre-Cretaceous basement-bedrock complex. The Coastal Plain sediments are primarily composed of clay, silt, sand, and gravel and were deposited in continental, coastal, and marine environments. The sediments generally strike northeast-southwest and dip to the southeast at a rate of 10 to 60 feet per mile. The approximate thickness of these sediments beneath NWS Earle is 900 feet. The pre-Cretaceous complex consists mainly of Pre-Cambrian and lower Paleozoic crystalline rocks and metamorphic schists and gneisses. The Cretaceous to Miocene Coastal Plain Formations are either exposed at the surface or subcrop in a banded pattern that roughly parallels the shoreline. The outcrop pattern is caused by the erosional truncation of the dipping sedimentary wedge. Where these formations are not exposed, they are covered by essentially flat-lying Post-Miocene surficial deposits.

Regional mapping places Site 13 within the outcrop area of the Vincentown Formation, which ranges between 10 and 130 feet in thickness in the NWS Earle area. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the Vincentown Formation. In general, the borings encountered alternating beds of yellowish-brown to brown, micaceous, silty, fine- to medium-grained sand and olive, glauconitic, silty sand and sand.

Hydrogeology

Groundwater classification areas are defined under NJDEP Water Technical Programs Groundwater Quality Standards in New Jersey Administrative Code (NJAC) 7:9-6. The Mainside area is located in the Class II-A, Groundwater Supporting Potable Water Supply, area. Class II-A includes those areas where groundwater is an existing source of potable water with conventional water supply treatment or is a potential source of potable water. In the Mainside area, in general, the deeper aquifers are used for public water supplies, and the shallower aquifers are used for domestic supplies.

Groundwater in the Vincentown aquifer beneath Site 13 occurs under unconfined conditions and is encountered at approximately 3 to 11 feet below ground surface (bgs). The direction of shallow groundwater flow in the aquifer under Site 13 is north-northwest. There does not appear to be a significant seasonal variation in groundwater flow direction. The hydraulic conductivity calculated for monitoring well MW13-04 is 2.64×10^{-5} centimeters per second (0.75 feet per day).

Nature and Extent of Contamination

The following discussion of nature and extent of contamination is excerpted from the proposed plan for Site 13 (TtNUS, 2002). Additional information can be found in the RI (B&R Environmental, 1998) and the FS (TtNUS, 2000). During the Site Inspection, six soil, three sediment, and three surface water samples were collected from Site 13. Surface water samples were analyzed for SVOCs, PCBs, pesticides, metals and cyanide. Elevated levels of several metals were present in surface water samples. No SVOCs, pesticides, or PCBs were detected in surface water. Low levels of metals, pesticides, PCBs, and SVOCs were detected in soil samples. Elevated levels of two semivolatiles were also detected in soil. Sediment samples were analyzed for SVOCs, pesticides, and PCBs. Low levels of pesticides, PCBs, and SVOCs were detected in sediments.

The Phase II Remedial Investigation (RI) at Site 13 included the installation and sampling of monitoring wells, the collection of soil, surface water, and sediment samples, and the excavation of test pits to observe wastes and sample subsurface soil. A wide variety of metals and volatile, semivolatile, and pesticide compounds were detected in Site 13 groundwater. PCBs, metals, semivolatiles, and pesticides were found in sediment, and limited metals were detected in surface water.

Site Status

The Proposed Plan for Site 13 was issued in December 2002 (TtNUS, 2002) and presented the preferred remedial alternative for Site 13 and summarized the information that led to the selection of the preferred alternative. The preferred alternative includes capping the landfill portion of the site with a low-

permeability cover system, institutional controls, and long-term monitoring. Also indicated in the Proposed Plan are two areas of possible excavation located outside the landfill limit. These areas are associated with sediment contamination and are the focus of this investigation. The Record of Decision (ROD) for this site is currently being prepared. The investigation outlined in the QAPP is being performed as part of pre-design activities for Site 13. It is anticipated that the results of this investigation will be presented in remedial design documents.

1.4 REPORT CONTENTS

Section 1.0 of this QAPP is the introduction and site background. Section 2.0 details the scope of work to be conducted for this investigation and the use of the data to be collected. Section 3.0 discusses the project organization including personnel and entities involved with this project. Section 4.0 discusses sampling procedures. Sections 5.0 through 15.0 detail the QA/QC requirements for the data collection, analysis, and validation. Appendix A contains the project specific HASP. Appendix B contains field forms, Appendix C contains standard operating procedures (SOPs), and Appendix D contains a brief discussion of the June 2003 pre-design sampling event and provides a description of the proposed September 2003 pre-design sampling event.

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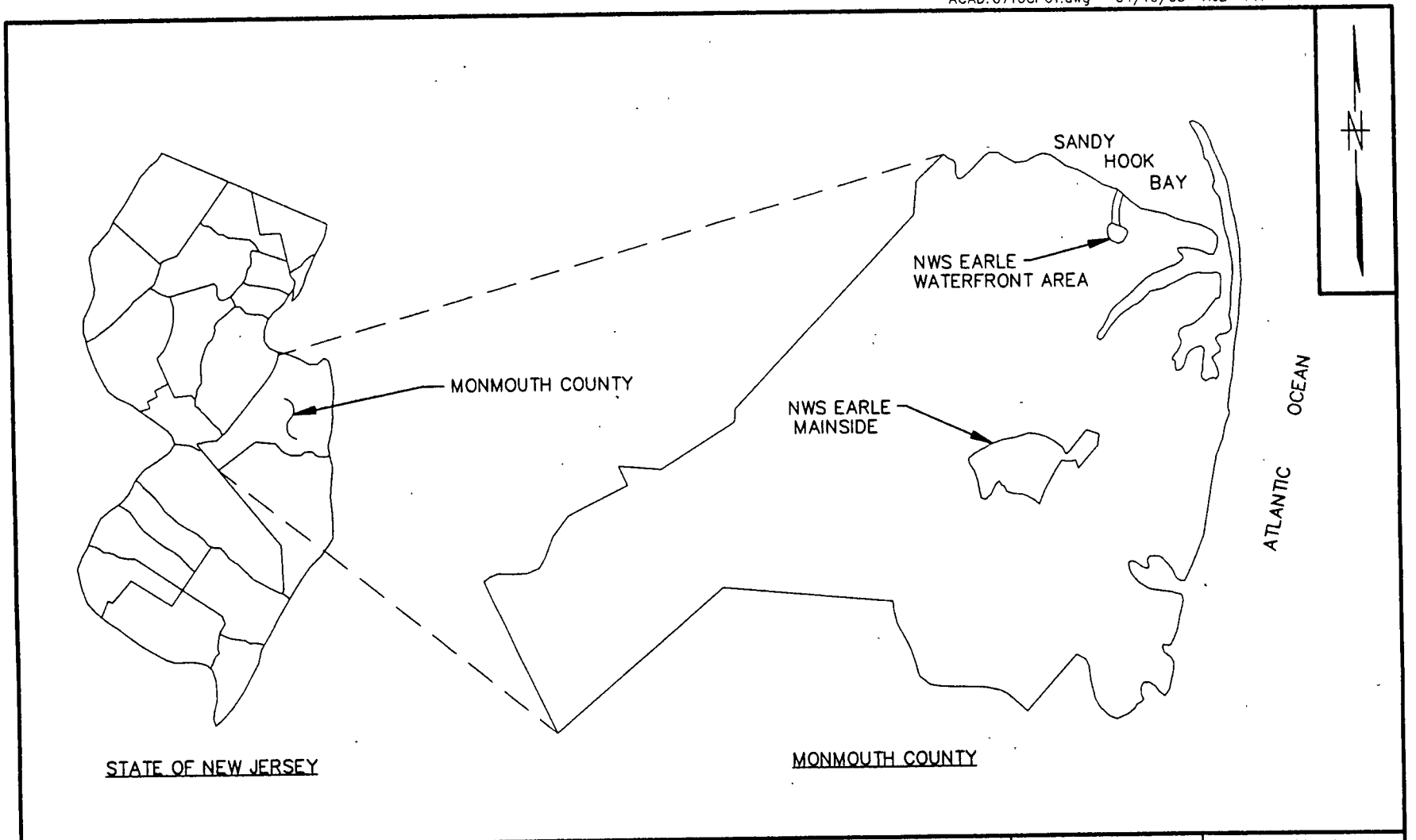

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COST/SCHED-AREA		APPROVED BY	DATE
SCALE NOT TO SCALE		DRAWING NO. FIGURE 1-1	REV. 0

FORM CADD NO. TtNUS_AH.DWG - REV 0 - 1/22/98

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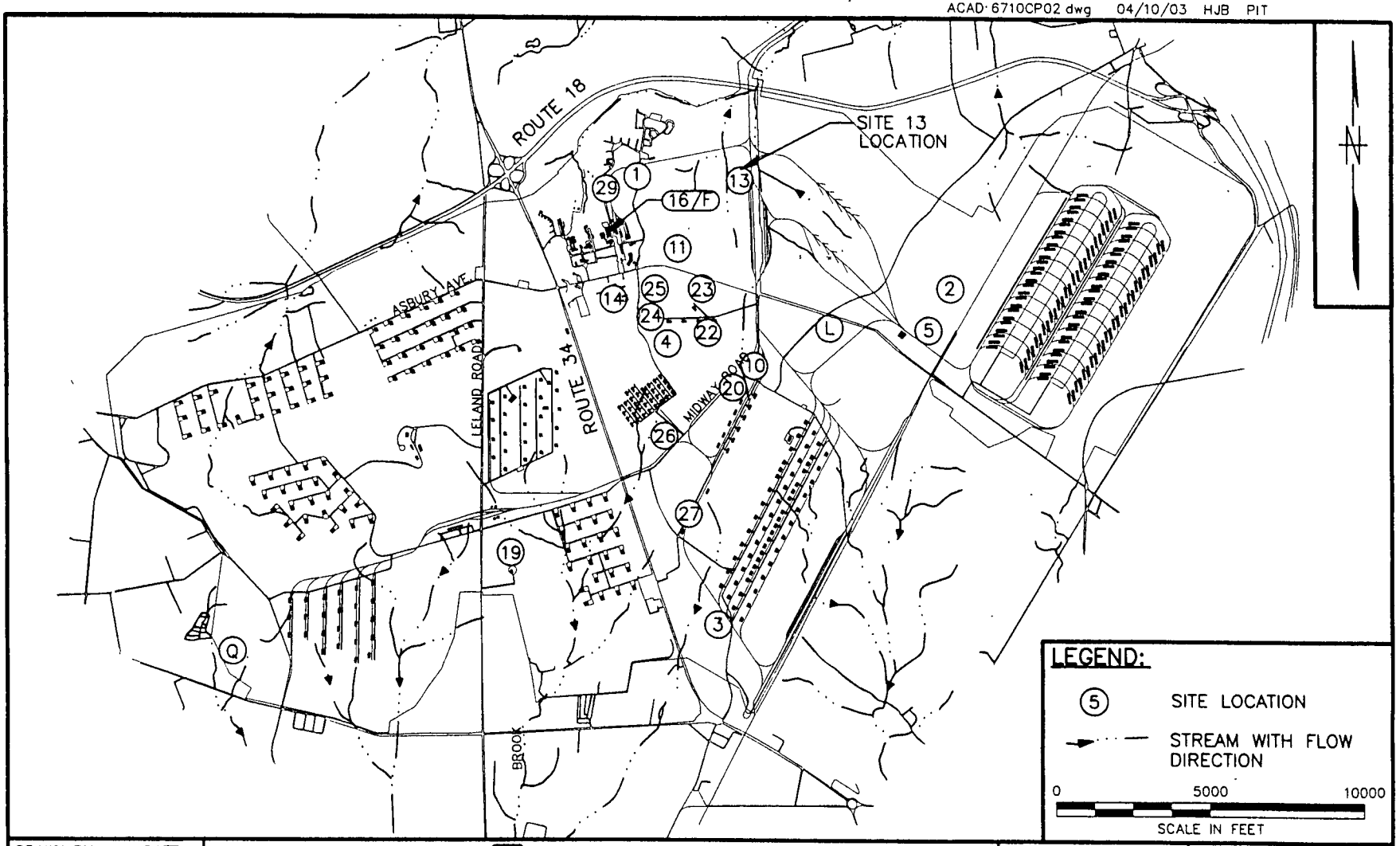

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CHECKED BY DATE	MAINSIDE IR SITE LOCATIONS NAVAL WEAPONS STATION EARLE COLTS NECK, NEW JERSEY	APPROVED BY David C Witt DATE 4/10/03	
COST/SCHED-AREA		APPROVED BY DATE	
SCALE AS NOTED		DRAWING NO. FIGURE 1-2	REV. 0

FORM CADD NO TtNUS_AH.DWG - REV 0 - 1/22/98

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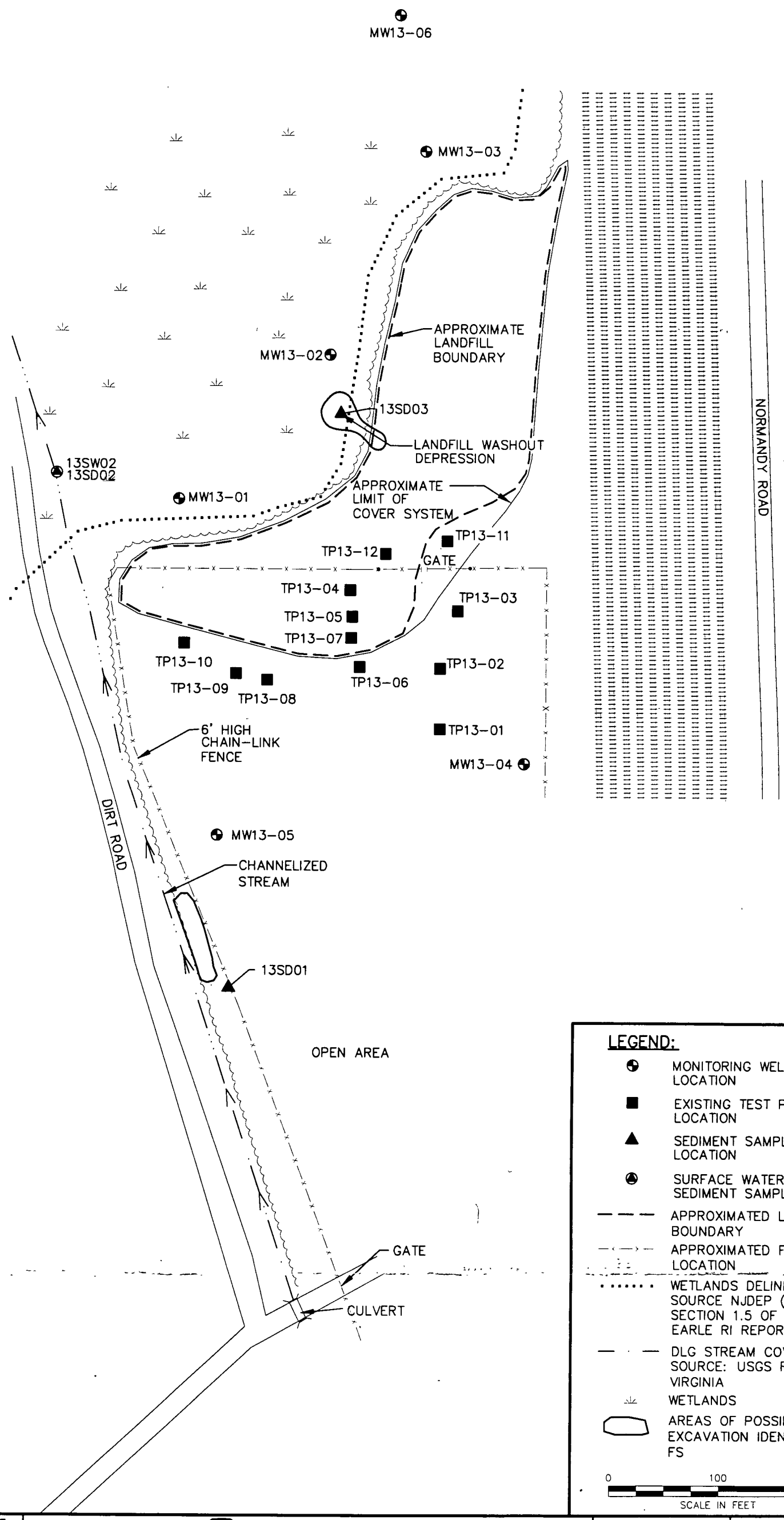

LEGEND:

- MONITORING WELL LOCATION
- EXISTING TEST PIT LOCATION
- SEDIMENT SAMPLE LOCATION
- SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- APPROXIMATED LANDFILL BOUNDARY
- APPROXIMATED FENCE LOCATION
- WETLANDS DELINEATION SOURCE NJDEP (SEE SECTION 1.5 OF NWS EARLE RI REPORT)
- DLG STREAM COVERAGE SOURCE: USGS RESTON, VIRGINIA
- WETLANDS
- AREAS OF POSSIBLE EXCAVATION IDENTIFIED IN FS

0 100 200
SCALE IN FEET

DRAWN BY HJB DATE 4/21/03	T tra Tech NUS, Inc.	CONTRACT NO. 6710	OWNER NO. 0851
CHECKED BY DATE	SITE MAP SITE 13 – DPDO YARD NAVAL WEAPONS STATION EARLE COLTS NECK, NEW JERSEY	APPROVED BY CWM	DATE 4/24/03
COST/SCHED-AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 1-3	REV. 0

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2.0 SCOPE OF WORK

2.1 PROJECT OBJECTIVES

The purpose of this Pre-Design Investigation is the collection of analytical data to further delineate areas of sediment contamination at Site 13. Two areas of possible excavation associated with sediment sample locations 13SD03 and 13SD01 were identified in the Proposed Plan for Site 13 (TtNUS, 2002). It is the objective of the sediment sampling to delineate the limit of sediment contamination requiring excavation at Site 13 (if any).

The ecological risk assessment for Site 13, summarized in the Site 13 FS (TtNUS, 2000), indicates that although silver and two aroclors may pose a moderate risk to aquatic and semi-aquatic receptors near the landfill, aquatic habitat is limited in area because the channelized stream is small, and the wetlands are forested with ephemeral standing water. In addition, it does not appear that silver is migrating or that PCBs have the potential to migrate to better habitats downstream. Because no evidence suggested that downstream migration of PCBs and silver has occurred, sampling and analysis to confirm the lack of PCB and silver migration extent could be conducted as part of the selected remedy.

The human health risk assessment contained in the RI (Brown & Root Environmental, 1998) did not identify sediment as a risk driver in any of the exposure scenarios; therefore, PCBs and silver will be further investigated in the sediments at Site 13 due primarily to potential ecological risks.

Since the silver and PCBs were identified as potential moderate ecological risks, they will be used to delineate the extent of sediment contamination requiring excavation.

2.2 PROPOSED SEDIMENT REMEDIATION LEVELS

The proposed sediment remediation level for silver is 3.7 mg/kg. This remediation level is based on the effect range–medium (ER-M) levels as summarized in Screening Quick Reference Tables (NOAA, 1999). This ER-M level is based on marine sediment; however, it will be used as a surrogate for the freshwater sediment at Site 13 because freshwater screening levels for silver are not readily available.

The proposed sediment remediation level for total PCBs is 1.0 mg/kg cited in USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-01 A Guide on Remedial Actions at Superfund Sites with PCB Contamination (1990). This level is based on the protection of human health under a residential scenario. Although this cleanup level is based on human health rather than ecological risks, it has been previously used for PCB remedial actions.

Although ecological screening levels are available for sediment [for instance the ER-M and probable effects levels (PEL), NOAA, 1999], they may be too conservative for a cleanup levels at Site 13. The areas of sediment contamination are primarily soils and sediments in hydric soil (i.e., wetland) and not true sediment. The ERMs and PELs are sediment benchmarks based off potential effects to the benthic community. The main difference that sediment contained within a stream and soil/sediment contained in wetlands is the difference in total organic carbon (TOC) percentage. Typical stream sediments usually fall below 5 percent TOC, while wetland soils/sediments can well exceed 10 percent. Contaminants (especially organics) contained in a wetland soil/sediment are highly bound to the TOC and thus less bioavailable, therefore, the use of "sediment" benchmarks for cleanup in wetland hydric soils/sediments may not be appropriate at Site 13.

2.3 SAMPLE AREAS

Two separate areas of sediment were identified in the Proposed Plan (TtNUS, 2002) and the FS (TtNUS, 2000) as possibly requiring excavation.

The first area is associated with sediment sample 13SD03 collected in the center of an area where materials have washed out of the landfill via erosion (Figure 1-3). This sediment sample had elevated levels of silver (22.7 mg/kg) and PCBs (Aroclor-1254 at 3,900 µg/kg and Aroclor-1260 at 1,200 µg/kg).

The second area is associated with sediment sample 13SD01 located where an eroded outfall originating under the DPDO yard joins the channelized stream west of the site. The silver concentration at this location was 2.4 mg/kg, and the only PCB detection was for Aroclor-1254 at 2,200 µg/kg.

2.4 DECISION RULE

Sediment sample analytical results will be compared to the remediation levels for silver and total PCBs listed in Section 2.2. If the measured concentration of any sample exceeds the proposed remediation level, the area will be considered for excavation. The need of excavation of sediments will be determined in consultation with the Navy, NJDEP and USEPA and will consider such items as the area extent of contamination, likely range of potential ecological receptors, and confidence in the applicability of the remediation levels.

If the limits of contamination are not bounded by the sediment sample locations proposed in this plan, additional sampling to delineate the contamination will be conducted. Bounding is defined as having all samples in the direction of potential contaminant migration that are of lesser contamination than the applicable remediation level. This additional sampling, if required, could be preformed as part of an

additional pre-design investigation or as part of verification sampling during the remedial action. The appropriate level of effort and timing of this investigation will depend on the results of this investigation.

2.5 SAMPLING DESIGN AND ANALYSIS

The sampling design for the first area (near 13SDS03) includes surrounding this relatively small area with five additional downgradient sediment samples to confirm that there has not been any further migration of silver and PCBs from the landfill (See Figure 2-1).

The sampling design for the second area (near 13SD01) includes collection of additional sediment samples upstream and downstream of sediment sample location 13SD01. The downstream sediment samples will confirm that silver and PCBs are not migrating downstream. The upstream samples will confirm that no upgradient source of these contaminants is present in this channelized stream. The samples will be spaced at approximately 50-foot intervals along the channelized stream. Eleven samples are proposed to be collected in the channelized stream (Figure 2-1).

The samples are proposed to be analyzed for Target Compound List (TCL) PCBs and Target Analyte List (TAL) metals because PCBs and silver were identified as potentially posing a moderate risk to ecological receptors. The entire list of TAL metals will be analyzed and reported to assure that no other metals are posing a risk to ecological receptors. Table 2-1 lists all samples to be collected as part of this investigation.

All sediment sample locations will be surveyed by a New Jersey-licensed surveyor.

2.6 PROJECT SCHEDULE

The sediment samples will be collected immediately following approval of this work plan. Allowing time for regulatory and Navy review and final submittal of this document, it is anticipated that the sediment sampling at Site 13 will occur in the middle of June 2003 and will take 2 to 3 days to complete. The lab analyses will then be completed on a 10-day turnaround.

2.7 PROJECT TARGET PARAMETERS AND INTENDED DATA USES

This section discusses the laboratory analytical information to be generated during the course of the investigation. No field data will be collected for investigative purposes for this project.

The analytical methods to be used for analysis of the NWS Earle samples have been selected based on existing analytical data from previous investigations. The suite of analyses for NWS Earle Pre-Design

Investigation includes TCL PCBs and TAL metals. SW-846 methodology will be used for preparation, sample extract clean-up (where applicable), and analysis of PCBs and metals in sediment. A laboratory certified by NJDEP to perform these analyses was selected to support this project.

The aforementioned parameters will be used to delineate sediment contamination and to establish excavation limits to be incorporated into the remedial design. Tables 2-2 and 2-3 provide a summary of all target analytes and associated required detection limits (RDLs)/required quantitation limits (RQLs)/practical quantitation limits (PQLs). Analytical methods are further discussed in Section 7.0 of this QAPP.

TABLE 2-1

SUMMARY OF PROPOSED SEDIMENT SAMPLING
SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

Sample Identification	Method of Collection	Sample Collection Depth	Analyses	
			TCL PCBs	TAL Metals[1]
SITE 13 SEDIMENT SAMPLES				
13SD04	Grab	0 to 6 inches	X	X
13SD05	Grab	0 to 6 inches	X	X
13SD06	Grab	0 to 6 inches	X	X
13SD07	Grab	0 to 6 inches	X	X
13SD08	Grab	0 to 6 inches	X	X
13SD09	Grab	0 to 6 inches	X	X
13SD10	Grab	0 to 6 inches	X	X
13SD11	Grab	0 to 6 inches	X	X
13SD12	Grab	0 to 6 inches	X	X
13SD13	Grab	0 to 6 inches	X	X
13SD13	Grab	0 to 6 inches	X	X
13SD14	Grab	0 to 6 inches	X	X
13SD15	Grab	0 to 6 inches	X	X
13SD16	Grab	0 to 6 inches	X	X
13SD17	Grab	0 to 6 inches	X	X
13SD18	Grab	0 to 6 inches	X	X
13SD19	Grab	0 to 6 inches	X	X
QUALITY CONTROL SAMPLES				
RB080802 [2]	Discrete aqueous sample	NA	TBD	TBD
SAMPLE-MS [3]	TBD	TBD	TBD	TBD
SAMPLE-MSD [4]	TBD	TBD	TBD	TBD
FD080802-01 [5]	TBD	TBD	TBD	TBD

1 Include TAL Metals from Table 2-2.
2 For rinse blanks the 6-digit number represents the date on which the sample was collected (i.e."080802" refers to August 8, 2002. In the event that disposable sampling equipment is used for the collection of Environmental samples for the entire day, no rinse blank would be required for that day.
3 The "MS" indicates that sample contains extra volume to run matrix spike analysis. MS samples are to be collected at a rate of 1 for every 20 environmental samples.
4 The "MSD" indicates that sample contains extra volume of the indicated sample to run matrix spike duplicate analysis.
5 The "080802" indicates the date on which the duplicate sample was collected. The "01" provides a sequential number for days when multiple duplicates are collected. The sample/duplicate pair will be recorded in the field logbook. Duplicate samples are to be collected at a rate of 1 for every 10 environmental samples collected for each site.

TCL Target Compound List.
TAL Target Analyte List.
TBD To be determined.
NA Not applicable.
PCB Polychlorinated biphenyls.

TABLE 2-2

ANALYTICAL DETECTION LIMITS - TCL PCBs
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 1 OF 2

Parameter PCBs	RQL[1] for Sediment Samples (µg/kg)	PQL[2] for Sediment Samples (µg/kg)
Aroclor-1016	33	16.5
Aroclor-1221	67	16.5
Aroclor-1232	33	16.5
Aroclor-1242	33	16.5
Aroclor-1248	33	16.5
Aroclor-1254	33	16.5
Aroclor-1260	33	16.5

1 RQL - Required Quantitation Limit.

2 PQL - Typical Practical Quantitation Limit; actual PQL may vary based on the laboratory.

TABLE 2-2

ANALYTICAL DETECTION LIMITS - TAL METALS
NWS EARLE, COLTS NECK, NEW JERSEY
PAGE 2 OF 2

Parameter	RDL Sediment Samples[1] (mg/kg)
Aluminum	IDL[1]
Antimony	IDL
Arsenic	6
Barium	IDL
Beryllium	IDL
Cadmium	0.6
Calcium	IDL
Chromium (total)	26
Cobalt	IDL
Copper	16
Iron	IDL
Lead	31
Magnesium	IDL
Manganese	IDL
Mercury	0.2
Nickel	16
Potassium	IDL
Selenium	IDL
Silver	3.7[2]
Sodium	IDL
Thallium	2
Vanadium	IDL
Zinc	120

1 RDL - Required Detection Limit as found in Guidance for Sediment Quality Evaluations. Freshwater Sediment Screening Guidelines, 1993.
2 Proposed remediation level.

IDL – Instrument Detection Limit. The laboratory will report all metals to the IDL. If the IDL is lover than the numbers listed the IDL will be reported.

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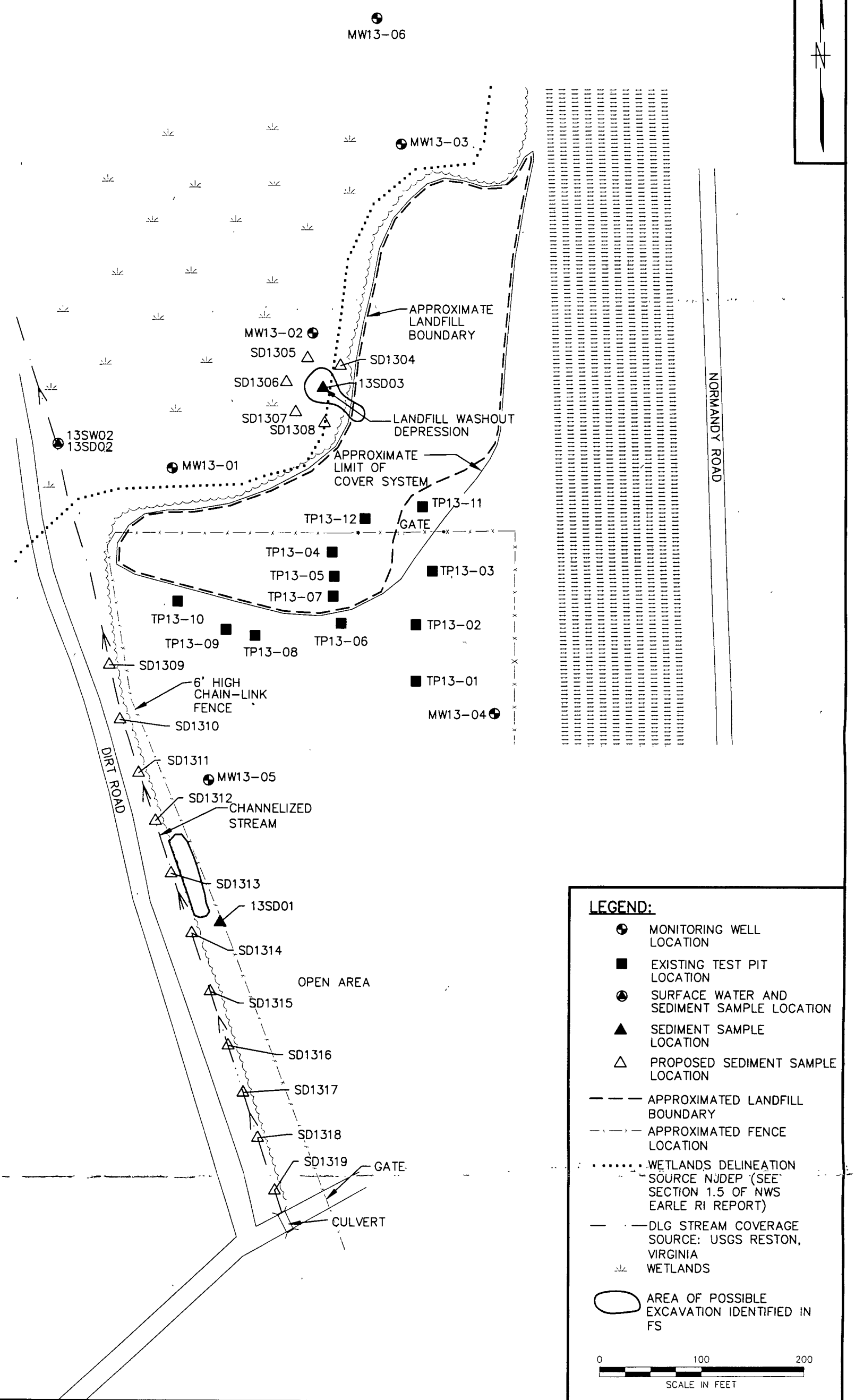


DRAWN BY HJB DATE 4/16/03	T tra Tech NUS, Inc.	CONTRACT NO. 6710	OWNER NO. ———
CHECKED BY DATE	PROPOSED SEDIMENT SAMPLE LOCATIONS SITE 13 – DPDO YARD NAVAL WEAPONS STATION EARLE COLTS NECK, NEW JERSEY	APPROVED BY [signature]	DATE 4/24/03
COST/SCHED–AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 2–1	REV. 0

FORM CADD NO T+NUS_BV.DWG - REV 0 - 1/20/98

3.0 PROJECT ORGANIZATION

This section presents project management and organization information for Site 13 PDI sampling and analysis activities. The project organization chart for the Navy/TtNUS team is provided in Figure 3-1. The various QA and management responsibilities of the Navy and key TtNUS personnel are defined in the following paragraphs.

3.1 NAVY REMEDIAL PROJECT MANAGER

The Navy Remedial Project Manager (RPM) is responsible for overall QA of the project. The Navy RPM has the responsibility for the following specific activities:

- Implementing the remedial action in accordance with the ROD.
- Serving as lead contact person with the regulatory agencies and regulatory oversight contractor, if applicable.
- Initiating and chair meetings.
- Facilitating resolution of issues during the planning and implementation stages.
- Assuring adequate resources are provided to complete activities in accordance with the approved plans, on schedule, and within budget.
- Assuring compliance with QA policies and procedures.

The Navy RPM for NWS Earle is Ms. Michele DiGeambeardino.

3.2 TtNUS CLEAN PROGRAM MANAGER

The TtNUS Navy Northern Division CLEAN Program Manager provides operations, technical, and administrative leadership and oversees and supports quality policies. The TtNUS Program Manager is responsible for the execution of all contractual obligations. He serves as the primary program point of contact for the client and provides an interface between the Navy and the project staff. The TtNUS Program Manager, Mr. John Trepanowski, may delegate authority to the Deputy Program Manager, Mr. Garth Glenn, P.E.

3.3 TtNUS PROJECT MANAGER

The TtNUS Project Manager (PM) is responsible for project performance, budget, and schedule and for ensuring the availability of necessary personnel, equipment, subcontractors, and services. The TtNUS PM will direct the development of the field program, the evaluation of findings, the determination of conclusions and recommendations, and the preparation of the technical report. The TtNUS PM is selected based upon technical experience, project needs, and previous experience. Additional responsibilities include:

- Ensuring timely resolution of project-related technical, quality, safety, or waste management issues.
- Functioning as primary interface with the Navy RPM and NWS Site Manager, field and office personnel, and subcontractor points-of-contact.
- Monitoring and evaluating subcontractor laboratory performance.
- Coordinating and overseeing work performed by field and office technical staff (including data validation, statistical evaluations, and report preparation).
- Coordinating and overseeing maintenance of all project records.
- Coordinating and overseeing review of project deliverables.
- Preparing and issuing final deliverables to the Navy.
- Approving the implementation of corrective action.

The TtNUS PM is Mr. Daniel Witt, P.E.

3.4 TtNUS HEALTH AND SAFETY MANAGER

The TtNUS Health and Safety Manager (HSM) is responsible for the following:

- Overseeing the development and review of the Site Security and HASP
- Implementing the Site Security and HASP
- Assigning the Site Safety Officer (SSO) and supervising his/her performance
- Conducting Health and Safety audits

- Preparing Health and Safety reports for management

The TtNUS HSM is Mr. Matthew Soltis.

3.5 QUALITY ASSURANCE

This section identifies the QA responsibilities for sediment sampling and analysis activities. Responsibilities of TtNUS and the analytical laboratories are discussed.

3.5.1 TtNUS Quality Assurance Manager

The TtNUS Quality Assurance Manager (QAM) is responsible for overall QA for the project and reports directly to the TtNUS Program Manager. The QAM has the responsibility for the following specific activities:

- Developing, maintaining, and monitoring QA policies and procedures.
- Providing training to TtNUS staff in QA/QC policies and procedures.
- Conducting systems and performance audits to monitor compliance with environmental regulations, contractual requirements, QAPP requirements, and corporate policies and procedures.
- Auditing project records.
- Monitoring subcontractor quality controls and records.
- Assisting in the development of corrective action plans,
- Ensuring correction of nonconformances reported in internal or external audits.
- Overseeing the implementation of the QAPP.
- Overseeing and reviewing the development and revision of the QAPP.
- Overseeing the responsibilities of the TtNUS Site QA/QC Advisor.
- Preparing QA reports for management.

The TtNUS QAM is Ms. Kelly Carper.

3.6 LABORATORY RESPONSIBILITIES

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

Laboratory Project Manager

The Laboratory Project Manager, who reports directly to the TtNUS PM, will:

- Ensuring that method- and project-specific requirements are properly communicated and understood by laboratory personnel.
- Ensuring that all laboratory resources are available on an as-required basis.
- Monitoring analytical and project QA requirements.
- Reviewing data packages for completeness, clarity and compliance with project requirements.
- Informing the TtNUS PM of project status and any sample receipt or analytical problems.

Laboratory Director

Responsibilities of the Laboratory Director include the following:

- Supporting the QA program within the laboratory
- Providing management overview of both production- and quality-related laboratory activities
- Maintaining adequate staffing to meet project analytical and quality objectives
- Approving all laboratory SOPs and QA documents
- Supervising in-house COC documentation
- Overseeing the preparation of and approving final analytical reports prior to submittal to TtNUS

Laboratory Quality Assurance Officer

The Laboratory QA Officer (QAO) has the overall responsibility for data after it leaves the laboratory. The Laboratory QAO will be independent of the laboratory but will communicate data issues through the Laboratory Project Manager. In addition, the QAO will:

- Overseeing laboratory QA
- Overseeing QA/QC documentation
- Conducting detailed data reviews
- Determining whether to implement laboratory corrective actions
- Defining appropriate laboratory QA procedures
- Preparing laboratory SOPs

Independent QA will be provided by the laboratory project manager and QAO prior to release of all data to TtNUS.

Laboratory Sample Custodian

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

- Receiving and inspecting the incoming sample containers.
- Recording the condition of the incoming sample containers.
- Signing appropriate documents.
- Verifying COCs.
- Notifying Laboratory Project Manager and Laboratory Director of sample receipt and inspection.
- Assigning a unique identification number and customer number and entering each into the sample receiving log.
- With the help of the laboratory manager, initiating transfer of the samples to appropriate lab sections.
- Controlling and monitoring access/storage of samples and extracts.

Laboratory Technical Staff

The laboratory technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the Laboratory Director.

3.7 PRE-DESIGN INVESTIGATION ACTIVITIES

TtNUS will be responsible for all field activities related to sediment sampling and analysis activities. The TtNUS field team will be organized according to the activities planned. Field team members will be selected based on the type and extent of effort required. All team members will be appropriately skilled and trained for the tasks they are assigned to perform. The team will consist of a combination of the following personnel:

- Field Operations Leader (FOL)
- Site QA/QC Advisor
- SSO
- Field technical staff

3.7.1 Field Operations Leader

The FOL is responsible for coordinating all on-site personnel and for providing technical assistance when required. The FOL, or designee, will coordinate and lead all sampling activities and will ensure the availability and maintenance of all sampling materials/equipment. The FOL is responsible for the completion of all sampling, field, and COC documentation will assume custody of samples and assure the proper handling and shipping of samples. The FOL is a highly experienced environmental professional who will report directly to the TtNUS PM. Specific FOL responsibilities include the following:

- Functioning as communications link between field staff members, the Site QA/QC Advisor, SSO, the NWS Site Manager and the TtNUS PM.
- Overseeing the mobilization and demobilization of all field equipment and subcontractors.
- Coordinating and managing the field technical staff.
- Adhering to the work schedules provided by the PM.
- Bearing responsibility for maintenance of the site logbook, field logbook, and field record-keeping.
- Initiating Field Task Modification Requests (FTMRs) when necessary.
- Identifying and resolving problems in the field; resolving difficulties in consultation with the NWS Site Manager; implementing and documenting corrective action procedures and providing communication between the field team and upper management.

3.7.2 Site Quality Assurance/Quality Control (QA/QC) Advisor

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

- Ensuring that field duplicates and field QC blanks are collected with the proper frequency.
- Ensuring that additional volumes of sample are supplied to the analytical laboratory with the proper frequency to accommodate laboratory QA/QC analyses.

- Ensure that measuring and test equipment are calibrated, used, and maintained in accordance with applicable procedures.

- Act as liaison between site personnel, laboratory personnel, and the TtNUS QAM.

- Manage bottleware shipments and oversee field sample preservation.

3.7.3 Site Safety Officer

The FOL (or designee) will also serve as the SSO. The duties of the SSO are detailed in the HASP. The SSO has stop-work authority, which can be executed upon the determination of an imminent safety hazard.

3.7.4 Field Technical Staff

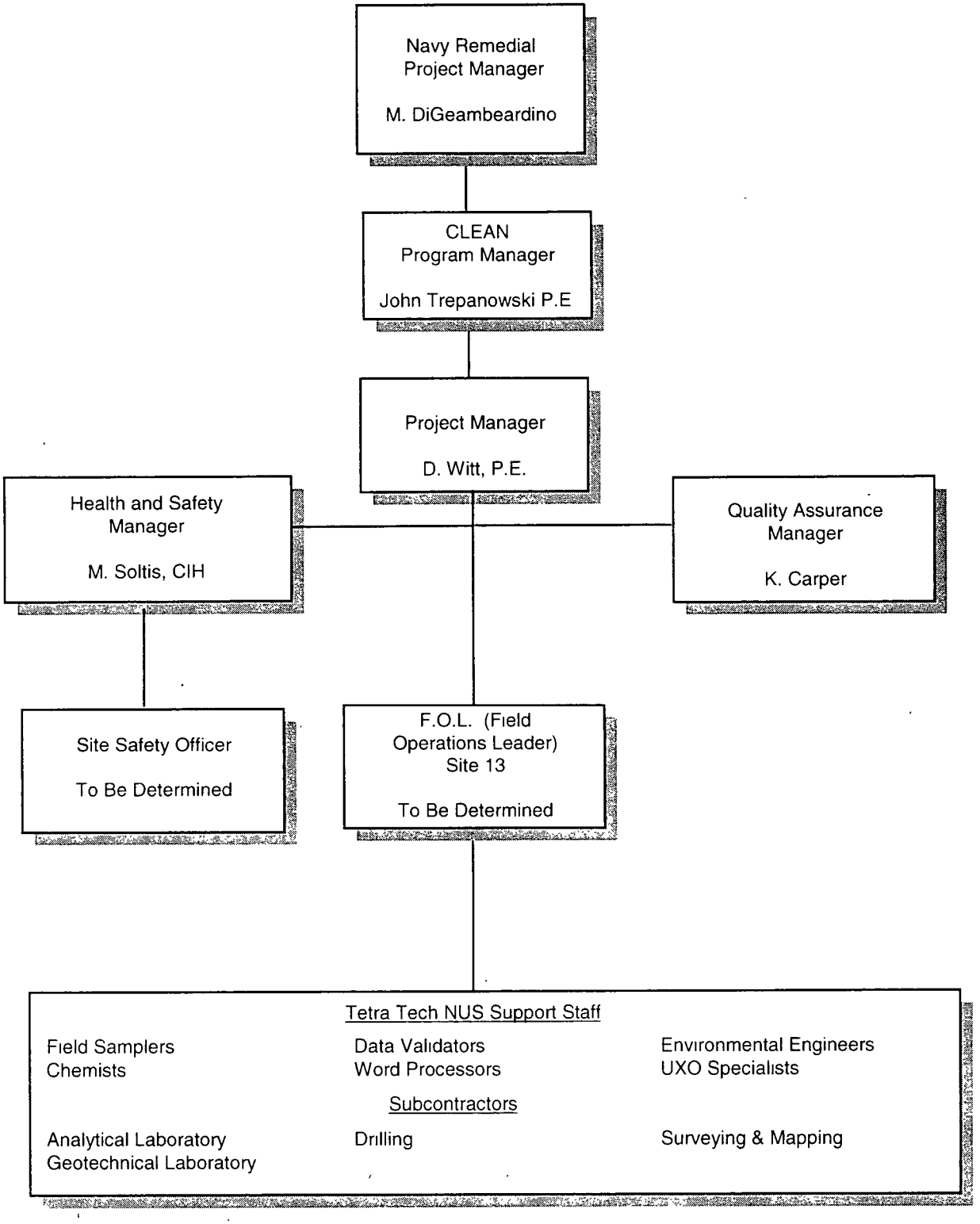
The field technical staff for this project will be drawn from TtNUS's pool of qualified personnel. All of the designated field team members will be experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work. The field staff is responsible for complying with field-related requirements as presented in the QAPP.

3.8 SPECIAL TRAINING REQUIREMENTS AND CERTIFICATIONS

All field personnel will have appropriate training to conduct the field activities to which they are assigned. Additionally, each site worker will be required to have completed a 40-hour course in Health and Safety Training as described under Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1610.120(b)(4) as well as the requirements/training and certifications outlined in the project-specific HASP.

FIGURE 3-1

PROJECT ORGANIZATION CHART
SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY



4.0 FIELD ACTIVITIES AND PROCEDURES

Summary tables and corresponding figures have been developed to identify the locations, identification numbers, analytical requirements, analytical methods, volumes, and holding times for each of the proposed samples.

The sample identification numbers, methods of collection, depths, and required analyses for the samples proposed at Site 13 are provided in Table 2-1. A summary of the analytical methods and bottleware, preservation, and holding time requirements is provided in Table 4-1.

The field activities will include the following tasks:

- Mobilization/demobilization
- Sediment sampling
- Sample handling
- Sample custody

4.1 MOBILIZATION/DEMOBILIZATION

TtNUS will prepare specifications and obtain a subcontractor for the laboratory analyses. All field team members will review this QAPP and the project HASP prior to the initiation of sediment sampling and analysis field activities. The project-specific HASP is provided in Appendix A. In addition, a field team orientation meeting will be held to familiarize personnel with the scope of the field activities.

4.2 SEDIMENT SAMPLING

Sediment sampling operations will be conducted as described in TtNUS SOP SA-1.3 (TtNUS, 1999a). The SOP is provided as part of Appendix C. A disposable trowel will be used to collect the grab sediment samples from a depth of 0 to 6 inches below existing or exposed ground surface. All pertinent field data will be recorded on a sample log form and in the field logbook. Sample field logs are provided in Appendix B.

Investigation-derived waste (IDW) to be generated during the investigation includes:

- Disposable sampling equipment
- Used personal protection equipment (PPE)
- General refuse

Excess sediment and decontamination fluids will be disposed on site at the point of generation. Excess sediment will be returned to the sampling site within the vicinity of the sample collection location. Decontamination fluids will be discharged to the ground surface near the sample locations. Disposable sampling equipment, used PPE, and general refuse will be bagged and removed from the site by TtNUS for disposal as general refuse.

4.3 SAMPLE HANDLING

Sample handling includes the field-related consideration of the selection of sample containers, preservatives, and allowable holding times. Sample identification, packaging, and shipping procedures are outlined in TtNUS SOP SA-6.1 (TtNUS, 2000a). Summaries of sample containers, volume requirements, preservatives, allowable holding times, and analyses requested as it applies to Site 13 are provided in Table 4-1.

4.3.1 Field Documentation

Sample documentation consists of the completion of COC reports and matrix-specific logsheets. COC reports are detailed in Section 6.0 of this QAPP. In addition, the Master Site Logbook, filled out in accordance with SOP SA-6.3 (TtNUS, 2000b), serves as the overall record of field activities. Information included daily in the Master Site Logbook includes weather conditions, identity and arrival and departure times of personnel, management issues, etc.

4.3.2 Sample Nomenclature

Each sample collected at Site 13 will be assigned a unique tracking number. The sample number designation includes the sample location number, site number, and an indication of the sample matrix. The sample locations identified in Table 2-1 incorporate the sample matrix/type, site, and sample location numbers.

4.3.3 Sample Preservation

The existence of some chemical constituents in some environmental matrices is unstable. Therefore, these types of samples must be "stabilized" using preservatives and/or special handling procedures. These preservation techniques prevent degradation of the sample to ensure that the sample is representative of actual site conditions. Preservation requirements for samples to be collected at Site 13 are presented in Table 4-1.

4.3.4 Documentation, Sample Packaging, and Shipping

Samples will be packaged and shipped in accordance with TtNUS SOP SA-6.1 (TtNUS, 2000a).

4.4 SAMPLE CUSTODY

Custody of samples must be maintained and documented at all times. The COC process begins with the collection of the samples in the field and ends with disposal by the laboratory. The sediment sample analysis will be performed by Lionville Laboratory, a NJDEP-certified laboratory as specified in Section 8.0 of this QAPP. TtNUS SOP SA-6.1 further details COC procedures.

TABLE 4-1

REQUIREMENTS FOR
BOTTLEWARE, PRESERVATION, AND HOLDING TIMES
SITE 13 – DEFENSE PROPERTY DISPOSAL OFFICE YARD
NWS EARLE, COLTS NECK, NEW JERSEY

Analysis	Method	Sample Volume	Container Material	Preservation	Holding Time
SEDIMENT					
TAL Metals	SW-846 6010B/7471A	8 oz.	Wide-mouth glass jar	Cool to 4°C	6 Months (28 days for Mercury)
TCL PCBs	SW-846 8082	4 oz.	Clear-wide mouth glass jar	Cool to 4°C	14 days to extract; 40 days to analysis

NOTE: Method number shall be indicated on the chain-of-custody form.

5.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, COC, laboratory analysis, and reporting that will provide results that are legally defensible in a court of law. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC , audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

The PARCC parameters (precision, accuracy, representativeness, comparability, and completeness) are qualitative and/or quantitative statements regarding the quality characteristics of the data used to support project objectives and ultimately, environmental decisions. These parameters are discussed in the remainder of this section. Specific routine procedures used to assess the quantitative parameters (precision, accuracy, and completeness) are provided in Section 13.0 of this QAPP.

5.1 PRECISION

5.1.1 Definition

Precision is a measure of the amount of variability and bias inherent in a data set. Precision describes the reproducibility of measurements of the same parameter for samples under similar conditions. The equation for determining precision is provided in Section 13.2 of this QAPP.

5.1.2 Field Precision Objectives

Field duplicate precision monitors the consistency with which environmental samples were obtained and analyzed. Field duplicate results for sediment matrix samples are considered to be precise if the relative percent difference (RPD) is less than or equal to 50 percent. Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 environmental samples or one duplicate per sampling day per matrix, whichever is greater.

5.1.3 Laboratory Precision Objectives

Laboratory precision QC samples are analyzed at a frequency of 5 percent (i.e., 1 quality control sample per 20 environmental samples). Laboratory precision is measured via comparison of calculated RPD values and precision control limits specified in the analytical method or by the laboratory's QA/QC Program.

The following analyses will be completed for environmental samples collected during the Pre-Design Investigation at NWS Earle:

- TAL Metals except Mercury analysis via SW-846 6010B (see Table 4-1 note)
- Mercury analysis via SW-846 Method 7471A
- PCB analysis via SW-846 Method 8082

Precision for TCL PCB organic analysis will be measured via the RPDs for matrix spike/matrix spike duplicate (MS/MSD) samples. Precision for TAL Metals inorganic analysis will be measured via RPDs for laboratory duplicates. RPD limits will be statistically derived at the analytical laboratory. These limits will be provided in each analytical data package.

5.2 ACCURACY

5.2.1 Definition

Accuracy is the degree of agreement between two results, which are the observed value and an accepted reference value. The equation for determining accuracy is provided in Section 13.1 of this QAPP.

5.2.2 Laboratory Accuracy Objectives

Accuracy in the laboratory is measured through the comparison of a spiked sample result against a known or calculated value expressed as a percent recovery (%R). %Rs are derived from the analysis of known amounts of compounds spiked into de-ionized water (i.e., laboratory control sample analysis) or into actual samples (i.e., surrogate or MS analysis). These analyses measure the accuracy of laboratory operations as affected by matrix. Laboratory control sample and/or MS analyses are performed with a frequency of 1 per 20 associated samples of like matrix. Surrogate spike analysis is performed for all organic analyses. Laboratory accuracy is assessed via comparison of calculated %R values with accuracy control limits specified in the analytical method or by the contracted laboratory's QA/QC Program.

The following analyses will be completed for environmental samples collected during the Pre-Design Investigation at NWS Earle:

- TAL Metals minus Mercury analysis via SW-846 6010B
- Mercury analysis via SW-846 Method 7471A
- PCB analysis via SW-846 Method 8082

Accuracy for PCBs analyses will be measured via the %Rs for surrogate spikes, LCS, and MS/MSDs. Accuracy for TAL Metals analysis will be measured via %Rs for MS and laboratory control samples. QC limits for matrix and surrogate spike recoveries are statistically derived by the analytical laboratory and will be provided in each analytical data package.

5.3 COMPLETENESS

5.3.1 Definition

Completeness is a measure of the amount of usable, valid, analytical data obtained compared to the amount expected to be obtained. Completeness is typically expressed as a percentage.

The ideal objective for completeness is 100 percent (i.e., every sample planned to be collected is collected; every sample submitted for analysis yields valid data). However, samples can be rendered unusable during shipping or preparation (e.g., bottles broken or extracts accidentally destroyed), errors can be introduced during analysis (e.g., loss of instrument sensitivity, introduction of ambient laboratory contamination), or strong matrix effects can become apparent (e.g., extremely low MS recovery). These instances result in data that do not meet QC criteria. Based on these considerations, 95 percent is considered an acceptable target for the data completeness objective. If critical data points are lost, re-sampling and/or reanalysis may be required.

One hundred percent of the data for the Pre-Design Investigation activities shall be validated. The validation will be in accordance with the USEPA National Functional Guidelines for Organic and Inorganic Data Review and the USEPA Region II SOP for validation of data unless dictated otherwise by project-specific data quality objectives (DQOs). Data rejected as a result of the validation process will be treated as incomplete data.

5.3.2 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid laboratory measurements obtained from all the laboratory measurements made in support of a given project. The equation for completeness is presented in Section 13.3 of this QAPP. Laboratory completeness for the NWS Earle Pre-Design Investigation activities is expected to be at least 95 percent.

5.4 REPRESENTATIVENESS

5.4.1 Definition

Representativeness is an expression of the degree to which the data accurately and precisely depict the actual characteristics of a population or environmental condition existing at an individual sampling point. Use of standardized sampling, handling, analytical, and reporting procedures ensures that the final data accurately represent actual site conditions.

5.4.2 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times, and analysis of field duplicate samples.

5.5 COMPARABILITY

5.5.1 Definition

Comparability is defined as the confidence with which one data set can be compared to another (e.g., between sampling points and between sampling events). Comparability is achieved by using standardized sampling and analysis methods and data reporting formats including use of consistent units of measure and reporting of solid matrix sample results on a dry-weight basis. Additionally, consideration is given to seasonal conditions and other environmental variations that could influence data results.

5.5.2 Measures to Ensure Comparability of Laboratory Data

Analytical data will be comparable when similar sampling and analytical methods are used and documented. Results will be reported in units that ensure comparability with previous data and with current State and federal standards and guidelines. PCB results will be reported in µg/kg, and TAL Metals results will be reported as mg/kg for sediment samples. Detection, reporting, and quantitation limits are discussed in Section 2 of this QAPP.

5.6 LEVEL OF QUALITY CONTROL EFFORT

Trip blank, equipment blank, field blank, method blank, duplicate, and MS samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical program.

External QC samples (i.e., field QC samples) consist of field duplicates, field blanks, trip blanks, and equipment (rinsate) blanks. Each of these types of field QC samples undergoes the same preservation,

analysis, and reporting procedures as the related environmental samples. Each type of field QC sample is discussed below.

Field duplicates are either two samples collected independently at a sampling location (e.g., surface water), or a single sample homogenized and split into two portions. Field duplicates are collected and analyzed for chemical constituents to measure the precision of the sampling and analysis methods employed. The general level of the QC effort will be 1 field duplicate for every 10 or fewer investigative samples or one duplicate per matrix per sampling day, whichever is greater.

Field blanks (ambient condition blanks), consisting of source water, will be submitted to the laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for background contamination at the site that may cause sample contamination. Field blanks will be collected based on conditions at the time of sampling at the discretion of the FOL, with a minimum of one field blank being collected per individual contiguous area of potential concern.

Equipment (rinsate) blanks are obtained under representative field conditions by collecting the rinse water generated by running analyte-free water through sample collection equipment after decontamination and prior to use. One rinsate blank will be collected per each type of sampling equipment used (i.e., bailer, split-spoon sampler, hand tools, etc.) per day that sampling is conducted at a minimum frequency of 10 percent. A sampling event is matrix-specific; therefore, an equipment blank must be collected for each matrix sampled. If pre-cleaned, dedicated, or disposable sampling equipment is used, one rinsate blank must be collected as a "batch blank." Rinsate blanks are analyzed for the same chemical constituents as the associated environmental samples.

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Laboratory duplicate samples are analyzed for inorganic parameters to check for sampling and analytical reproducibility.

MS samples provide information about the effect of the sample matrix on the digestion and measurement methodology. All MS for organic analyses are performed in duplicate and are hereinafter referred to as MS/MSD samples. One MS/MSD will be analyzed for every 20 or fewer investigative samples per sample matrix (i.e., sediment, soil).

The level of QC effort for testing of PCBs will conform to the SW-846 Method 8082. The level of QC effort for testing of TAL Metals minus Mercury will conform to the SW-846 Method 6010B. The level of QC effort for testing Mercury will conform to the SW-846 Method 7471A.

6.0 CUSTODY PROCEDURES

Documented sample custody is one of several factors necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all original laboratory reports and purge files, are maintained under document control in a secure area. A sample or evidence file is under custody when any one of the following conditions is satisfied:

- The item is in the actual physical possession of an authorized person.
- The item is in view of the person after being in his or her possession.
- The item was placed in a secure area to prevent tampering.
- The item is in a designated and identified secure area with access restricted to authorized personnel only.

The COC form is a multi-part, standardized form used to summarize and document pertinent sample information such as sample identification and type, sample matrix, date and time of collection, preservation, and requested analyses. Furthermore, through the sequential signatures of various sample custodians (e.g., sampler, airbill number, laboratory sample custodian), the COC form documents sample custody and tracking. Laboratory custody procedures will ensure that sample integrity is not compromised from the time of receipt at the laboratory until final data are reported to TtNUS. This requires that the laboratory control all sample handling and storage conditions and circumstances. Custody procedures apply to all environmental and associated field QC samples obtained as part of the data collection system.

6.1 FIELD CUSTODY PROCEDURES

The FOL (or designee) is responsible for the care and custody of the samples collected until they are relinquished to the laboratory or entrusted to a commercial courier. COC forms are completed to the fullest extent possible for each sample cooler used for shipment. The forms are legibly completed with waterproof ink and are signed and dated by the sampler. COC forms will include the following information: project name, sample number, time collected, matrix, designated analyses, type of sample, preservative, and name of sampler. Pertinent notes or comments are also indicated on the COC form.

Information similar to that contained on the COC form is provided on the sample label, which is securely attached to the sample bottle. Sample labels will include, at a minimum, the following information: sample number, date and time of collection, analysis required for the sample aliquot in the associated sample

container, and a space for the laboratory sample number. The procedures for sample numbering are listed in SOP CT-04 in Appendix C of this QAPP.

Site conditions during sampling and the care with which samples are handled may factor into the degree to which samples represent the media from which they are collected. This, in turn, could affect the ability of decision makers to make accurate and timely decisions concerning the contamination status of the site. As appropriate, logbooks are assigned to, and maintained by, key field team personnel. The logbooks are used to record daily conditions and activities such as weather conditions, dates and times of significant events, level of PPE used, actual sample collection locations, photographs taken, problems encountered during field activities, chemical screening results, and corrective actions taken to overcome problems. In addition, the names of site visitors and the purposes of their visits shall be recorded. Field logbook assignments shall be recorded in the site logbook or other central file, the location of which is known by the FOL and PM. During field activities, the FOL is responsible for the maintenance and security of all field records. At the completion of field activities, the FOL will forward all field records to the TtNUS PM. All field sample records will eventually be docketed into the final evidence file.

A temperature blank shall be included in each cooler containing samples for use by the laboratory upon receipt. Each cooler shall be taped shut with strapping tape in at least two places to prevent tampering. Custody seals shall be attached so that the seals must be broken to open the cooler. Samples for chemical analysis will be sent for next-day receipt to the laboratory within 24 hours of collection.

The following procedures will be used when transferring custody of samples. As previously noted, individual custody records will accompany each sample cooler. The method of shipment, courier name, and other pertinent information will be entered in the remarks section of the custody record. When transferring samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the COC record. The original record (top copy of the multi-part form) will accompany the shipment, and the field sampler will retain a copy. This record documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common courier). After COC records have been placed within sealed shipping coolers, the signed courier airbills will serve to document COC. When samples arrive at the laboratory, internal laboratory sample custody procedures will be followed (see Section 6.2).

6.2 LABORATORY CUSTODY PROCEDURES

Upon laboratory receipt of a shipment of samples, the laboratory's sample custodian will verify that the correct number of coolers has been received. The custodian will examine each cooler's custody seals to verify that they are intact and that the integrity of the environmental samples has been maintained. The custodian will then open each cooler and measure its internal temperature by measuring the temperature

custodian will then open each cooler and measure its internal temperature by measuring the temperature of the temperature blank. The temperature reading will be documented. The sample custodian will then sign the COC form and examine the contents of the cooler. Identification of broken sample containers or discrepancies between the COC form and sample labels will be recorded. The laboratory will retain the original field COC forms, providing copies of the forms with the final data package deliverable. All problems or discrepancies noted during sample receipt will be promptly reported to the TtNUS PM. Samples will be logged into the laboratory information management system.

6.3 FINAL EVIDENCE FILES

The TtNUS Central File will be the repository for all documents that constitute evidence relevant to sampling and analysis activities described in this QAPP. TtNUS will be the custodian of the evidence file and will maintain the contents of these files, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secure, limited-access location and under custody of the TtNUS QAM. The control file will include at a minimum:

- Field logbooks
- Field data and data deliverables
- Photographs and negatives
- Drawings
- Laboratory data deliverables
- Data validation reports
- Data assessment reports
- Progress reports, QA reports, interim project reports, etc.
- All custody documentation (tags, forms, airbills, etc.)
- Sample log sheets
- FTMR
- Corrective actions documentation.

Upon completion of the contract, all files associated with this investigation will be relinquished to the custody of the Navy.

The FOL will be responsible for ensuring the completion of the following forms:

- Sample labels
- COC forms

- COC seals for coolers
- Shipping labels for coolers
- Public courier air bills

6.4 QUALITY CONTROL SAMPLES

Field QC samples will be collected or generated during environmental sampling activities. Field QC samples will be addressed in more detail in Sections 5.6 and 9.2.

6.5 RECORD KEEPING

In addition to COC records, certain standard forms will be completed for sample description and documentation. These forms shall include sample log sheets, daily activity records, and logbooks. A bound, weatherproof notebook shall be maintained by the FOL. All information related to sampling or field activities will be recorded in the field notebook. This information will include, but is not limited to, sampling time, weather conditions, unusual events, and field measurements. Field notebooks should also contain qualitative or semi-qualitative information on sample conditions such as odor and color. Record keeping is discussed in further detail in SOP SA-6.3 in Appendix C of this QAPP.

7.0 CALIBRATION PROCEDURES AND FREQUENCY

All instrumentation used to perform chemical measurements must be properly calibrated prior to use in order to obtain valid and usable results. The requirement to properly calibrate instruments prior to use applies equally to field instruments as it does to fixed laboratory instruments. Laboratory instrument calibration is discussed in Section 7.1. No field measurements will be made, so no discussion about calibration is necessary. The field staff will utilize photo-ionization detectors for health and safety reasons only. Because none of these measurements will be used to support the objectives, they are not considered field measurements.

7.1 LABORATORY INSTRUMENT CALIBRATION

Calibration procedures for a specific laboratory instrument will consist of initial calibration (generally three to five points), initial calibration verification (inorganic methods only), and continuing calibration verification and will comply with the analytical methods. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution. The frequency of calibration will be performed according to the requirements of the specific methods.

All standards used to calibrate analytical instruments must be obtained from the National Institute of Standards and Technology (NIST) or through a reliable commercial supplier with a proven record for quality standards. All commercially supplied standards must be traceable to NIST reference standards, where possible, and appropriate documentation will be obtained from the supplier. In cases where documentation is not available, the laboratory will analyze the standard and compare the results to a USEPA-supplied known or previous NIST-traceable standard.

The calibration procedures and frequencies used by the subcontract laboratory will comply with the applicable analytical method. Brief descriptions of calibration procedures for the pertinent instrument types follow.

7.1.1 PCB Analyses

For PCB analyses, the GC system will be calibrated in accordance with SW-846 8082. The initial calibration is required before any samples are analyzed, and a multi-point initial calibration sequence is analyzed using dual column injection. A minimum of a five-point initial calibration with standards bracketing the range of detection (for PCBs, five-point calibration for Aroclor-1016/1260 mixture and the other aroclors is analyzed, and a one-point calibration factor is determined). If all initial calibration criteria are met, samples may be analyzed for a period of 12 hours. The calibration must be verified (continuing

calibration every 12 hours). Calibration standards must be injected after every 20 samples. If continuing calibration criteria are met, analysis of samples can continue. If continuing calibration criteria are not met it is necessary to recalibrate.

7.1.2 Metals Analyses

7.2.2.1 Inductively Coupled Argon Plasma Analyses

Inductively coupled plasma (ICP) spectrometry systems will be calibrated for the analysis of TAL metals in accordance with the SW-846 protocols outlined in Method 6010B. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least one standard. Following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration), an initial calibration blank, and an interference check sample are analyzed. A continuing calibration verification sample and a continuing calibration blank are run every 2 hours or every 10 samples, whichever occurs first. A continuing calibration verification sample, a continuing calibration blank, and an interference check sample are also run after analysis of the last sample. The initial calibration verification standard, continuing calibration verification standard, and interference check sample each contain analytes of interest at different concentrations. The calibration verification standards must agree within 10 percent of their known values and must have a relative percent difference of less than 5 percent for the calibration to be considered valid. All calibration standards contain acids at the same concentrations as the sample digestates.

7.2.2.2 Atomic Absorption Analyses

Cold vapor atomic absorption (CVAA) analyses will be calibrated in accordance with the SW-846 protocols outlined in Method 7471A and 7000A. Initial calibration is required each day before any samples are analyzed and consists of a calibration blank and at least three calibration standards covering the range of concentrations of interest. Immediately following initial calibration, an initial calibration verification sample (obtained from a different source than the solutions used for calibration) and an initial calibration blank are analyzed. The initial calibration verification must agree within 10 percent of the known value for the calibration to be considered valid. A continuing calibration verification sample and a continuing calibration blank are run every 2 hours or every 10 samples, whichever occurs first. A continuing calibration verification sample and a continuing calibration blank are also run after analysis of the last sample. The continuing calibration verification must be within 20 percent of the known value or the previous set of 10 samples must be re-analyzed.

8.0 ANALYTICAL AND MEASUREMENT PROCEDURES

The analytical laboratory has yet to be determined, however, typical QA/QC control limits have been provided by Lionville Laboratory (208 Welsh Pood Road, Lionville, PA, 19341; (610) 280-3000) which may be utilized to perform the majority of the routine chemical analyses for the environmental samples to be collected as part of this investigation.

8.1 LABORATORY ANALYTICAL AND MEASUREMENT PROCEDURES

PCBs and TAL Metals will be analyzed in accordance with the SW-846 analytical procedures set forth in the USEPA SW-846 Methods 8082 and 6010B/7471A, respectively.

8.1.1 List of Project Target Compounds and Detection Limits

Table 8-1 provides a summary of the preparation, clean-up, and analytical methods for the anticipated activities. A complete list of the target compounds/analytes, RQLs, and RDLs is provided in Section 2 of this QAPP. Organics data generated through use of SW-846 protocols will be reported to the RDL. Metals data generated through use of SW-846 protocols will be reported to the Instrument Detection Limit (IDL) or RDL, whichever is lower and technically feasible. All sediment sample results will be reported on a dry-weight basis. Quantitation and detection limits will also be adjusted, as necessary, based on dilutions and sample volume.

Non-detects will be reported to the RDL/IDL as applicable and marked with a "U" flag. Positive results between the RDL and method detection limit will be flagged "J".

8.1.2 List of Associated Quality Control Samples

In addition to the field QC samples (duplicates, trip blanks, rinsate blanks, etc.) discussed in Sections 5.6 of this QAPP, laboratory QC samples including MS/MSD samples, method blanks, preparation blanks, etc. will be analyzed as required by the SW-846 methods. Laboratory QC samples are discussed in additional detail in Section 9.2 of this QAPP.

TABLE 8-1

SUMMARY OF ORGANIC AND INORGANIC ANALYTICAL PROCEDURES
SEDIMENT MATRIX
NWS EARLE, NEW JERSEY

Analytical Parameter	Preparation Method[1]	Clean-up Method	Analytical Method[1]
TAL Metals minus Mercury	SW-846 Method 3050B	N/A	SW-846 Method 6010B
Mercury	SW-846 Method 3050B	N/A	SW-846 Method 7471A
PCBs	SW-846 Methods 3540C or 3550B	SW-846 Methods 3620B or 3665A	SW-846 Method 8082

1 USEPA, 1986. Test Methods for Evaluating Solid Waste; Physical/Chemical Methods (SW-846), 3rd Edition, up to and including Update III. Office of Solid Waste and Emergency Response, Washington, DC.

NA = Not applicable
PCB = Polychorinated biphenyls
TAL = Target Analyte List

9.0 INTERNAL QUALITY CONTROL CHECKS

Field-related QC checks were discussed in Section 4.0 of this QAPP. This section provides additional information regarding internal QC checks for the field and the laboratory.

9.1 FIELD QUALITY CONTROL CHECKS

Collection of the field QC samples will be in accordance with the sampling procedures provided in this QAPP at the frequencies discussed in Section 4.0 of this QAPP.

9.2 LABORATORY QUALITY CONTROL CHECKS

The subcontract laboratory will have a QC program that ensures the reliability and validity of the analyses performed at the laboratory. All analytical procedures are typically documented in writing as SOPs. Laboratory SOPs for any and all analyses will be provided in either addenda to the QAPP or under separate cover contingent upon the logistics of the laboratory procurement process.

Internal QC procedures for SW-846 analyses (PCB and metals) are discussed in SW-846 Methods 8000, 8082, 7000, 7471A, 6000, and 6010B. Several internal laboratory QC checks are briefly discussed in the remainder of this section.

Laboratory method blanks are prepared and analyzed in accordance with the analytical method employed to determine whether contaminants originating from laboratory sources have been introduced and have affected environmental sample analyses. A method blank generally consists of an aliquot of analyte-free water (or purified sodium sulfate for soil/sediment samples) that is subjected to the same preparation and analysis procedures as the environmental samples undergoing analysis. If method blank contamination is found to exist, corrective actions indicated in the SW-846 Methods or laboratory SOPs must be followed. Under no circumstances are laboratory method blank contaminant values subtracted from environmental sample analysis results.

MS analysis for organic fraction analyses is performed in duplicate as a measure of laboratory precision. For inorganic analyses, 1 **laboratory duplicate** analysis is likewise performed for every 20 environmental sample analyses of like matrix. Laboratory duplicates are prepared by thoroughly mixing and splitting a sample aliquot into two portions and analyzing each portion following the same analytical procedures used for the environmental sample analyses. The field crew provides extra volumes of sample matrices designated for laboratory QC analyses, as required. Control limits for laboratory duplicate analyses are established statistically by the laboratory in accordance with method-specific procedures and general

protocols outlined in the laboratory SOPs for non-CLP analyses. The laboratory SOPs and SW-846 Methods define circumstances under which corrective actions are warranted and how they must be performed when required.

Surrogates are organic compounds (typically brominated, fluorinated, or isotopically labeled) that are similar in nature to the compounds of concern and that are not likely to be present in environmental media. Surrogates are spiked into each sample, standard, and method blank prior to analysis and are used only in organic chromatographic analysis procedures as a check of method effectiveness. Surrogate recoveries are evaluated against laboratory-derived statistical control limits.

LCSs serve to monitor the overall performance of each step during the analysis, including the sample preparation. LCS analysis will be performed for TAL Metals and PCB analyses. Solid/sediment LCS results must fall within the control limits established by the supplier of the LCS standard. Solid/sediment LCSs shall be analyzed utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples.

TABLE 9-1

LIONVILLE LABORATORY QC SAMPLE CRITERIA
NWS EARLE, NEW JERSEY

Compound	MS/MSD	LCS	Precision
PCB QC LIMITS			
Surrogate			
Decachlorobiphenyl	38%-122%	38%-122%	NA
Spiked Compounds			
Aroclor-1016	50%-150%	50%-150%	50%
Aroclor-1260	50%-150%	50%-150%	50%
METALS QC LIMITS			
All Metals	75%-125%	80%-120%	20%

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

This section describes the procedures to be used for data reduction, validation, and reporting for the NWS Earle Sediment Pre-Design Investigation. All data generated during the course of the investigation will be maintained in hardcopy format by TtNUS in the Naval Engineering Field Activity Northeast designated central files located in the TtNUS Pittsburgh, Pennsylvania office.

In addition to the central files, photocopies of all hardcopy data (as well as electronic data) will be maintained in the Chemistry/Toxicology/Risk Assessment Department database records files located in the TtNUS Pittsburgh, Pennsylvania office. Upon completion of the contract, files will be relinquished to the Navy.

10.1 DATA REDUCTION

Data reduction will be completed for laboratory-generated analytical data. Reduction of laboratory data is discussed in the remainder of this section.

10.1.1 Laboratory Data Reduction

Data reduction for laboratory analytical data generated via the SW-846 analytical protocol, QA requirements, and reporting procedures (PCB organics and TAL metals) will be completed in accordance with the applicable analytical methods.

Laboratory analytical data will be reported using standard concentration units to ensure comparability with regulatory standards/guidelines and previous analytical results. Reporting units for sediment matrix for the classes of chemicals under consideration are as follows:

- PCB organics - µg/kg
- TAL metals - mg/kg

Field QC sample results will be included in the database for the NWS Earle Sediment Pre-Design Investigation. Specifically, the analytical results for field duplicates, source water blanks, trip blanks, rinsate blanks, and ambient condition blanks will be provided. The results for field QC samples will be considered during the course of data validation (in concert with laboratory method blanks) to eliminate false positive results according to the 5- and 10-times rules specified in the National Functional Guidelines for Organic and Inorganic Data Review. The results for laboratory QC samples such as

method blanks will not be presented in the Pre-Design Investigation Report database. In addition, only the original (unspiked) sample results for MS/MSD samples will be provided in the database.

10.2 DATA VALIDATION

Validation of field measurements and laboratory analytical data are discussed in this section. Laboratory analytical data will be validated in accordance with current USEPA guidance as discussed in Section 10.2.1.

10.2.1 Laboratory Data Validation

One hundred percent of the laboratory data will be validated. Validation of analytical data will be completed by the TtNUS Chemistry Department located in TtNUS's Pittsburgh, Pennsylvania office. Final review and approval of validation deliverables will be completed by the Department's Data Validation Coordinator.

The analytical results for PCB and metals fractions generated using SW-846 methodology will be validated against method-specific requirements, National Functional Guidelines for Organic and Inorganic Data Review, and the USEPA Region II SOP for Data Validation to the extent practicable.

10.3 DATA REPORTING

10.3.1 Laboratory Data Reporting

Data reported by the laboratory will be in accordance with CLP reporting format including all non-CLP data (to the extent practicable). All pertinent QC data including raw data and summary forms for blanks, standards analysis, calibration information, etc., will be provided for the non-CLP analyses. Case narratives will be provided for each Sample Delivery Group.

All environmental and field QC sample results (trip blanks, field duplicates, rinsate blanks, source water blanks, ambient condition blanks) will be included in the report as an appendix. The database will include pertinent sampling information such as sample number, sampling date, general location, depth, and survey coordinates (if applicable). Sample-specific reporting limits will be reported for nondetected analytes. Units will be clearly summarized in the database and will conform to those identified in Section 10.1.1. The analytical data may also be reported in summary fashion within the body of the report text in tabular and graphic fashion.

Data will be handled electronically pursuant to the electronic deliverable requirements specified in TtNUS's Master Services Agreement with analytical laboratories. This agreement requires the analytical

laboratories to provide data in both hardcopy and electronic form. The original electronic diskettes and the original hardcopy analytical data are maintained in TtNUS's Northern Division central files as received.

Validation will be completed using the PDF file data. Upon completion of validation of a Sample Delivery Group and review by the Data Validation Coordinator, the validation qualifiers will be entered in the electronic database and will be subjected to independent review for accuracy. During this review process, the electronic database printout will also be compared to the hard copy data (Form Is) to ensure that the hard copy data and electronic data are consistent.

11.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits will be performed periodically to ensure that work is being implemented in accordance with the approved Project Plans and in an overall satisfactory manner. Such audits will be performed by various personnel and will include evaluation of field, laboratory, data validation, and data reporting processes. Examples of pertinent audits are as follows:

- Performance and system audits of the laboratory will be performed regularly, in accordance with the requirements of NJDEP (external, annual evaluation), by a Navy Contractor (internal, 18 month cycle), and in accordance with the Laboratory Quality Assurance Plan (internal, as specified).

- Data validators will review (on a timely basis) the chemical analytical data packages submitted by the laboratory. The data validators will check that the data were obtained through use of an approved methodology, that the appropriate level of QC effort and reporting was conducted, and whether or not the results are in conformance with QC criteria. On the basis of these factors, the data validator will generate a report describing data limitations, which will be reviewed internally by the Data Validation Coordinator prior to submittal to the PM.

- A formal audit of the field sampling procedures may be conducted by the TtNUS QAM or designee in addition to the auditing that is an inherent part of the daily project activities. The purpose of this audit would be to ensure that sample collection, handling, and shipping protocols, equipment decontamination and field documentation procedures are being performed in accordance with the approved Project Plans and SOPs.

- A sample tracking system, as further described in Section 4 of the QAPP, will be employed for all environmental samples. This system will allow for early detection of errors made in the field or by the laboratory so that necessary adjustments can be made while the field crew is mobilized.

The PM will maintain contact with the FOL and Data Validation Coordinator to ensure that management of the acquired data proceeds in an organized and expeditious manner.

12.0 PREVENTIVE MAINTENANCE PROCEDURES

Measuring equipment used in environmental monitoring or analysis for the NWS Earle Pre-Design Investigation shall be maintained in accordance with the manufacturer's operation and maintenance manuals. Equipment and instruments shall be calibrated in accordance with the procedures, and at the frequencies, discussed in Section 7.0 (Calibration Procedures and Frequency). Preventive maintenance for laboratory equipment is discussed in the remainder of this section.

12.1 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

Proper maintenance of laboratory instruments and equipment is essential to ensuring their readiness when needed. Maintenance intervals are established for each instrument based on manufacturer's recommendations. All instruments must be labeled with a model number and serial number, and a maintenance logbook must be maintained for each instrument. Personnel must be alert to the maintenance status of the equipment they are using at all times.

12.1.1 Major Instruments

Table 12-1 provides a summary of preventive maintenance procedures typically performed for key analytical instruments. Maintenance of key instruments is sometimes covered under service contracts with external firms. These contracts provide for periodic routine maintenance to help guard against unexpected instrument downtime. The contracts also provide for quick response for unscheduled service calls when malfunctions are observed by the operator.

The use of manufacturer-recommended grades or better of supporting supplies and reagents is also a form of preventive maintenance. For example, gases used in the various GC and metals instruments should be of sufficient grade to minimize fouling of the instrument. The routine use of septa, chromatographic columns, ferrules, atomic absorption furnace tubes, and other supporting supplies from reputable manufacturers will assist in averting unnecessary periods of instrument downtime.

12.1.2 Refrigerators/Ovens

The temperatures of refrigerators used for sample storage and drying ovens will be monitored a minimum of once daily. The acceptable range for refrigerator temperatures is 4°C ±2°C. Required temperatures of ovens will vary based on the analytical methods for which the ovens are used. The temperatures will be recorded on temperature logs that contain the following information at a minimum:

- Date
- Temperature
- Initials of person performing the check

Maintenance of the logs is typically the responsibility of the sample custodian. However, assignment of responsibilities for temperature monitoring to specific personnel does not preclude the participation of other laboratory personnel. If unusual temperature fluctuations are noted, it is the responsibility of the observer to immediately notify the person in charge of the discrepancy before the condition of the samples is compromised.

Unstable or fluctuating temperatures may be indicative of malfunctions in the cooling or heating system. On the other hand, the instability may be due to frequent opening of the door. Regardless of the cause, such an observation must be investigated, and modifications must be made to access procedures or repairs to equipment must be made to prevent jeopardizing the integrity of the samples.

TABLE 12-1

TYPICAL PREVENTIVE MAINTENANCE FOR KEY ANALYTICAL INSTRUMENTS
NWS EARLE, COLTS NECK, NEW JERSEY

Instrument	Preventive Maintenance	Maintenance Frequency
GC	Replace solvent washes and clean syringe. Clip column, clean injection port, replace liner, and bake oven.	Daily. As required.
ICP	Change sample introduction tubing, clean nebulizer, clean spray chamber, clean torch, manual profile, and automatic profile optics.	As required.
CVAA	Change sample introduction tubing, change drying cell, re-zero detector.	As required.

13.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

The purpose of this section is to indicate the methods by which it will be ensured that the data collected for this investigation coincide with the project objectives as specified in Section 2 of this QAPP. The data assessment will be conducted to evaluate analytical data quality via compliance with the QA objectives addressed in Section 5.0 of this QAPP. Additionally, the data will be reviewed for indications of interferences to results caused by sample matrices; cross contamination during sampling, cross contamination in the laboratory, and sample preservation and storage anomalies.

The data validation process will be used to flag data with quality indicators that fall outside the QC acceptance limits. A summary of the data validation qualifiers for all project samples will be prepared. This summary will include a list of chemicals identified as laboratory and/or field QC blank contaminants, holding time exceedances, samples exhibiting field duplicate/replicate imprecision as well as affected chemicals, rejected results and associated specific causes, and general causes of estimated results. This summary will facilitate the preparation of a summary of the data validation results and completeness assessment for inclusion in the report.

Compliance with the completeness objectives for laboratory measurements/data will be calculated electronically via a database subroutine. Sections 13.1, 13.2, and 13.3 present equations to be used for computing precision, accuracy, and completeness values, respectively. Section 13.4 presents additional data quality considerations that will be evaluated after completion of data validation.

13.1 ACCURACY ASSESSMENT

As described in Sections 5.2.2 and 9.2, to assure the accuracy of the analytical procedures, a minimum of 1 of every 20 samples is spiked with a known amount of the analyte or analytes to be evaluated. The spiked sample is then analyzed. The increase in concentration of the analyte observed in the spiked sample because of the addition of a known quantity of the analyte compared to the reported value of the same analyte in the unspiked sample determines the %R. Control charts are plotted by the laboratory for each commonly analyzed compound and kept on matrix-specific and analyte-specific bases. The %R for a spiked sample is calculated according to the following formula:

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

Section 9.2 also describes the use of surrogate spikes and LCSs as measures of accuracy. The %R for a surrogate spike or LCS is calculated using the following formula:

$$\%R = \frac{\text{Experimental Concentration}}{\text{Known Amount Added}} \text{ X } 100\%$$

13.2 PRECISION ASSESSMENT

As described in Sections 5.1.1 and 9.2, duplicate samples (for inorganic analyses) and MSD samples (for organic analyses) are prepared and analyzed at a minimum frequency of 1 per every 20 environmental samples. As addressed in Section 5.6, field duplicate samples will also be collected at a minimum frequency of 1 per 10 environmental samples. The RPD between the sample (or spike) and duplicate (or duplicate spike) is calculated using the following formula:

$$\text{RPD} = \frac{\text{Amount in Sample 1} - \text{Amount in Sample 2}}{0.5\,(\text{Amount in Sample 1} + \text{Amount in Sample 2})} \text{ X } 100\,\%$$

13.3 COMPLETENESS ASSESSMENT

As addressed in Section 4.3, completeness is the ratio of the number of valid sample results to the total number of sample results expected to be obtained for the project as a whole. Following the completion of the analytical testing and data validation, the percent completeness will be calculated using the following equation:

$$\text{Completeness} = \frac{\text{(number of valid measurements)}}{\text{(number of measurements planned}} \text{ x } 100\%$$

13.4 DATA ASSESSMENT

The laboratory data collected during the NWS Earle Pre-Design Investigation will be used to meet the objectives presented in Section 2 of this QAPP. The QC results associated with each analytical parameter (only one) will be compared with the objectives presented in Sections 5.1 though 5.5 of this QAPP. Only data deemed usable during data validation will be considered usable for quantitative purposes.

In addition, the data obtained will be both qualitatively and quantitatively assessed. The results of this assessment will be presented in the NWS Earle Pre-Design Investigation Report. Examples of issues to be considered in the data assessment are as follows:

- Were all samples obtained using the methodologies and SOPs specified in the QAPP?
- Were samples obtained from all sampling locations for all analyses specified in the QAPP?
- Were all laboratory analyses performed using the methodologies specified in the QAPP?
- Was all laboratory data validated as specified in the QAPP?
- Do any analytical results exhibit elevated reporting limits? If so, what are the causes and what overall impact does this have on the data?
- Were any data points determined to be unusable (qualified as "R") during the data validation process? If so, are these rejected data points critical in meeting the objectives of the project?
- Have sufficient data of appropriate quality been generated to support the objectives described in Section 2 of the QAPP?

14.0 CORRECTIVE ACTION

Under the TtNUS QA/QC program, it is required that any and all personnel noting conditions adverse to quality report these conditions immediately to the PM and QAM. These parties, in turn, are charged with performing root-cause analyses and implementing appropriate corrective action in a timely manner. It is ultimately the responsibility of the QAM to document all findings and corrective actions taken and to monitor the effectiveness of the corrective measures performed.

14.1 FIELD CORRECTIVE ACTION

Field nonconformances or conditions adverse to quality must be identified and corrected as quickly as possible so that work integrity or product quality is not compromised. The need for corrective action may arise based on deviations from Project Plans and procedures, adverse field conditions, or other unforeseen circumstances. Corrective action needs may become apparent during the performance of daily work tasks or as a consequence of internal or external field audits.

Corrective action may include resampling and may involve amending previously approved field procedures. If warranted by the severity of the problem (e.g., if a change in the approved Project Plan documents or SOPs is required), the Navy will be notified in writing via a FTMR, and Navy (in conjunction with USEPA Region II and NJDEP) approvals will be obtained. The FOL is responsible for initiating FTMRs; an FTMR will be initiated for all deviations from the Project Plan documents, as applicable. An example of an FTMR is provided as Figure 14-1. Copies of all FTMRs will be maintained with the on-site project planning documents and will be placed in the final evidence file.

Minor modifications to field activities such as a slight offset of a sampling location will be initiated at the discretion of the FOL, subject to on-site approval by NWS Earle personnel. Approval for major modifications (e.g., elimination of a sampling point) must be obtained via an FTMR.

14.2 LABORATORY CORRECTIVE ACTION

In general, laboratory corrective actions are warranted whenever an out-of-control event or potential out-of-control event is noted. The specific corrective action taken depends on the specific analysis and the nature of the event. Generally, the following occurrences alert laboratory personnel that corrective action may be necessary:

- QC data are outside established warning or control limits.
- Method blank analyses yield concentrations of target analytes greater than acceptable levels.

- Undesirable trends are detected in spike recoveries or in duplicate RPDs.
- There is an unexplained change in compound detection capability.
- Inquiries concerning data quality are received.
- Deficiencies are detected by laboratory QA staff audits or from performance evaluation sample test results.

Corrective actions are typically documented for out-of-control situations on a corrective action form. Using a corrective action form, any employee may notify the QA/QC Officer of a problem. The QA/QC Officer generally initiates the corrective action by relating the problem to the appropriate Laboratory Manager and/or Internal Coordinator, who then investigates or assigns responsibility for investigating the problem and its cause. Once determined, an appropriate corrective action is approved by the QA/QC Officer, its implementation is verified and documented on the corrective action form and it is further documented through audits.

14.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The need for corrective action may become apparent during data validation, interpretation, or presentation activities or problems may be identified as a result of oversight findings. The performance of rework, instituting a change in work procedures, or providing additional/refresher training are possible corrective actions relevant to data evaluation activities. The PM will be responsible for approving the implementation of corrective action.

FIGURE 14-1

TETRA TECH NUS
FIELD TASK MODIFICATION REQUEST FORM

Client Identification | Project Number | FTMR Number

To_____ Location_____ Date_____

Description:

_____
_____
_____
_____

Reason for Change:

_____
_____
_____
_____

Recommended Disposition:

_____
_____
_____
_____

_____
Field Operations Leader (Signature, if applicable) Date

Disposition:

_____
_____
_____
_____

_____
Project Manager (Signature, if required) Date

_____

Distribution:
Program Manager
Quality Assurance Officer
Project Manager
Field Operations Leader_____

Others as required_____
_____
_____

15.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

QA reports to management will be provided in three primary formats during the course of the NWS Earle Pre-Design Investigation. Data validation letter reports will be prepared on a Sample Delivery Group-specific basis and will summarize QA issues for the subcontract laboratory data. In addition, daily verbal reports summarizing accomplishments and QA/QC issues during the field investigation will be provided by the FOL. Finally, monthly progress reports are provided by the PM to the Navy. In addition, a summary of data validation qualifiers and a completeness assessment for all project samples will be included in the PDI Report.

15.1 CONTENTS OF PROJECT QUALITY ASSURANCE REPORTS

The contents of the specific QA reports are as follows. The data validation reports address all major and minor laboratory noncompliances as well as noted sample matrix effects. In the event that major problems occur with the analytical laboratory (e.g., holding time exceedances or calibration noncompliances, etc.), the Data Validation Coordinator will notify the PM, the Program Manager, and the Laboratory Services Coordinator. Such notifications (if necessary) are typically provided via internal memoranda and are placed in the project file. Such reports contain a summary of the noncompliance, a synopsis of the impact on individual projects, and recommendations regarding corrective action and compensational adjustments. Corrective actions are initiated at the program level.

The FOL will provide the PM with daily reports via telephone regarding accomplishments, deviations from the QAPP, upcoming activities, and a QA summary during the course of the field investigation. In addition, monthly project review meetings are held for all active Navy CLEAN projects. Issues discussed at the project review meeting include all aspects of budget and schedule compliance and QA/QC problems. The PM provides a monthly progress report to the Navy that addresses the project budget, schedule; accomplishments, planned activities, required revisions of the QAPP, QA/QC issues, and intended corrective actions.

15.2 INDIVIDUALS RECEIVING/REVIEWING QUALITY ASSURANCE REPORTS

Data validation QA Reports are provided to the PM for inclusion in the project files. In the event that major problems are observed for a given laboratory, the Program Manager, Deputy Program Manager, QAM, PM, and Laboratory Services Coordinator are provided with copies of the QA report. Weekly field progress reports are provided to the PM by the FOL. Monthly progress reports are provided to the Navy CLEAN Program Manager and the Navy CLEAN Contracting Officers Technical Representative.

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APPENDIX A

PROJECT-SPECIFIC HEALTH AND SAFETY PLAN

Health and Safety Plan
for
Pre-Design Investigation Work Plan
at
Naval Weapons Station Earle
Colts Neck, New Jersey

Engineering Field Activity Northeast
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0851

April 2003

HEALTH AND SAFETY PLAN
FOR
PRE-DESIGN INVESTIGATION WORK PLAN
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:

Engineering Field Activity Northeast
Environmental Branch, Code 18
Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop No. 82
Lester, Pennsylvania 19113-2090

Submitted by:
TetraTech NUS, Inc.
661 Andersen Drive
Foster Plaza 7
Pittsburgh, Pennsylvania 15220-2745

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0851

APRIL 2003

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) provides practices and procedures for Tetra Tech NUS, Inc. (TtNUS) and subcontractor personnel engaged in environmental investigation activities at the Naval Weapons Station (NWS) Earle in Colts Neck, Monmouth County, New Jersey. This HASP must be used in conjunction with the TtNUS Health and Safety Guidance Manual. Both of these documents must be present at the site during the performance of site activities. The Guidance Manual provides detailed information pertaining to the HASP as well as applicable TtNUS Standard Operating Procedures (SOPs). This HASP and the contents of the Guidance Manual were developed to comply with the requirements stipulated in 29 CFR 1910.120 (Occupational Safety and Health Administration's [OSHA's] Hazardous Waste Operations and Emergency Response Standard); OSHA's Construction Industry Standards, 29 CFR 1926; and NWS Earle procedures and protocol, as they may apply.

This HASP has been developed using the latest available information regarding known or suspected chemical contaminants and potential physical hazards associated with the proposed work at the site. The HASP will be modified if new information becomes available. All changes to the HASP will be made with the approval of the TtNUS Project Health and Safety Officer (PHSO) and the TtNUS Health and Safety Manager (HSM). Requests for modifications to the HASP will be directed to the PHSO, who will determine if the changes are necessary. The PHSO will notify the Project Manager (PM), who will notify affected personnel of changes.

1.1 KEY PROJECT PERSONNEL AND ORGANIZATION

This section defines responsibility for site safety and health for TtNUS and subcontractor employees engaged in onsite activities. Personnel assigned to these positions will exercise the primary responsibility for onsite health and safety. These persons will be the primary point of contact for questions regarding the safety and health procedures and the selected control measures that are to be implemented for onsite activities.

- The TtNUS PM is responsible for the overall direction of health and safety for this project.
- The PHSO is responsible for developing this HASP in accordance with applicable OSHA regulations. Specific responsibilities include:

  i. Providing information regarding site contaminants and physical hazards associated with the site.
  ii. Establishing air monitoring and decontamination procedures.
  iii. Assigning personal protective equipment (PPE) based on task and potential hazards.

iv. Determining emergency response procedures and emergency contacts.

v. Stipulating training requirements and reviewing appropriate training and medical surveillance certificates.

vi. Providing standard work practices to minimize potential injuries and exposures associated with hazardous waste work.

vii. Modify this HASP, as it becomes necessary.

- The TtNUS Field Operations Leader (FOL) is responsible for implementation of the HASP with the assistance of an appointed Site Safety Officer (SSO). The FOL manages field activities, executes the Work Plan, and enforces safety procedures as applicable that plan.
- The SSO supports site activities by advising the FOL on aspects of health and safety onsite. These duties may include:

i. Coordinates health and safety activities with the FOL.

ii. Selects, applies, inspects, and maintains PPE.

iii. Establishes work zones and control points in areas of operation.

iv. Implements air monitoring program for onsite activities.

v. Verifies training and medical clearance of onsite personnel status in relation to site activities.

vi. Implements Hazard Communication, Respiratory Protection Programs, and other associated health and safety programs as they may apply to site activities.

vii. Coordinates emergency services.

viii. Provides site-specific training for onsite personnel.

ix. Investigates accidents and injuries (see Attachment I - Illness/Injury Reporting Procedure and Form)

x. Provides input to the PHSO regarding the need to modify, this HASP, or applicable health and safety associated documents as per site-specific requirements.

- Compliance with the requirements stipulated in this HASP is monitored by the SSO and coordinated through the TtNUS HSM.

1.2 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name: NWS Earle
EFANE RPM: Michele DiGeambeardino
Site Contact: Lawrence Burg

Addr ss: 201Highway 34 South Colts Neck, NJ
Phone Number: (610) 595-0567 (Ext. 117)
Phone Number: (732) 866-2621

Scheduled Activities: Site activities that will be addressed in this HASP include excavation of test trenches, soil boring and split spoon sampling, sediment sampling, wetlands delineation, and surveying activities. Further details on these and other site tasks are in Section 4 of this HASP.

Dates of scheduled activities: Site activities will begin in the Spring of 2003.

Project Team:

TtNUS Management Personnel:	**Discipline/Tasks Assigned:**
Daniel C. Witt, P.E.	Project Manager
TBA	Field Operations Leader (FOL)
TBA	Project Geologist
Matthew M. Soltis, CIH, CSP	Health and Safety Manager
Donald J. Westerhoff, CSP	Project Health and Safety Officer (PHSO)
TBA	Site Safety Officer (SSO)

Other Potential TtNUS Project Personnel:

Tom Patton	Equipment Manager

Non-TtNUS Personnel	**Affiliation/Discipline/Tasks Assigned**
TBA	Excavation contractor
TBA	Drilling contractor
TBA	Analytical Laboratory
TBA	Surveying contractor

Hazard Assessment (for purpose of 29 CFR 1910.132) for HASP preparation has been conducted by:

Donald J. Westerhoff, CSP

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section is to direct and guide field personnel in the event of an emergency. All site activities are coordinated with the client contacts. In the event of an onsite emergency, personnel will evacuate to a safe place of refuge and notify the NWS Earle Emergency Coordinator who is the Fire Chief. The NWS Earle emergency staff will coordinate on-site activities. They are the only authorized emergency responders who provide service in emergency situations. TtNUS and subcontractor personnel will notify the NWS Earle Emergency Dispatcher and only provide initial or incipient stage emergency response measures. Workers who are ill or who have suffered a non-serious injury may be transported by site personnel to nearby medical facilities, provided that such transport does not aggravate or further endanger the welfare of the injured or ill person. The NWS Earle emergency response agencies listed in this plan are fully capable of providing the most effective response, and as such, are designated as the primary responders. These agencies are located within a reasonable distance from the area of site operations, which ensures adequate emergency response time. The TtNUS Project Manager and HSM are to be notified in the event of an onsite incident. This Emergency Action Plan conforms to the requirements of 29 CFR 1910.38(a), as allowed in 29 CFR 1910.120(l)(1)(ii).

TtNUS will, through necessary services, provide the following emergency action measures:

- Incipient stage fire-fighting support and prevention
- Incipient spill control and containment measures and prevention
- Removal of personnel from emergency situations
- Initial medical support for injuries or illnesses requiring basic first aid
- Site control and security measures as necessary

2.2 PRE-EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, emergencies resulting from chemical, physical, or fire hazards are the types of emergencies that could be encountered during site activities.

To minimize and eliminate the potential for these emergency situations, pre-emergency planning activities will include the following (which are the responsibility of the SSO and/or the FOL):

- Coordinating with local Emergency Response personnel to ensure that TtNUS emergency action activities are compatible with existing emergency response procedures. NWS Earle Fire Protection

and Emergency Services will be notified about scheduled events and activities. This is most imperative in situations where their services may be required.

- Establishing and maintaining information at the project staging area (support zone) for easy access in the event of an emergency. This information will include the following:
  - Chemical inventory (of chemicals used onsite), with Material Safety Data Sheets (MSDSs).
  - Onsite personnel medical records (Medical Data Sheets).
  - A log book identifying personnel onsite each day.
  - Hospital route map with directions (these should also be placed in each site vehicle).
  - Emergency notification - phone numbers.

The TtNUS FOL will be responsible for the following tasks:

- Identifying a chain of command for emergency action.
- Educating site workers to the hazards and control measures associated with planned activities at the site, and providing early recognition and prevention, where possible.
- Periodically performing practice drills to ensure site workers are familiar with incidental response measures.
- Providing the necessary equipment to safely accomplish identified tasks.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Emergency situations that may be encountered during site activities will generally be recognized by visual observation. Visual observation is primarily relevant for physical hazards that may be associated with the proposed scope of work. Visual observation will also play a role in detecting some chemical hazards. To adequately recognize chemical exposures, site personnel must have a clear knowledge of signs and symptoms of exposure associated with site contaminants. This information is provided in Table 6-1. Tasks to be performed at the site, potential hazards associated with those tasks, and the recommended control methods are discussed in detail in Sections 5.0 and 6.0. Additionally, early recognition of hazards will be supported by daily site surveys to eliminate a situation predisposed to an emergency. The FOL and/or the SSO will be responsible for performing surveys of work areas before initiating site operations and periodically while operations are being conducted. Findings will be documented by the FOL and/or the SSO in the Site Health and Safety logbook; however, site personnel will be responsible for reporting hazardous situations. Where potential hazards exist, TtNUS will initiate control measures to prevent adverse effects to human health and the environment.

The above actions will provide early recognition for potential emergency situations and allow TtNUS to initiate necessary control measures. However, if the FOL and the SSO determine that control measures are not sufficient to eliminate the hazard, TtNUS will withdraw from the site and notify the appropriate response agencies listed in Table 2-1.

2.3.2 Prevention

TtNUS and subcontractor personnel will minimize the potential for emergencies by following the Health and Safety Guidance Manual and ensuring compliance with the HASP and applicable OSHA regulations. Daily site surveys of the work areas will also assist in the prevention of illness/injuries by identifying potential hazards and initiating appropriate control measures. The FOL or SSO will conduct these surveys at the beginning of each workday.

2.4 EVACUATION ROUTES, PROCEDURES, AND PLACES OF REFUGE

An evacuation will be initiated whenever recommended hazard controls are insufficient to protect the health, safety, or welfare of site workers. Specific examples of conditions that may initiate an evacuation include, but are not limited to, the following: severe weather conditions; fire or explosion; monitoring instrumentation readings that indicate levels of contamination are greater than established action levels; and evidence of personnel overexposure to potential site contaminants.

In the event of an emergency requiring evacuation, personnel will immediately stop activities and report to the designated safe place of refuge unless doing so would pose additional risks. When evacuation to the primary place of refuge is not possible, personnel will proceed to a designated alternate location and remain until further notification from the TtNUS FOL. Other safe places of refuge will be identified before the commencement of site activities by the SSO and will be conveyed to personnel as part of the pre-activities training session. This information will be reiterated during daily safety meetings. Whenever possible, the safe place of refuge will also serve as the telephone communications point for that area. During an evacuation, personnel will remain at the refuge location until directed otherwise by the TtNUS FOL or the On-scene Incident Commander. The FOL or the SSO will perform a head count at this location to account for and to confirm the location of site personnel. Emergency response personnel will be immediately notified of unaccounted personnel. The SSO will document the names of personnel onsite (on a daily basis) in the site Health and Safety Logbook. This information will be used to perform the head count in the event of an emergency.

Evacuation procedures will be discussed during the pre-activities training session before the initiation of project tasks. Evacuation routes from the site and safe places of refuge are dependent on the location at which work is being performed and the circumstances under which an evacuation is required. Additionally, site location and meteorological conditions (i.e., wind speed and direction) may dictate evacuation routes. As a result, assembly points will be selected and communicated to the workers relative to the site location where work is being performed. Evacuation should always take place in an upwind direction from the site.

2.5 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

TtNUS personnel will work in close proximity at NWS Earle. As a result, hand signals, voice commands, and line-of-site communication will be sufficient to alert site personnel of an emergency. When project tasks are performed simultaneously on different sites, cell phones or air/vehicle horns will be used to communicate emergency situations. If an emergency warranting evacuation occurs, the following procedures are to be initiated:

- Initiate the evacuation via hand signals, voice commands, line-of-site communication, cell phones or air/vehicle horns. The following signals shall be used when communication via air/vehicle horn is necessary:

HELP	three short blasts	. . .
EVACUATION	three long blasts	- - -

- Report to the designated refuge point.
- Once nonessential personnel are evacuated, appropriate response procedures will be enacted to control the situation.
- Give the FOL (FOL will serve as the Incident Coordinator) pertinent incident details.

TtNUS personnel will perform removal of personnel from emergency situations and may provide initial medical support for injuries/illnesses requiring only first aid level support. Medical attention above that level will require assistance and support form the designated emergency response agency. Attachment I provides the procedure to follow when reporting an injury/illness and the form to be used for this purpose. **If the emergency involves exposures to chemicals, follow the steps provided in Figure 2-2.**

In the event that site personnel cannot mitigate the hazardous situation, the FOL and/or SSO, will enact emergency notification procedures to secure additional assistance in the following manner:

Dial the NWS Earle Emergency Center immediately and then call other pertinent emergency contacts listed in Table 2-1 to report the incident. Give the emergency operator the location of the emergency, the type of emergency, the number of personnel injured, and a brief description of the incident. Stay on the phone and follow the instructions given by the operator. The operator will then notify and dispatch the proper emergency response agencies.

2.6 EMERGENCY CONTACTS

Before initiating field activities, personnel will be thoroughly briefed on the emergency procedures to be followed in the event of an accident. Table 2-1 provides a list of emergency contacts and their associated telephone numbers. This table must be posted where it is readily available to site personnel. Facility maps should also be posted showing potential evacuation routes and designated meeting areas

TABLE 2-1

EMERGENCY REFERENCE
NWS EARLE, NEW JERSEY

CONTACT	PHONE NUMBER
Emergency Center: Police, Fire, Ambulance	**2911** or (732) 866-2911
Fire Department, NWS Earle	(732) 866-2333
Security, NWS Earle	(732) 866-2291
NWS Earle, UXO Support (Chief Winkle)	(732) 866-2009
Riverview Medical Center	(732) 741-2700
New Jersey Poison Control Center	(800) 962-1253
New Jersey One Call (Underground Utility Locator)	(800) 272-1000
National Response Center	(800) 424-8802
Chemtrec	(800) 424-9300
NWS Earle Base Contact – Larry Burg	(732) 866-2621 (732) 327-2717-pager (732) 539-1929 -cell
EFANE RPM – Michele DiGeambeardino	(610) 595-0567 ext. 117
TtNUS Project Manager – Dan Witt, P.E.	(412) 921- 8259
Health and Safety Manager - Matthew M. Soltis, CIH, CSP	(412) 921-8912
Project Health and Safety Officer – Donald J. Westerhoff, CSP	(412) 921-7281

2.7 EMERGENCY ROUTE TO HOSPITAL

Riverview Medical Center; 1 Riverview Plaza, Red Bank, New Jersey 07701

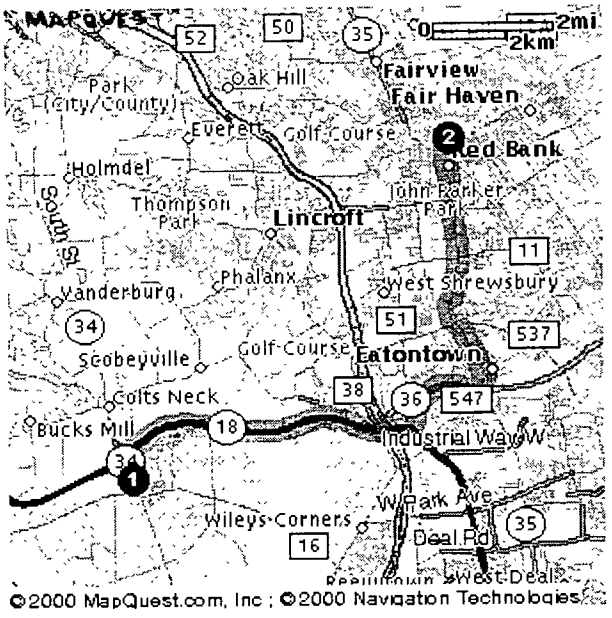
Directions from Mainside Base:

Turn Route 34 north to County Road ❶. At the "T" turn right onto Swimming River Road. Make a left onto Sycamore Avenue. In Shrewsbury, turn left on to Broad Street. Make a right onto Front Street and an immediate left onto Wharf Avenue. ❷The hospital is on the right.

FIGURE 2-1

ROUTE MAP FROM MAIN SIDE NWS EARLE TO RIVERSIDE MEDICAL CENTER

FULL ROUTE



DESTINATION

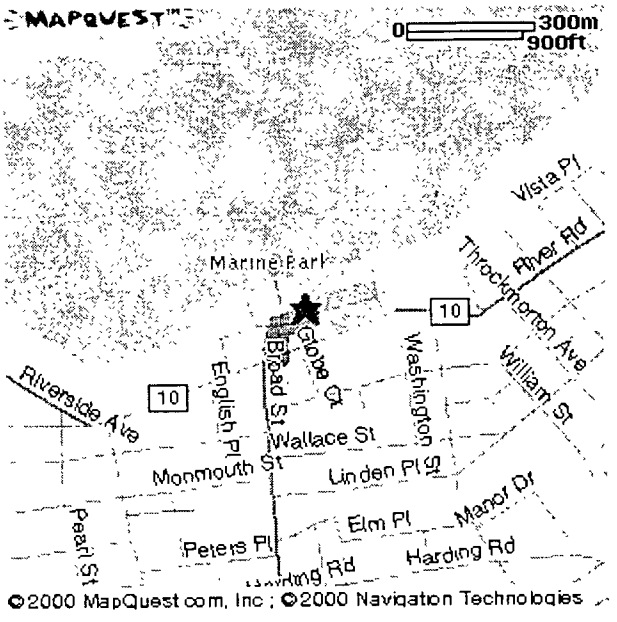


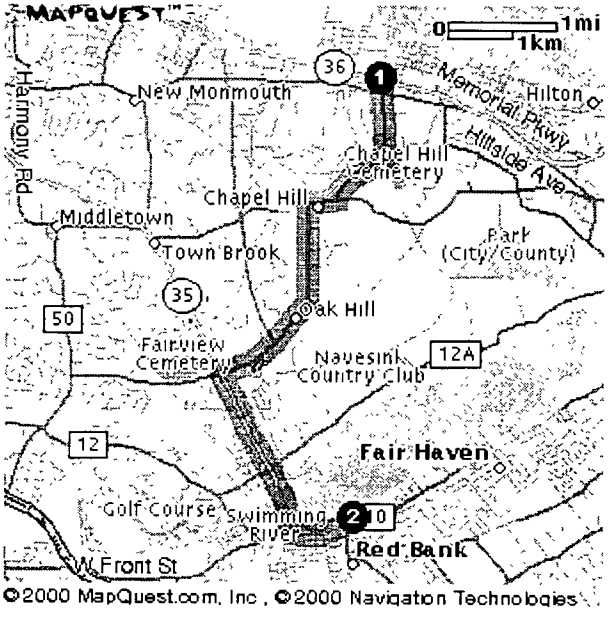
FIGURE 2-1A

ROUTE MAP FROM WATERFRONT NWS EARLE TO RIVERSIDE MEDICAL CENTER

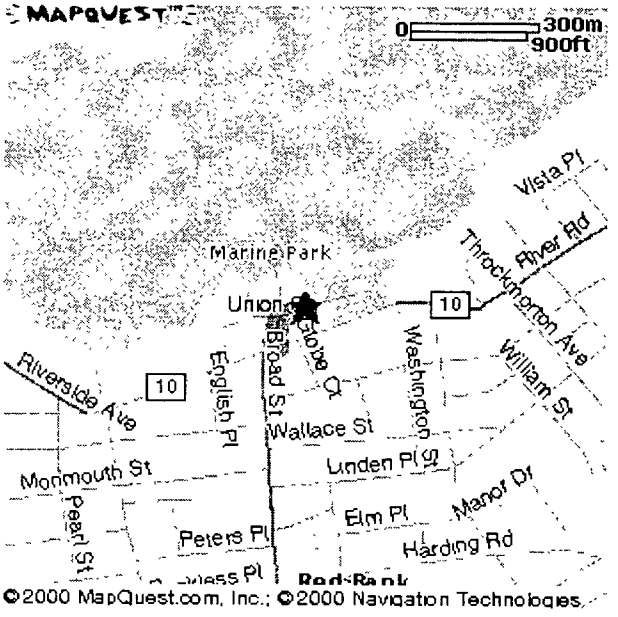
Directions from the Waterfront:

Take Normandy Road south. ❶ Make the first left onto Sleepy Hollow Road. At the "T" turn right onto Chapel Hill Road. Turn left onto Route 35. After crossing Cooper's Bridge, make a left onto Front Street. After crossing Maple, take the second left onto Wharf Avenue. ❷ Riverview Hospital is on the right.

FULL ROUTE



Destination



2.8 DECONTAMINATION PROCEDURES / EMERGENCY MEDICAL TREATMENT

During a site evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. Decontamination will not be performed if the incident warrants immediate evacuation. However, it is unlikely that an evacuation would occur that would require workers to evacuate the site without first performing the necessary decontamination procedures.

2.9 INJURY/ILLNESS REPORTING

If TtNUS personnel are injured or develop an illness as a result of working on site, the TtNUS "Injury/Illness Procedure" (Attachment I) must be followed. Following this procedure it is necessary for documenting the information obtained at the time of the incident.

Pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite. If an exposure to hazardous materials has occurred, provide information on the chemical, physical, and toxicological properties of the subject chemical(s) to medical service personnel.

2.10 PPE AND EMERGENCY EQUIPMENT

PPE normally available for the project will also be available for use in case of an emergency or spill incident.

A first aid kit, eye wash units, and fire extinguishers will be maintained on-site and shall be immediately available for use in case of an emergency.

FIGURE 2-2
EMERGENCY RESPONSE PROTOCOL

The purpose of this protocol is to provide guidance for the medical management of injury situations.

In the event of a personnel injury or accident:

- Rescue, when necessary, employing proper equipment and methods.
- Give attention to emergency health problems -- breathing, cardiac function, bleeding, and shock.
- Transfer the victim to the medical facility designated in this HASP by suitable and appropriate conveyance (i.e. ambulance for serious events)
- Obtain as much exposure history as possible (a Potential Exposure report is attached).
- If the injured person is a Tetra Tech NUS employee, call the medical facility and advise them that the patient(s) is/are being sent and that they can anticipate a call from the WorkCare physician. WorkCare will contact the medical facility and request specific testing which may be appropriate. WorkCare physicians will monitor the care of the victim. Site officers and personnel should not attempt to get this information, as this activity leads to confusion and misunderstanding.
- Call WorkCare at 1-800-455-6155 enter Extension 109, or follow the voice prompt for after hours and weekend notification, and be prepared to provide:
  - Any known information about the nature of the injury.
  - As much of the exposure history as was feasible to determine in the time allowed.
  - Name and phone number of the medical facility to which the victim(s) has/have been taken.
  - Name(s) of the involved Tetra Tech NUS, Inc. employee(s).
  - Name and phone number of an informed site officer who will be responsible for further investigations.
  - Fax appropriate information to WorkCare at (714) 456-2154.
- Contact Corporate Health and Safety Department (Matt Soltis) at 1-800-245-2730.
- Contact the Human Resources Manager (Marilyn Duffy) at 1-800-245-2730.

As data is gathered and the scenario becomes more clearly defined, this information should be forwarded to WorkCare.

WorkCare will compile the results of data and provide a summary report of the incident. A copy of this report will be placed in each victim's medical file in addition to being distributed to appropriately designated company officials.

Each involved worker will receive a letter describing the incident but deleting personal or individual comments. A personalized letter describing the individual findings/results will accompany this generalized summary. A copy of the personal letter will be filed in the continuing medical file maintained by WorkCare.

FIGURE 2-2 (continued)
WORKCARE

POTENTIAL EXPOSURE REPORT

Name: _____ Date of Exposure: _____

Social Security No.: _____ Age: _____ Sex: _____

Client Contact: _____ Phone No.: _____

Company Name: _____

I. **Exposing Agent**
Name of Product or Chemicals (if known): _____

Characteristics (if the name is not known)
Solid Liquid Gas Fume Mist Vapor

II. **Dose Determinants**
What was individual doing? _____
How long did individual work in area before signs/symptoms developed? _____
Was protective gear being used? If yes, what was the PPE? _____
Was their skin contact? _____
Was the exposing agent inhaled? _____
Were other persons exposed? If yes, did they experience symptoms? _____

III. **Signs and Symptoms** (check off appropriate symptoms)

Immediately With Exposure:

Burning of eyes, nose, or throat
Tearing
Headache
Cough
Shortness of Breath
Chest Tightness / Pressure
Nausea / Vomiting
Dizziness
Weakness

Delayed Symptoms:

Weakness
Nausea / Vomiting
Shortness of Breath
Cough
Loss of Appetite
Abdominal Pain
Headache
Numbness / Tingling

IV. **Present Status of Symptoms** (check off appropriate symptoms)
Burning of eyes, nose, or throat
Tearing
Headache
Cough
Shortness of Breath
Chest Tightness / Pressure
Cyanosis
Nausea / Vomiting
Dizziness
Weakness
Loss of Appetite
Abdominal Pain
Numbness / Tingling

Have symptoms: (please check off appropriate response and give duration of symptoms)
Improved: _____ Worsened: _____ Remained Unchanged: _____

V. **Treatment of Symptoms** (check off appropriate response)
None: _____ Self-Medicated: _____ Physician Treated: _____

3.0 SITE BACKGROUND

3.1 SITE HISTORY AND LOCATION

The NWS Earle is located in the central coastal region of Monmouth County in Colts Neck, New Jersey, approximately 35 miles south of New York City and 70 miles northeast of Philadelphia. It is situated on approximately 11,134 acres and includes a Mainside area, which is approximately 10 miles inland from the Atlantic Ocean at Sandy Hook Bay, and a Waterfront area, which includes an ammunition depot and associated piers. The Mainside and Waterfront areas are linked by a narrow tract of land that serves as a right-of-way for a government road and railroad.

The main entrance to NWS Earle is located off State Route 34, and the entrance to the Waterfront area is located adjacent to State Route 36.

The majority of the land at the Mainside area is undeveloped land associated with ordnance operations, production, and storage facilities; the undeveloped land is encumbered by explosive safety quantity distance (ESQD) arcs. Land use at the Mainside facility includes residences, office buildings, workshops and warehouses, recreational areas, open space, and undeveloped land. The area around the Mainside facility includes agricultural areas, vacant land, and low-density residential land.

3.1.1 Site 13

Site 13 is located at least partially within ESQD arcs. Therefore, future development at this site is severely restricted. The DPDO Yard is an area of fill material extending into a marsh near the rail classification yards. Activities at the site included storage of scrap metals and batteries and the burial of material, such as cars, trucks, electronic equipment, clothing/shoes, sheet metal, furniture, scrap metal, and batteries. Additionally, batteries were broken open at the site for lead recovery, and acid was drained onto the ground. Since the primary function of this site was scrap metal storage, it is unlikely that any unexploded ordnance (UXO) would be present in the fill material, however, ordinance "shapes" have been encountered at this site during previous intrusive activities. Ordnance handling only occurs within specifically designated areas of NWS Earle. Obvious fill material is present at the ground surface at several places across the site. A partial removal of exposed debris was performed by NWS Earle public works employees in the summer of 1997.

NWS Earle is located in the coastal lowlands of Monmouth County, New Jersey, within the Atlantic Coastal Plain Physiographic Province. The Mainside area, which includes Site 13, lies in the outer Coastal Plain, approximately 10 miles inland from the Atlantic Ocean. The Mainside area is relatively flat, with elevations ranging from approximately 100 to 300 feet above mean sea level (MSL). The most significant topographic

relief within the Mainside area is Hominy Hills, a northeast-southwest-trending group of low hills located near the center of NWS Earle.

4.0 SCOPE OF WORK

This section describes the project tasks that will be performed at NWS Earle. Additionally, each task has been evaluated and the associated hazards and recommended control measures are listed in Table 5-1 of this HASP. If new tasks are to be performed at the site, Table 5-1 and this section will be modified accordingly.

The following is a list of activities that are proposed for the investigation:

- Mobilization and demobilization – These tasks include the procurement and shipping of equipment and materials for the field investigation; review of planning documents; site reconnaissance (site characterization, site preparation, layout of sampling and test trench locations, obtaining necessary utility or UXO clearances, isolation physical hazards, etc.)
- Test trench excavations – Test trenches will be excavated to define the lateral extent of Site 13.
- Soil boring and sampling activities (using hollow stem auger techniques) – Three soil borings will be installed within the landfill area to characterize the subsurface conditions at Site 13. Representative samples will be collected from each split-barreled sampler and a total and 10 soil samples will be collected from the soil boring to be submitted to a geotechnical laboratory for analysis.
- Decontamination of sampling and heavy equipment – Heavy equipment (drill rig) will be cleaned and decontaminated with high-pressure wash (pressure washer). Sampling equipment (split spoon, trowels, etc.) will be decontaminated with soap (liquinox or equivalent) and water and allowed to air dry.
- Topographic and Point Surveying – Ground surface topography, physical features, and point survey of the soil boring locations, test trench locations, wetland delineation stakes/flagging, and sediment sampling locations will be obtained from a New Jersey licensed surveyor.
- Wetlands Delineation – The wetlands delineation will include Site 13, contiguous areas within 50 feet of the Site 13 limits as presented in the Feasibility Study, and 500 feet of the channelized stream upstream of Site 13.
- Sediment sampling – Sediment sampling will be performed in a half circle pattern bounding sediment sample location SD03 which is adjacent to the landfill in an area where landfill soil was deposited via erosion.

These activities represent a summarization of the tasks as they apply to the scope and application of this HASP. If additional tasks are determined to be necessary, this HASP will be amended and a hazard evaluation of the additional tasks will be performed.

5.0 TASKS/HAZARDS/ASSOCIATED CONTROL MEASURES

Table 5-1 of this section serves as the primary portion of the site-specific HASP that identifies the tasks that are to be performed as part of the scope of work. This table will be modified and incorporated into this document as new or additional tasks are performed at the site. The anticipated hazards, recommended control measures, air-monitoring recommendations, required PPE, and decontamination measures for each site task are discussed in detail. This table and the associated control measures shall be changed if the scope of work, contaminants of concern, or other conditions change.

Through using the table, site personnel can determine which hazards are associated with each task and at each site, and what associated control measures are necessary to minimize potential exposure or injuries related to those hazards. The table also assists field team members in determining which PPE and decontamination procedures to use based on proper air monitoring techniques and site-specific conditions.

The TtNUS Health and Safety Guidance Manual accompanies this table and HASP. The guidance manual further explains supporting programs and elements for other site-specific aspects as required by 29 CFR 1910.120. The Guidance Manual should be referenced for additional information regarding air monitoring instrumentation, decontamination activities, emergency response, hazard assessments, hazard communication and hearing conservation programs, medical surveillance, PPE, respiratory protection, site control measures, standard work practices, and training requirements. Many TtNUS SOPs are also provided in the Guidance Manual.

Safe Work Permits issued for exclusion zone activities (See Section 10.10 and Attachment IV) will use elements defined in Table 5-1 as its primary reference. The FOL and/or the SSO completing the Safe Work Permit will add additional site-specific information. In situations in which the Safe Work Permit is more conservative than the direction provided in Table 5-1 due to the incorporation of site-specific elements, the Safe Work Permit will be followed. Attachment VI is the "Standard Operating Procedures for Unexploded Ordnance Avoidance Operations." Additional site-specific information will be added to the Safe Work Permit by the FOL and/or the SSO.

5.1 GENERAL SAFE WORK PRACTICES

In addition to the task-specific work practices identified on Table 5-1 general safe work practices should be followed when conducting work involving known and unknown site hazards. These safe work practices

establish a pattern of general precautions and measures for reducing risks associated with hazardous site operations.

- Refrain from eating, drinking, chewing gum or tobacco, taking medication, or smoking in contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists.
- Wash hands and face thoroughly upon leaving a contaminated or suspected contaminated area. A thorough shower and washing must be conducted as soon as possible if excessive skin contamination occurs.
- Avoid contact with potentially contaminated substances by walking around puddles, pools, mud, or other such areas. Avoid, whenever possible, kneeling on the ground or leaning or sitting on equipment.
- Be aware of the location of the nearest telephone and the emergency telephone numbers. See Section 2.0, Table 2-1.
- Rehearse unfamiliar operations prior to implementation.
- Maintain visual contact with each other and with other on-site team members by remaining in close proximity in order to assist each other in case of emergency.
- Establish appropriate safety zones including support, contamination reduction, and exclusion zones.
- Minimize the number of personnel and equipment in contaminated areas (such as the exclusion zone). Non-essential vehicles and equipment should remain within the Support Zone.
- Establish appropriate decontamination procedures for leaving the site.
- Observe coworkers for signs of toxic exposure and heat stress. Inform co-workers of potential symptoms of illness, such as headaches, dizziness, nausea, or blurred vision.
- Always stand upwind from the excavation site and away from the reach of the backhoe, tires, and outrigger.
- Establish hand signals with the backhoe operator.
- Work areas must be kept free of ground clutter.
- When in operation, personnel will remain more than three feet from the boom.

5.2 DRILLING OPERATIONS - SAFE WORK PRACTICES

The following Safe Work Practices are to be followed when working in or around drill rigs.

5.2.1 Before Drilling Operations

- Identify all underground utilities and buried structures before drilling. Use the Utility Locating and Excavation Clearance Standard Operating Procedure provided in Attachment II. See notes for the time lines required on and off-Base utility clearances under mobilization/demobilization Section 4.1.

- All drilling rigs will be inspected by the SSO (or designee), prior to the acceptance of the equipment at the site and prior to the use of the equipment. All repairs or deficiencies identified will be corrected prior to use. The inspection will be accomplished using the Equipment Inspection Checklist provided in Attachment III. Inspection frequencies will be once every 10 day shift or following repairs.

- The work area around the point of operation will be graded to the extent possible to remove any trip hazards near or surrounding operating equipment.

- The driller's helper will establish an equipment staging and lay-down plan. The purpose of this is to keep the work area clear of clutter and slips, trips, and fall hazards. Mechanisms to secure heavy objects such as auger flights will be provided to avoid the collapse stacked equipment.

- Potentially contaminated tooling will be wrapped in polyethylene sheeting for storage and transport to the centrally located decontamination unit.

5.2.2 <u>During Drilling Operations</u>

- Minimize contact to the extent possible with contaminated tooling and environmental media.

- Support functions (sampling and screening stations) will be maintained a minimum distance from the drilling rig of the height of the mast plus five feet to remove these activities from within physical hazard boundaries.

- Only qualified operators and knowledgeable ground crew personnel will participate in the operation of the drill rig. All drill rig operators will be instructed in the location and operation of emergency stop buttons, switches or other devices and these shall in good operating condition and inspected daily.

- In order to minimize contact with potentially contaminated tooling and media and to minimize lifting hazards, multiple personnel should move heavy tooling, where necessary.

- Only personnel absolutely essential to the work activity will be allowed in the exclusion zone. Site visitors will be escorted at all times.

5.2.3 Aft r Drilling Operations

- All equipment used within the exclusion zone will undergo a complete decontamination and evaluation by the SSO to determined cleanliness prior to moving to the next location, exiting the site, or prior to down time for maintenance.

- All motorized equipment will be fueled prior to the commencement of the day's activities. During fueling operations all equipment will be shutdown and bonded to the fuel provider.

- When not in use all drill rigs will be shutdown, emergency brakes set, and wheels chocked.

- All areas subjected to subsurface investigative methods will be restored to equal or better condition than original to remove any contamination brought to the surface and to remove any physical hazards. In situations where these hazards cannot be removed these areas will be barricaded to minimize the impact on field crews working in the area.

5.3 EXCAVATION – GENERAL SAFE WORK PRACTICES

5.3.1 Before Excavation Activities

- Although not anticipated to be present at Site 13, efforts to locate and clear underground utilities and buried structures must be performed before the commencement of excavation activities. Use the Utility Locating and Excavation Clearance Standard Operating Procedure provided in Attachment II. This includes an evaluation of the intended loading areas to insure swing patterns of excavators are not nearing any overhead power lines. A minimum clearance of 20 feet must be maintained from overhead power lines unless positive control of the energy source may be obtained. See Attachment II for additional information.

- All excavation boundaries will be demarcated with appropriated signage warning of construction activities in progress. Signs shall be used also for informational purposes as well to direct personnel, to indicate PPE requirements.

- All heavy equipment will be subjected to an equipment inspection, upon arrival on-site and prior to leaving. This inspection will be recorded on the Equipment Inspection Checklist provided in Attachment III of this HASP.

- Establish traffic patterns for foot and small vehicular traffic out of the pattern for heavy equipment.

- All traffic patterns for heavy equipment will be constructed to maintain traffic flow a minimum of 10 feet from unsupported walls (excavation boundaries) Note: The standard (29 CFR 1926 Subpart P) stipulates 2 feet distance from unsupported walls for resource staging. However, a maintenance distance of 10 feet will be maintained until soil classification is complete supporting a closer distance.

- All ground personnel will be provided with reflective vests to increase visibility and air horns to signal loud trucks and heavy equipment.

- All operators traveling over public roadways will carry a Commercial Drivers License (Class B minimum) and up-to-date medical clearance.

5.3.2 During Excavation Activities

- Ground activities should be supported with a ground spotter.

- Minimize the number of personnel in the excavation area.

- Heavy equipment and vehicles will maintain a safe distance (at least 3 feet) from the edges of open excavations to prevent potential excavation collapse or tipping of equipment/vehicles

- No personnel associated with this field effort will enter any excavation.

5.3.3 After Excavation Activities

- Excavations will not be left unattended. All excavations will be backfilled immediately after completion.

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Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring Type/Action Levels	Personal Protective Equipment *Italicize text represents optional equipment to be worn when conditions dictate.*	Decontamination Procedures
Mobilization/ Demobilization	***Chemical hazards:*** 1) Exposure to potential site contaminants is not anticipated during this activity. However, chemicals brought on site in support of field activities are to be identified, logged, accompanied by an appropriate MSDS, properly stored, and evaluated for purposes of hazard communication. ***Physical hazards:*** Potential physical hazards associated with this task may include: 2) Lifting (muscle strains and pulls) 3) Pinches and compressions 4) Slip, trips, and falls 5) Vehicular and foot traffic	***Chemical hazards:*** 1) To eliminate potential chemical hazards associated with this task ensure the following: - A chemical inventory list is generated for all chemicals brought on site (Complete Section 5.0 of the Health and Safety Guidance Manual). - Material Safety Data Sheets must be available for all chemicals brought on site (Complete Section 5.0 of the Health and Safety Guidance Manual). - Materials are stored in accordance with recommended practices and according to compatibility (See MSDS for storage and compatibility recommendations). ***Physical hazards:*** 2) Use machinery or multiple personnel for heavy lifts. - Use proper lifting techniques. 3) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. 4) Preview and prepare work locations where unstable/uneven terrain exists. Barricade all excavations and embankments deeper than 2 feet. 5) Identify all access/egress routes and locations to within established areas of operation. - All equipment capable of self-propelled movement will be equipped with movement alarms as applicable. - Traffic regulations for NWS Earle are to be followed as posted.	Not required during mobilization/demobilization.	Mobilization/demobilization activities is intended to initiate and proceed in Level D protection: Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants; or coveralls) - Safety shoes or boots with steel toe - Safety glasses - *Hardhat (when overhead hazards exists, or identified as an operation requirement)* - *Hearing protection for high noise areas, or as directed on an operation by operation scenario. As a general rule of thumb, if you need to raise your voice to be heard while engaged in conversation with someone who is within 2 feet of your position, you may be exposed to excessive noise levels and should use hearing protection.* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	As potential site contaminants are not anticipated as part of this task, personal decontamination is not required. All equipment arriving/leaving the site will be inspected prior to permitting this equipment to enter or exit the site. The SSO will inspect the equipment and give the clearance to allow the equipment to pass. Failure to pass inspection will prohibit entering or exiting the site as applicable. All equipment that fails the inspection will have to be decontaminated again to a level acceptable to the SSO prior to passage on or off site. All equipment permitted to pass on/off site will be documented using an Equipment Inspection Checklist. This form may be found in Attachment III of this HASP.

Task/Operation/ Location	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring/Type and Action Levels	Personal Protective Equipment *Italicize text represents optional equipment to be worn as conditions dictate*	Decontamination Procedures
Excavation Test Trenches to define lateral extent at Site 13	*Chemical hazards:* 1) Previous analytical data identified various contaminants of concern including metals, PCBs, various pesticides and VOCs (primarily chlorinated solvents and associated degradation products). However, none of the contaminants of concern were previously detected at concentrations that are likely to present an inhalation exposure hazard to site personnel. It should be noted that historical information on Site 13 suggests that the potential exists for encountering lead and battery acids (from previous disposal practices). Further information on some of the primary contaminants of concern is presented in Figure 6-1. 2) Transfer of contamination into clean areas or onto persons. *Physical hazards:* 3) Heavy equipment/machinery hazards (moving equipment, struck by hazards, etc.) 4) Collapse of the excavation 5) Energized systems (contact with underground or overhead utilities) 6) Noise in excess of 85 dBA 7) Vehicular and equipment traffic 8) Strain from heavy lifting 9) Slips, trips, and falls 10) Ambient temperature extremes (heat stress) 11) Cut, abrasions, and lacerations 12) UXO Hazards *Natural hazards:* 13) Insect/animal bites and stings, poisonous plants, etc. 14) Inclement weather	***Chemical hazards:*** 1) As a general rule, avoiding contact with contaminated media (air, water, soils, etc.) will be a universal control measure. Airborne concentrations of potential site contaminants of concern are unlikely to be present at levels that could represent a health hazard. However, some of the contaminants of concern are solids and may be bound to particulates. Site activities are not anticipated to present significant airborne dusts, however, if visible dusts are observed, dust suppression (area wetting methods) will used to minimize potential exposures. Exposure via ingestion or skin contact will be minimized through the use of PPE, following decontamination measures, and performing good personal hygiene including washing hands prior to performing hand to mouth activities (smoking, eating, etc.). 2) Restrict the cross use of equipment and supplies between locations and activities without first going through a suitable decontamination. ***Physical hazards:*** 3) All equipment to be employed will be: - Inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600,601,.602), and manufacturer's design, and documented as such using Equipment Inspection Checklist provided as Attachment III. Complete the Equipment Inspection Checklist for each piece of equipment used at the site. Equipment operation will be limited to knowledgeable operators and coordinated by experienced ground crew, as applicable. 4) All excavations shall be in conformance with requirements established under 29 CFR 1926.650 - .652 concerning sloping, shoring, storage, and movement on and over and around trenches and excavations. - **No personnel associated with this field effort will enter any excavations.** - All supplies, clean fill, vehicular traffic will be maintained at a minimum distance of 3 feet from the excavation. - Excavations will not proceed any closer than 10 feet to any foundation, footer, and/or support base. - Site control during excavation will be accomplished through the use of barricade tape and weighted poles and signs indicating excavation in progress 5) All utility clearances shall be obtained prior to any excavation activities (Refer to Attachment II). Where the utility clearance cannot be obtained in a reasonable period, or not located, excavations shall proceed with extreme caution and precede using cable and piping locators and other geophysical detection methods to avoid utility damage. 6) Hearing protection will be worn by all personnel in the immediate area of the excavator during test pit operations. 7) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e., Boom + 3 feet). - All equipment shall be equipped with movement warning systems. - Employ safety belts and follow the site traffic rules. See Section 5.3.1 through 5.3.3 of this HASP. 8) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 9) Preview work locations for unstable/uneven terrain. Avoid working/walking too close to excavation and other areas of unsure footing. 10) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding heat stress concerns is provided in Section 4.0 of the TtNUS Health and Safety Guidance Manual. 11) Avoid contacting sharp or jagged edges of containers or debris. Wear leather or cut-resistant gloves when handling excavated/sharp objects. 12) As a precautionary measure, intrusive activities at Site 13 will require UXO screening operations to be performed by EOD personnel from TtNUS. Any suspected UXO items will be marked and avoided. 13) Avoid nesting areas; Tape pant legs to work boots when in high brush (knee high) (tick hazards); Use repellents – follow manufacturer instructions. Apply Permonone over clothing articles to avoid skin irritation. Application of repellants should concentrate where ticks and other insects will gain entry. Pant to boots, shirt to pants, collar; Perform close body inspections upon exiting high brush areas to facilitate and remove ticks and other insects; Report potential hazards to the SSO. Follow guidance presented in Section 4.0 of the TtNUS Health and Safety Guidance Manual and Section 6.3 of this HASP. 14) Suspend or terminate operations until directed otherwise by SSO	**VOCs** **None of the contaminants of concern are anticipated to be present at detectable airborne concentrations. As a result, the contaminants of concern are unlikely to present a significant exposure potential to site workers, particularly via inhalation.** However, as a precautionary measure, a PID with a 10.6 eV lamp source will be used to: 1) Screen potential source areas (excavated soils) to detect the presence of any VOCs. Elevated readings at a source area will require: Worker breathing zones to be monitored to determine airborne concentrations of VOCs that may oppose an inhalation hazard to site workers. Any sustained (> 1 minute in duration) airborne concentration greater than 5.0 ppm in a worker breathing zone requires site activities to be suspended and notification of the PHSO. **Dusts/Particulates** Observations of visible dust (approximately 2 mg/m^3) will require site personnel to employ dust suppression (area wetting) methods if airborne dusts cannot be otherwise avoided by moving site operations upwind or by repositioning site equipment away from visible dust clouds. This conservative action level will control potential exposures to all site contaminants and nuisance particulates.	All excavation operations will be performed in Level D protection, including the following articles: - Standard field dress (long pants, sleeved shirts) - Steel toe safety shoes or work boots - Hard hat - Safety glasses with side shields - High visibility reflective vests - Hearing protection - *Tyvek or washable cotton coveralls if the potential for soiling work clothing exists or to control potential contact with ticks and other insects.* - *Nitrile gloves or surgical style gloves when handling potentially contaminated soils* - *Rubber boots or Impermeable boot covers to prevent soiling work boots or if muddy conditions are observed..* Personnel must closely inspect all PPE prior to beginning any on-site activities. **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task. As site conditions may change, the following equipment will be maintained during all on-site activities - Fire Extinguishers - First Aid Kits	**Personnel Decontamination** – This decontamination procedure for **Level D** protection will consist of - Equipment drop - Soap/water wash and rinse of outer gloves, boots, (if applicable) - Removal or PPE in the following order: Boot covers, Outer gloves, coveralls, and inner gloves (if applicable) - Use handy wipes or other hand cleaners until a more thorough cleaning with soap and water is available.

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring Type/Action Levels	Personal Protective Equipment *Italicize text represents optional equipment to be worn when conditions dictate.*	Decontamination Procedures
Multi-media sampling activities including soil and sediment sampling and handling/processing of split spoons and geotechnical sample cores.	***Chemical hazards:*** 1) Previous analytical data identified various contaminants of concern including metals, PCBs, various pesticides and VOCs (primarily chlorinated solvents and associated degradation products). However, none of the contaminants of concern were previously detected at concentrations that are likely to present an inhalation exposure hazard to site personnel. It should be noted that historical information on Site 13 suggests that the potential exists for encountering lead and battery acids (from previous disposal practices). Further information on some of the primary contaminants of concern is presented in Figure 6-1. 2) Transfer of contaminants into clean areas or onto persons ***Physical hazards:*** 3) Lifting (muscle strains and pulls) 4) Pinches and compressions 5) Slip, trips, and falls 6) Noise hazards ***Natural hazards:*** 7) Temperature extremes 8) Insect/animal bites and stings 9) Inclement weather	***Chemical hazards:*** 1) Use real-time monitoring instrumentation, action levels, and identified PPE to identify, quantify, and control exposures to potentially contaminated media (e.g., air, water, soils). 2) Restrict the cross-use of equipment and supplies between sampling locations without first going through a suitable decontamination. ***Physical hazards:*** 3) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 4) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. -. A remote sampling device must be used to sample drill cuttings near rotating tools. The equipment operator shall shutdown machinery if the sampler is near moving machinery parts. 5) Preview work locations for unstable/uneven terrain. 6) Use hearing protection when working in the vicinity of operating equipment or other noise producing equipment. ***Natural hazards:*** 7) Personnel must be aware of the conditions of heat/cold stress and take appropriate preventive measures to prevent the illness. For example, drink caffeine-free liquids to replace body fluids lost as a result of sweating if working under hot conditions, take rest breaks in appropriate areas (shaded if conditions are hot, and warm break areas if conditions are cold). See Section 4 of the Tetra Tech NUS Health and Safety Guidance Manual for additional information on heat stress and cold stress. 8) Avoid nesting areas; Tape pant legs to work boots when in high brush (knee high) (tick hazards); Use repellents – follow manufacturer instructions. Apply Permonone over clothing articles to avoid skin irritation. Application of repellants should concentrate where ticks and other insects will gain entry. Pant to boots, shirt to pants, collar; Perform close body inspections upon exiting high brush areas to facilitate and remove ticks and other insects; Report potential hazards to the SSO. Follow guidance presented in Section 4.0 of the TtNUS Health and Safety Guidance Manual and Section 6.3 of this HASP. 9) All operations will be temporarily suspended during electrical storms.	**VOCs** **None of the contaminants of concern are anticipated to be present at detectable airborne concentrations. As a result, the contaminants of concern are unlikely to present a significant exposure potential to site workers, particularly via inhalation.** However, as a precautionary measure, a PID with a 10.6 eV lamp source will be used to: 1) Screen potential source areas (excavated soils) to detect the presence of any VOCs. Elevated readings at a source area will require: Worker breathing zones to be monitored to determine airborne concentrations of VOCs that may oppose an inhalation hazard to site workers. Any sustained (> 1 minute in duration) airborne concentration greater than 5.0 ppm in a worker breathing zone requires site activities to be suspended and notification of the PHSO. **Dusts/Particulates** Observations of visible dust (approximately 2 mg/m^3) will require site personnel to employ dust suppression (area wetting) methods if airborne dusts cannot be otherwise avoided by moving site operations upwind or by repositioning site equipment away from visible dust clouds. This conservative action level will control potential exposures to all site contaminants and nuisance particulates.	All sampling activities are anticipated to proceed in Level D protection as specified below: Level D - (Minimum Requirements) For sampling activities: - Standard field attire (Sleeved shirt; long pants) - Safety shoes or boots (Steel toe) - Safety glasses with side shields - Nitrile gloves (Clean pair for each sample location), layered if necessary - *Hard-hat (when overhead hazards exists such as when working around heavy equipment, or as identified as an operation requirement)* - *Reflective vest for high traffic areas or when working around heavy equipment* - *Hearing protection for high noise areas, or as directed on an operation by operation scenario.* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	Decontaminate sample containers in accordance with the Field Sampling Plan / Work Plan. **Personnel decontamination:** - Equipment drop-off - Wash and rinse reusable outer protective garments (if applicable) - Remove and dispose of disposable PPE - Wash hands and face, leave contamination reduction zone. **Equipment decontamination:** See Task - Decontamination of Sampling and Heavy Equipment

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring/Type and Action Level	Personal Protective Equipment *Italicize text is optional equipment to be worn as conditions require.*	Decontamination Procedures
Soil Borings Soil boring activities will be performed using hollow stem auger techniques.	***Chemical hazards:*** 1) Previous analytical data identified various contaminants of concern including metals, PCBs, various pesticides and VOCs (primarily chlorinated solvents and associated degradation products). However, none of the contaminants of concern were previously detected at concentrations that are likely to present an inhalation exposure hazard to site personnel. It should be noted that historical information on Site 13 suggests that the potential exists for encountering lead and battery acids (from previous disposal practices). Further information on some of the primary contaminants of concern is presented in Figure 6-1. 2) Transfer of contamination into clean areas or onto clean persons. ***Physical hazards:*** 3) Rotating machinery (entanglement) 4) Noise 5) Energized systems 6) Slips, trips, and falls 7) Pinch/compression 8) Ambient Temperature Extremes ***Natural hazards:*** 9) Natural hazards (Insect/animal bites and stings) 10) Inclement weather	***Chemical hazards:*** 1) Use real-time monitoring instrumentation, action levels, identified PPE, and work practices to control exposures to potentially contaminated media (air, water, soils, etc.). 2) Decontaminate all equipment and supplies between borings and prior to leaving the site ***Physical hazards:*** 3) All equipment to be used will be - Inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600.601.602), and manufacturer's design. All inspections will be documented using the Equipment Inspection Checklist found in Attachment III of this HASP. - Operated and supported by knowledgeable operators, and ground crew. - Used within safe work zones, with routes of approach clearly demarcated. All personnel not directly supporting this operation will remain at least 25 feet from the point of operation. This will be the area identified as the exclusion zone. In addition to equipment considerations, the following safe operating procedures will be incorporated: - Hydraulic masts or other projecting devices shall be at least 20 feet from overhead power sources and a minimum of 3 feet from underground utilities. - Hand signals will be established prior to the commencement of the operation. - Only manufacturer-approved equipment may be used in conjunction with equipment repair procedures (e.g., flight connectors). - Work areas will be kept clear of clutter. - Secure all loose articles to avoid possible entanglement during coring activities. - All self-propelled equipment shall be equipped with movement warning systems. - All personnel will be instructed in the location and operations of the emergency shut-off device(s). This device will be tested initially (and then periodically) to ensure its operational status. - Areas will be inspected prior to the movement of the drill rig and support vehicles to eliminate any physical hazards. This will be the responsibility of the FOL and/or SSO. - The drill rig and support vehicles will be moved no closer than 3 feet to unsupported side-walls of excavations and embankments. 4) Hearing protection will be used during all drill rig intrusive activities. 5) All utility clearances shall be obtained prior to any subsurface investigation. Prior to any subsurface investigations, the locations of all underground utilities will be identified and marked. Follow the guidelines established in Attachment II (Utility Locating and Excavation Clearance SOP). The FOL will obtain written permit clearance prior to all subsurface investigations. 6) Preview and prepare work locations where unstable/uneven terrain exists. 7) Keep machine guards in place. Avoid moving parts. Secure long clothing, hair, or jewelry that could be entangled. 8) Personnel must be aware of the conditions of heat/cold stress and take appropriate preventive measures to prevent the illness. For example, drink caffeine-free liquids to replace body fluids lost in sweating if working under hot conditions, take rest breaks in appropriate areas (shaded if conditions are hot, and warm break areas if conditions are cold). See Section 4 of the Tetra Tech NUS Health and Safety Guidance Manual for additional information on heat stress and cold stress. ***Natural hazards:*** 9) This activity may take place in remote locations where natural hazards are a concern. To control this hazard: - Preview all work areas to remove or barricade physical hazards or potential nesting areas. - Clear sufficient area around the drill rig to permit unimpeded work. - See the Health and Safety Guidance Manual for information on Tick Control and Lyme Disease. 10) All operations will be temporarily suspended during electrical storms or other hazardous weather conditions.	**VOCs** **None of the contaminants of concern are anticipated to be present at detectable airborne concentrations. As a result, the contaminants of concern are unlikely to present a significant exposure potential to site workers, particularly via inhalation.** However, as a precautionary measure, a PID with a 10.6 eV lamp source will be used to: 1) Screen potential source areas (excavated soils) to detect the presence of any VOCs. Elevated readings at a source area will require: Worker breathing zones to be monitored to determine airborne concentrations of VOCs that may oppose an inhalation hazard to site workers. Any sustained (> 1 minute in duration) airborne concentration greater than 5.0 ppm in a worker breathing zone requires site activities to be suspended and notification of the PHSO. **Dusts/Particulates** Observations of visible dust (approximately 2 mg/m^3) will require site personnel to employ dust suppression (area wetting) methods if airborne dusts cannot be otherwise avoided by moving site operations upwind or by repositioning site equipment away from visible dust clouds. This conservative action level will control potential exposures to all site contaminants and nuisance particulates. Where the utility clearance cannot be determined, subsurface activities shall proceed with extreme caution using hand digging to at least below the frost-line depth (no less than 4 ft. BGS). Also, a magnetometer must be used for periodic down-hole surveys every 2 feet to a depth of at least 10 feet.	All soil boring operations are to be initiated in Level D protection. Level D protection constitutes the following minimum protection - Standard field dress (long pants, sleeved shirts) - Steel-toe safety shoes or boots - Nitrile gloves - Hard-hat, safety glasses, and earplugs or muffs. - *Tyvek coveralls will be worn if there is a possibility of soiling work attire.* - *Rubber boots for muddy conditions* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** - Will consist of a soap/water wash and rinse for outer protective equipment (e.g. boots, gloves, etc.). This function will take place at an area adjacent to the drilling operations bordering the support zone. This decontamination procedure for Level D protection will consist of - Equipment drop - Remove and dispose of any disposable PPE (Tyvek coveralls, outer gloves, etc.) - Soap/water wash and rinse of reusable PPE items (e.g., boots). - Wash hands and face; leave contamination reduction zone **Equipment Decontamination** - All heavy equipment decontamination will take place at Site 13 utilizing steam or pressure washers. Heavy equipment will have the wheels and tires cleaned along with any loose debris removed, prior to transporting to the central decontamination area. All site vehicles will be restricted access to exclusion zones, or also have their wheels/tires sprayed off so as not to track mud onto the roadways servicing this installation. Roadways shall be cleared of any debris resulting from the onsite activity. All equipment used in the exclusion zone will require a complete decontamination between locations and prior to removal from the site. The FOL or the SSO will be responsible for evaluating equipment arriving on site and prior to leaving the site. No equipment will be authorized access or exit without this inspection and authorization. See Attachment III Equipment Inspection Checklist.

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring/Type and Action Levels	Personal Protective Equipment *Italicize text represents optional equipment to be worn when conditions dictate.*	Decontamination Procedures
Surveying and wetlands delineation activities. These activities are combined since they involve similar site locations and similar site hazards are associated with each.	***Chemical hazards:*** **Exposure to potential site contaminants during surveying and wetlands delineation activities is unlikely given the nature of the work and the limited contact with potentially contaminated media (soils, sediments, surface water, etc.). To further reduce the potential for exposure, site personnel performing these activities will minimize contact with potentially contaminated media and will avoid areas where chemical hazards may exist.** Previous analytical data identified various contaminants of concern including metals, PCBs, various pesticides and VOCs (primarily chlorinated solvents and associated degradation products). However, none of the contaminants of concern were previously detected at concentrations that are likely to present an inhalation exposure hazard to site personnel. It should be noted that historical information on Site 13 suggests that the potential exists for encountering lead and battery acids (from previous disposal practices). ***Physical hazards:*** 1) Slip, trips, and falls ***Natural hazards:*** 2) Insect/animal bites and stings, poisonous plants 3) Inclement weather 4) Ambient Temperature Extremes 5) Water Hazards	1) Preview work locations and site lines for uneven and unstable terrain. Clear necessary vegetation and establish temporary means for traversing hazardous terrain (e.g. rope ladders). ***Natural hazards:*** 2) Avoid potential nesting areas of biting/stinging insects and animals. Use commercially available insect repellents. Avoid contact with poisonous vegetation. Wear appropriate clothing. Tape ankle and wrists areas to prevent ticks, chiggers, etc. from attaching themselves to your skin. Wear light-colored clothing so that ticks and other biting insects can be easily visible and be removed. Follow directions as specified in section 6.2 concerning natural hazards. 3) All operations will be temporarily suspended during electrical storms. 4) Personnel must be aware of the conditions of heat/cold stress and take appropriate preventive measures to prevent the illness. For example, drink caffeine-free liquids to replace body fluids lost in sweating if working under hot conditions, take rest breaks in appropriate areas (shaded if conditions are hot, and warm break areas if conditions are cold). See Section 4 of the Tetra Tech NUS Health and Safety Guidance Manual for additional information on heat stress and cold stress. 5) Use appropriate clothing and protective equipment (boots, hip waders, etc.) to minimize contact with water and to prevent clothing and footwear from becoming saturated (which increases the potential for hypothermia). It is not anticipated that site workers performing these tasks will be required to enter water area that pose a drowning hazard.	No air monitoring is needed given that volatile contaminants are not likely to be present during these site activities. The potential for exposure to site contaminants during this activity is considered minimal.	Surveying and wetlands delineation activities shall be performed in Level D protection. Level D Protection consists of the following: - Standard field dress including sleeved shirt and long pants - Steel-toe work boots or shoes - *Safety glasses, hard hats (if working near machinery or when eye/overhead hazards are present)* - *Tyvek coveralls may be worn to provide additional protection against poisonous plants and insects, particularly ticks.* - *Work gloves may be worn if desired.* - *Snake chaps for heavily wooded area where encounters are likely.* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	Personnel Decontamination - A structured decontamination is not required, as the likelihood of encountering contaminated media is considered remote. However, survey parties should inspect themselves and one another for the presence of ticks when exiting wooded areas, grassy fields, etc. This action will be used to stop the transfer of these insects into vehicles, homes, and offices.

Task/Operation/ Location	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring/Type and Action Levels	Personal Protective Equipment	Decontamination Procedures
Decontamination of Sampling and Heavy Equipment	*Chemical Hazards* 1) Previous analytical data identified various contaminants of concern including metals, PCBs, various pesticides and VOCs (primarily chlorinated solvents and associated degradation products). However, none of the contaminants of concern were previously detected at concentrations that are likely to present an inhalation exposure hazard to site personnel. It should be noted that historical information on Site 13 suggests that the potential exists for encountering lead and battery acids (from previous disposal practices). Further information on some of the primary contaminants of concern is presented in Figure 6-1. 2) Decontamination fluids - Liquinox (detergent), acetone or isopropanol *Physical Hazards* 3) Lifting (strain/muscle pulls) 4) Noise in excess of 85 dBA 5) Flying projectiles 6) Vehicular and foot traffic 7) Slips, trips, and falls *Natural Hazards* 8) Ambient temperature extremes (heat stress) 9) Inclement weather	1) and 2) Use protective equipment to minimize contact with site contaminants and hazardous decontamination fluids. Obtain manufacturer's MSDS for any decontamination fluids used onsite. These must be used in well-ventilated areas, such as outdoors. Use appropriate PPE as identified on MSDS. All chemicals used must be listed on the Chemical Inventory for the site, and site activities must be consistent with the Hazard Communication section of the Health and Safety Guidance Manual (Section 5). ***Physical hazards:*** 3) Use multiple persons where necessary for lifting and handling sampling equipment for decontamination purposes. 4) Wear hearing protection when operating pressure washer. 5) Use eye and face protective equipment when operating pressure washer. All other personnel must be restricted from the area. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 7) Preview work locations for unstable/uneven terrain. ***Natural hazards:*** 8) Personnel must be aware of the conditions of heat/cold stress and take appropriate preventive measures to prevent the illness. For example, drink caffeine-free liquids to replace body fluids lost in sweating if working under hot conditions, take rest breaks in appropriate areas (shaded if conditions are hot, and warm break areas if conditions are cold). See Section 4 of the Tetra Tech NUS Health and Safety Guidance Manual for additional information on heat stress and cold stress. 9) Suspend or terminate operations until directed otherwise by SSO.	Use visual observation, and real-time monitoring instrumentation to ensure all equipment has been properly cleaned of contamination and dried. After decon is completed, screen equipment with a PID. If any elevated readings (i.e., above background) are observed, perform decon again and re-screen. Repeat until no elevated PID readings are noted.	*Italicized text represent optional equipment to be worn as conditions dictate* For Heavy Equipment This applies to high-pressure soap/water, steam cleaning wash and rinse procedures. Level D Minimum requirements - - Standard field attire (Long sleeve shirt; long pants) - Safety shoes (Steel toe/shank) - Nitrile outer gloves - Safety glasses underneath a splash shield - Hearing protection (plugs or muffs) - *PVC Rainsuits or PE or PVC coated Tyvek* - *Chemical resistant boot covers* - *Hard hat (at SSO's discretion)* For sampling equipment the following PPE is required Note: Consult MSDS for PPE guidance. Otherwise, observe the following. Level D Minimum requirements - - Standard field attire (Long sleeve shirt; long pants) - Safety shoes (Steel toe/shank) - Nitrile outer gloves - Safety glasses In the event of overspray of chemical decontamination fluid use PVC Rainsuits or PE or PVC coated Tyvek as necessary. **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** will consist of a soap/water wash and rinse for reusable outer protective equipment (boots, gloves, PVC splash suits, as applicable). The decontamination function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Soap/water wash and rinse of outer boots and gloves, as applicable - Soap/water wash and rinse of the outer splash suit, as applicable - Disposable PPE will be removed and bagged. **Equipment Decontamination** - All heavy equipment decontamination will take place at a centralized decontamination pad utilizing steam or pressure washers. Heavy equipment will have the wheels and tires cleaned along with any loose debris removed, prior to transporting to the central decontamination area. All site vehicles will have restricted access to exclusion zones, and have their wheels/tires sprayed off as not to track mud onto the roadways servicing this installation. Roadways shall be cleared of any debris resulting from the onsite activity. **Sampling Equipment Decontamination** Sampling equipment will be decontaminated as per the requirements in the Sampling and Analysis Plan and/or Work Plan. MSDS for any decon solutions (Alconox, isopropanol, etc.) will be obtained and used to determine proper handling / disposal methods and protective measures (PPE, first-aid, etc.). All equipment used in the exclusion zone will require a complete decontamination between locations and prior to removal from the site. The FOL or the SSO will be responsible to evaluate equipment as it arrives and leaves the site. No equipment will be authorized access or exit without this evaluation. See Attachment III Equipment Inspection Checklist.

6.0 HAZARD ASSESSMENT

The following section provides information regarding the chemical, physical, and natural hazards anticipated to be present during the activities to be conducted. Table 6-1 provides information related to chemical constituents that have been identified by analysis or are suspected to be present at the site based on historical data. Specifically, toxicological information, exposure limits, symptoms of exposure, physical properties, and air monitoring and sampling data are discussed in the table.

6.1 CHEMICAL HAZARDS

Previous analytical data from Site 13 indicated the presence of various contaminants of concern including various metals, polychlorinated biphenyls (PCBs), an assortment of pesticides, and several volatile organic compounds (VOCs) primarily in the form of chlorinated solvents and associated degradation products. None of these contaminants of concern were previously detected at concentrations that present an acute inhalation exposure hazard to site workers. However, contact with potentially contaminated media (soils, sediments, groundwater) will be avoided. Potential routes of exposure through ingestion and skin contact will be minimized through the use of personal protective equipment (PPE), decontamination procedures, and good personal hygiene (washing hands prior to performing hand to mouth activities such as eating, smoking, etc.). As a precautionary measure, real-time monitoring instruments (photoionization detectors) will be used to detect the presence of any airborne concentrations of VOCs. Additionally, site personnel will visually monitor excavation and drilling operations to determine the presence of airborne dusts. If airborne dusts are observed, area wetting methods will be used to suppress the generation of dusts that may facilitate exposure through inhalation of airborne dusts. Table 6-1 provides information on the toxicological, chemical, and physical properties of some of the contaminants of concern.

TABEL 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
SITE 13 NWS EARLE, COLTS NECK, NEW JERSEY

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
1,2-Dichloroethylene	540-59-0	PID: I P 9 65 eV, high response with PID and 10 2 eV lamp FID. 50% response with FID	Air sample using charcoal tube, and carbon disulfide desorption, Sampling and analytical protocol in accordance with OSHA Method #07, and NIOSH Method #1003	OSHA, NIOSH, ACGIH 200 ppm IDLH 1000 ppm	Adequate- odor threshold 0 085-17 ppm Use organic vapor/acid gas cartridges for exceedances above the TWA up to 1,000 ppm. >1,000 ppm should use pressure-demand supplied air respirator above exposure limits **Recommended glove:** nitrile - 0 12 hrs, viton - 0 95 hrs	**Boiling Pt:** 117°F, 47°C **Melting Pt:** 7°F, -13 8°C **Solubility:** 0 4% **Flash Pt:** 36°F, 2 2°C **LEL/LFL:** 5 6% **UEL/UFL:** 12 8% **Vapor Density:** 2 0 **Vapor Pressure:** 180-260 mmHg **Specific Gravity:** 1 27 @ 90°F, 32°C **Incompatibilities:** Strong oxidizers, alkalis, potassium hydroxide, and copper When heated to decomposition temperatures will emit toxic fumes of phosgene **Appearance and Odor:** Colorless liquid with an acrid odor	Overexposure may result in CNS depression with potential to cause sleepiness, hallucinations, distorted perceptions, and stupor (narcosis) Systemically, symptoms may result in nausea, vomiting, weakness, tremors, and cramps May also irritate the eyes, skin, and mucous membranes Chronic exposures may result in dermatitis, liver, kidney, and lung damage.
Methylene chloride	75-09-2	PID: I P. 11 32 eV, High response with PID and 11 7 eV lamp FID· 100% response with FID	Air sample using charcoal or Anasorb CMS sorbent tube, carbon disulfide desorption, gas chromatography-flame ionization detector; Sampling and analytical protocol shall proceed in accordance with OSHA Method #59, 80, or NIOSH Method #1005.	OSHA 50 ppm, 100 ppm (Ceiling) ACGIH 50 ppm NIOSH. Lowest feasible concentration IDLH 2300 ppm	Inadequate - Odor threshold 160 ppm Use a gas mask with a Type N canister for concentrations up to 25 ppm In excess of 25 ppm, use a supplied air respirator (airline respirator with emergency escape cylinder or a Self-Contained Breathing Apparatus - (SCBA) **Recommended gloves:** Nitrile rubber latex glove 3 00 hrs (vendor specific), supported Polyvinyl alcohol glove, unsupported 1-8 hrs; Silver shield 1.90 hrs	**Boiling Pt:** 104°F, 39.8°C **Melting Pt:** -141°F, -96°C **Solubility:** 2% **Flash Pt:** Not available **LEL/LFL:** 13% **UEL/UFL:** 12% **Vapor Density:** 2 93 **Vapor Pressure:** 380 mmHg @ 72°F; 22°C **Specific Gravity:** 1.33 **Incompatibilities:** Strong oxidizers, caustics, metals (i e aluminum, magnesium, potassium, sodium, lithium), and concentrated acids **Appearance and Odor:** Colorless liquid with a chloroform-like odor (Note. A gas above 104°F, 40°C)	Effects of overexposure may include CNS effects - cause sleepiness, fatigue, weakness, lightheadedness, numbness of the limbs, altered cardiac rate and incoordination These signs and symptoms may be accompanied by nausea, gastric and pulmonary irritation leading possibly to pulmonary edema In addition to the narcosis long term effects may include liver injury Listed as possessing carcinogenic properties by NTP, IARC, and ACGIH
Trichloroethylene	79-01-6	PID I P 9 45 eV, High response with PID and 10 2 eV lamp FID 70% Response with FID	Air sample using charcoal tube, carbon disulfide desorption; Sampling and analytical protocol shall proceed in accordance with OSHA Method #07, or NIOSH Method #1022 or #1003	OSHA 50 ppm 200 ppm (Ceiling) ACGIH· 50 ppm 100 ppm STEL NIOSH 25 ppm IDLH 1000 ppm	Inadequate - Odor threshold 82 ppm APRs with organic vapor/acid gas cartridges may be used for escape purposes. Exceedances over the exposure limits require the use of positive pressure-demand supplied air respirator **Recommended gloves:** PV Alcohol unsupported >16 00 hrs, Silver shield >6.00 hrs; Teflon >24 00 hrs, or Viton >24 00 hrs; Nitrile (Useable time limit 0.5 hr, complete submersion for the nitrile selection)	**Boiling Pt:** 188°F, 86.7°C **Melting Pt:** -99°F; -73°C **Solubility:** 0.1% @ 77°F; 25°C **Flash Pt:** 90°F, 32°C **LEL/LFL:** 8% @ 77°F; 25°C **UEL/UFL:** 10 5 @ 77°F, 25°C **Vapor Density:** 4 53 **Vapor Pressure:** 100 mmHg @ 90°F; 32°C **Specific Gravity:** 1.46 **Incompatibilities:** Strong caustics and alkalis, chemically active metals (barium, lithium, sodium, magnesium, titanium, and beryllium) **Appearance and Odor:** Colorless liquid with a chloroform type odor. Combustible liquid, however, burns with difficulty	Central nervous system effects including euphoria, analgesia, anesthesia, paresthesia, headaches, tremors, vertigo, and somnolence Damage to the liver, kidneys, heart, lungs, and skin have also been reported Contact may result in irritation to the eyes, skin, and mucous membranes. Ingestion may result in GI disturbances including nausea, and vomiting NIOSH lists this substance a potential human carcinogen

TABEL 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
SITE 13 NWS EARLE, COLTS NECK, NEW JERSEY

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Tetrachloroethylene See also Perchloroethylene PERK PCE	127-18-4	PID I P 9 32 eV, relative response ratio 200% with 10 6 eV lamp FID: 70% relative response ratio with a FID.	Air sample using charcoal tube, carbon disulfide desorption, GC/FID detection Sampling and analytical protocol shall proceed in accordance with OSHA Method #07, or NIOSH Method #1003	ACGIH· 25 ppm 100 ppm STEL OSHA 100 ppm 200 ppm Ceiling, 300 ppm 5-minute max peak in any 3-hr period IDLH. 150 ppm	Odor threshold for this substance has been determined to be at airborne concentrations of approximately 47 ppm, which is considered adequate APR with organic vapor/acid gas cartridges should be used for escape purposes only Exceedances over the recommended exposure limits requires the use of airline or airline/APR combination units **Recommended glove:** Viton, PV alcohol 5-16 hrs; silver shield >6 00 hrs, teflon 10-24 hrs, and Nitrile in that order The breakthrough time for the nitrile glove ranges between 1 5 - 5 5 hrs. during complete immersion.	**Boiling Pt:** 250°F; 121°C **Melting Pt:** -2°F; 19°C **Solubility:** 0 02% **Flash Pt:** Not available **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** 5 83 **Vapor Pressure:** 14 mmHg @ 77°F, 25°C **Specific Gravity:** 1 62 @ 77°F, 25°C **Incompatibilities:** Strong oxidizers, alkalis, fuming sulfuric acid, and chemically active metals When heated to decomposition temperatures will emit toxic fumes of chlorine **Appearance and Odor:** Colorless liquid with a mild chloroform like odor.	Overexposure may result in irritation to eyes, nose, throat, and skin. Potential CNS effects including sleepiness, incoordination, headaches, hallucinations, distorted perceptions, and stupor (narcosis). Systemically, symptoms may result in nausea, vomiting, weakness, tremors, and cramps. Chronic exposures may result in dermatitis, enlarged tender liver, kidney, and lung damage. This material is considered a animal carcinogen (liver tumors), however, inadequate evidence exists concerning carcinogenic potential in humans
Antimony	7440-36-0	Particulate form - unable to be detected by PID/FID .	Air sample using particulate filter, acid desorption, atomic absorption spectrometry PeCam Sampling and analytical protocol shall proceed in accordance with NIOSH Method #261.	OSHA/NIOSH/ACGIH 0 5 mg/m³ IDLH 50 mg/m³	Metallic taste resulting from exposure **Recommended Air Purifying Cartridges:** Protect from dusts, fumes, and mists use HEPA filters **Recommended gloves:** This is in the particulate form Therefore any glove suitable to prevent skin contact	**Boiling Pt:** 2975°F; 1635°C **Melting Pt:** 1166°F, 630°C **Solubility:** Insoluble **Flash Pt:** Nonflammable **LEL/LFL:** Nonflammable **UEL/UFL:** Nonflammable NOTE This substance is nonflammable but may present a moderate explosion hazard when airborne dusts of an adequate concentration are exposed to flames **Vapor Density:** Not available **Vapor Pressure:** 1 mmHg @ 1627°F, 886°C **Specific Gravity:** 6 684 @ 77°F, 25°C **Incompatibles:** Acids, oxidizers, halogens **Appearance and odor:** silvery gray, lustrous metal	This substance is considered a poison by ingestion, irritating to the skin and mucous membranes causing inflammation to the nose,mouth, and throat. Chronic exposure may result in some forms of dermatitis. Ingestion may result in a metallic taste, vomiting, colic, and diarrhea Chronic exposure may result in addition to those stated above indigestion, loss of appetite and weight, and diarrhea Sores in the mouth along with a sore throat help distinguish this form of poisoning from other forms of metallic poisoning such as lead and arsenic Inhalation at excessive concentrations may result in difficulty in breathing, headaches and a bloody discharge from the nose, and chemical pneumonitis

TABEL 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
SITE 13 NWS EARLE, COLTS NECK, NEW JERSEY

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Arsenic	7440-38-2	Particulate form - This substance is unable to be detected by PID/FID.	Air sample using a particulate filter, acid desorption, AAS detection Sampling and analytical protocol shall proceed in accordance with NIOSH Method #7900	OSHA. Organic compounds 0 5 mg/m³ Inorganic compounds 0.01 mg/m³ NIOSH (Ceiling) 0 002 mg/m³ ACGIH. 0 01 mg/m³ IDLH 5 mg/m³ as arsenic	No identifiable warning properties to indicate presence and thereby detection. **Recommended APR Cartridge:** Suitable for dust and fume Organic vapor acid gases with HEPA filter This substance may be presented as a pesticide, therefore a cartridge suitable for pesticides (MSA-GMP) **Recommended Gloves:** This is in the particulate form Therefore any glove suitable to prevent skin contact (Nitrile has been the one most widely used for the other substances)	**Boiling Pt:** sublimation @ 1134°F, 612° C **Melting Pt:** 1497°F; 814°C @ 36 atm **Solubility:** Insoluble in water;soluble in nitric acid **Flash Pt:** Nonflammable, however, airborne in the form of a dust this substance will support combustion **LEL/LFL:** Nonflammable **UEL/UFL:** Nonflammable **Vapor Density:** Not available **Vapor Pressure:** 1 mmHg @ 372°C (sublimes) **Specific Gravity:** 5 73 **Incompatibilities:** Oxidizers, halogens,zinc, lithium, azides, and acetylides **Appearance and odor:** Gray to black, brittle, crystalline, amorphous, odorless	Overexposure to this substance through inhalation or ingestion may result in ulceration of the nasal septum, GI disturbances resulting in violent purging and vomiting, hoarse voice, sore throat, excessive salivation, peripheral neuropathy (numbness and burning sensations beginning at the extremities followed by motor weakness), respiratory irritation leading to possible pulmonary edema Skin or eye contact may result in irritation, conjunctiva, dermatitis, and hyperpigmentation (darkening of the areas exposed) of the skin. This substance has been judged to be a Human carcinogen by NTP, and IARC.
Cadmium	7440-43-9	Particulate Form - Unable to be easily detected by PID or FID	Air sample using a mixed cellulose-ester filter / acid desorption and analysis by atomic absorption-flame Sampling and analytical protocol shall proceed in accordance with NIOSH Method #7300 or #7048	OSHA 2 µg/m³ (0 002 mg/m³) ACGIH 0.01 mg/m³ (total particulate) 0 002 mg/m³ (respirable particulate) IDLH 9 mg/m3 (as cd)	The use of an air purifying, full face-piece respirator with a high efficiency particulate air filter for concentrations up to 0 25 mg/m³ **Recommended Gloves:** This is in particulate form Therefore any glove suitable to prevent skin contact	**Boiling Pt:** 1412°F; 767°C **Melting Pt:** 610°F, 321°C **Solubility:** Insoluble **Flash Pt:** Not applicable (Airborne dust may burn or explode when exposed to heat, flame, or incompatible chemicals) **LEL/LFL:** Not applicable **UEL/UFL:** Not applicable **Vapor Density:** Not available **Vapor Pressure:** 1 mmHg @ 741°F, 394°C **Specific Gravity:** 8.65 @ 90°F; 32°C **Incompatibilities:** Strong oxidizers, elemental sulfur, selenium, tellurium, zinc, nitric acid, and hydrazoic acid **Appearance and Odor:** Metal Silver-white, blue-tinged lustrous, odorless solid. Fume. yellow-brown, finely divided particulate dispersed in air.	Overexposure to this substance may result in irritation to the respiratory tract, dyspnea, tightness in the chest, coughing, possibly pulmonary edema. Overexposure to fumes causes symptoms characteristic of the flu (headaches, chills, muscle aches, nausea, vomiting, diarrhea) Chronic exposure may result in damage to the lungs, kidneys and liver This substance has been identified as a confirmed animal, potential human carcinogen by IARC and NTP.

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Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Chromium Compounds	7440-47-3 (Element)	Not detectable by PID. Not detectable by FID	Air sample using mixed cellulose - ester filter; acid desorption and analysis by atomic absorption Sampling and analytical protocol shall proceed in accordance with NIOSH Method #7024	OSHA & NIOSH (Chromium II, III) 0 5 mg/m³ (Chromium VI) 0 1 mg/m³ (Ceiling) ACGIH 0 5 mg/m³ (Chromium II, III compounds), 0 05 mg/m³ (Chromium VI compounds) IDLH 30 mg/m³ (Chromium VI compounds)	The use of a air purifying, full face-piece respirator with a high efficiency particulate filter for concentrations up to 0 1 mg/m³ **Recommended Gloves:** This is in particulate form Therefore any glove suitable to prevent skin contact	**Boiling Pt:** 4788°F, 2642°C **Melting Pt:** 3452°F, 1900°C **Solubility:** Insoluble **Flash Pt:** Not applicable (Airborne dust may burn or explode when exposed to heat, flame, or incompatible chemicals) **LEL/LFL:** Not applicable **UEL/UFL:** Not applicable **Vapor Density:** Not available **Vapor Pressure:** 0 mmHg **Specific Gravity:** 7 14 **Incompatibilities:** Strong oxidizers, peroxides, and alkalis **Appearance and Odor:** Appearance and odor vary depending upon the specific compound	Health hazards are characterized normally through chronic exposure manifesting as histologic fibrosis of the lungs and ulceration of the nasal septum and skin IARC, NTP and ACGIH list various chromium compounds as possessing carcinogenic properties
Mercury	7439-97-6	Jerome Mercury Vapor Analyzer This substance is unable to be detected by PID/FID	Air sample using Hydrar® sorbent tube, acid desorption, AA cold detection Sampling and analytical protocol shall proceed in accordance with NIOSH Method #6009	OSHA, NIOSH, ACGIH as alkyl compounds 0 01 mg/m³, STEL 0 03 mg/m³ IDLH 10 mg/m³	No identifiable warning properties to indicate presence and thereby detection **Recommended APR Cartridge:** Suitable for Metallic mercury with HEPA filter Preferably, with an end-of-service life indicator. **Recommended gloves:** Rubber gloves	**Boiling Pt:** 674°F, 356 9°C **Melting Pt:** -38°F, -38 89°C **Solubility:** Insoluble **Flash Pt:** Not available **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** Not available **Vapor Pressure:** 0 0012 mmHg @ 77° F, 25°C **Specific Gravity:** 13 6 **Incompatibilities:** Acetylene, ammonia, chlorine dioxide, azides, calcium, sodium carbide, lithium, rubidium, and copper **Appearance and odor:** Silvery-white heavy mobile liquid, odorless	This substance is corrosive to all points of contact. Systemic symptoms include irritability, wakefulness, muscle weakness and tremors increased reflexes, gingivitis, anorexia, headache, tinnitus, hypermobility, GI disturbances (nausea, vomiting), diarrhea (sometimes bloody), liver changes, dermatitis, and fever Symptoms experienced via inhalation include to those above coughing, chest pain, dyspnea, bronchial pneumonitis, and excessive salivation

TABEL 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
SITE 13 NWS EARLE, COLTS NECK, NEW JERSEY

Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
Lead	7439-92-1	Particulate form - Unable to be detected by either PID or FID	Air sample using a mixed cellulose ester filter, or HNO_3 or H_2O_2 desorption, or Atomic absorption detection NIOSH Method #7082 or #7300	OSHA 0 05 mg/m³ ACGIH 0 05 mg/m³ NIOSH 0.10 mg/m³ IDLH 100 mg/m³ as lead	The use of a air purifying, full-face respirator with high efficiency particulate air filter for up to 2 5 mg/m³ **Recommended gloves:** This is in the particulate form Therefore any glove suitable to prevent skin contact (Nitrile has been the one most widely used for the other substances).	**Boiling Pt:** 3164°F, 1740°C **Melting Pt:** 621°F, 327°C **Solubility:** Insoluble **Flash Pt:** Not applicable (Airborne dust may burn or explode when exposed to heat, flame, or incompatible chemicals) **LEL/LFL:** Not applicable **UEL/UFL:** Not applicable **Vapor Density:** Not available **Vapor Pressure:** 0 mmHg **Specific Gravity:** 11 34 **Incompatibilities:** Strong oxidizers, peroxides, sodium acetylide, zirconium, and acids **Appearance and Odor:** Metal: A heavy ductile, soft gray solid.	Overexposure to this substance via ingestion or inhalation may result in metallic taste in the mouth, dry throat, thirst, Gastrointestinal disorders (burning stomach pain, nausea, vomiting, possible diarrhea sometimes bloody or black, accompanied by severe bouts of colic), CNS effects (muscular weakness, pain, cramps, headaches, insomnia, depression, partial paralysis possibly coma and death Extended exposure may result in damage to the kidneys, gingival lead line, brain, and anemia.
Silver	7440-22-4	Particulate form - Unable to be detected by PID or FID	Air sample using a mixed cellulose ester filter, acid desorption, Atomic absorption or plasma emission spectroscopy detection Sampling and analytical protocol shall proceed in accordance with NIOSH Method #5(s182), or OSHA Method #ID121	NIOSH, OSHA, ACGIH 0 01 mg/m³	No identifiable warning properties to indicate presence and thereby detection. The use of a air purifying, full-face respirator with a high efficiency particulate air filter **Recommended gloves:** This is in the particulate form Therefore any glove suitable to prevent skin contact (Nitrile has been the one most widely used for the other substances)	**Boiling Pt:** 4014°F, 2212°C **Melting Pt:** 1764°F, 962°C **Solubility:** Insoluble **Flash Pt:** Not applicable (Airborne dust may burn or explode when exposed to heat, flame, or incompatible chemicals) **LEL/LFL:** Not applicable **UEL/UFL:** Not applicable **Vapor Density:** Not available **Vapor Pressure:** 0 mmHg **Specific Gravity:** 10 49 **Incompatibilities:** Acetylene, acetylene compounds, ammonia, peroxides, bromoazide, chlorine, trifluoride, ethylene imine, oxalic acid, nitric acid, and tartaric acid **Appearance and Odor:** Metal white lustrous solid	Overexposure to this substance may result in gastrointestinal, upper respiratory, and skin irritation Discoloration of the eyes, skin and hair
Chlordane	57-74-9	Substance is not volatile (VP= 00001 mmHg) I.P is unknown, therefore detection by PID is unknown. Substance is non-combustible, therefore a FID is not expected to have a response to chlordane.	Air sample using Chromosorb-102 sorbent tube with mixed cellulose-ester filter or a xad-2 sorbent tube with filter Toluene desorption and analysis by gas chromatography-electron capture detector. Sampling and analytical protocol will proceed in accordance with NIOSH Method #5510 or OSHA Method #67.	OSHA, NIOSH, ACGIH 0 5 mg/m³	Adequate - can use an air purifying respirator with an organic vapor & high efficiency air filter cartridges. **Recommended gloves:** PTFE Teflon for pure product Nitrile acceptable for incidental contact	**Boiling Pt:** 347°F, 175°C **Melting Pt:** Not available **Solubility:** Insoluble **Flash Pt:** Not available **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** Not available **Vapor Pressure:** 0 00001 mmHg **Specific Gravity:** 1.56 @ 60°F, 15 5°C **Incompatibilities:** Strong oxidizers and alkaline reagents **Appearance and Odor:** Amber-colored, viscous liquid with a pungent, chlorine like odor	Earliest signs of overexposure manifest as hypersensitivity of the central nervous system characterized by hyperactive reflexes, muscle twitching, tremors, incoordination, ataxia, and clonic convulsions Cycles of excitement and depression may be repeated over and over Chronic health hazard information similar to those for DDT

TABEL 6-1
CHEMICAL, PHYSICAL, AND TOXICOLOGICAL DATA
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Substance	CAS No.	Air Monitoring/Sampling Information		Exposure Limits	Warning Property Rating	Physical Properties	Health Hazard Information
DDT and the major metabolites, DDD and DDE	50-29-3 72-54-8 72-55-9	Substance is not volatile, I.P is unknown, detection by PID is unknown Substance non-combustible, therefore a FID is anticipated to have reduced response to DDT	Air sample using a binder free, glass fiber filter, isoctane desorption, gas chromatography-electron capture detector Sampling and analytical protocol will proceed in accordance with NIOSH Method #3(S274)	OSHA; ACGIH: 1 mg/m³ NIOSH 0 5 mg/m³	Adequate - Can use air purifying respirator with high efficiency particulate air filter (HEPA) **Recommended glove:** Nitrile acceptable for incidental contact	**Boiling Pt:** 230°F, 110°C **Melting Pt:** 226°F, 108°C **Solubility:** Insoluble **Flash Pt:** 162-171°F, 72-77°C **LEL/LFL:** Not available **UEL/UFL:** Not available **Vapor Density:** Not available **Vapor Pressure:** Low **Specific Gravity:** 0 99 **Incompatibilities:** Strong oxidizers and alkalis **Appearance and Odor:** Colorless crystals or off-white powder with a slight aromatic odor	Large doses are followed by vomiting due to gastric irritation, diarrhea may follow Numbness and parethesias of the lips tongue and face associated with malaise, headache, sorethroat, fatigue and weakness Coarse tremors (usually first of the neck, head, and eyelids). This may be accompanied by confusion, apprehension, and depression Convulsions may result and death may occur from respiratory failure. DDT is absorbed and retained in the fat of humans Chronic exposure may result in damage to the liver, kidneys and Peripheral Nervous System DDT is recognized as possessing carcinogenic properties by IARC and NTP.
Aroclor-1260 (Polychlorinated Biphenyl, PCB) It should be noted that this substance is representative of the more common isomers Aroclor - 1242, 1254, which may be encountered	11096-82-5 53469-21-9 (42%) 11097-69-1 (54%)	Substance is not volatile (VP=0 00006 mmHg), I P is unknown however is anticipated to be elevated, therefore, PID is not anticipated to detect substance Substance is non combustible and as a result will not be detected by FID	Air sample using a particulate filter, Florisil sorbent tube with glass fiber filter, hexane desorption, gas chromatography-electron capture detector. Sampling and analytical protocol shall proceed in accordance with NIOSH Method #5503 (PCBs)	OSHA, ACGIH 0 5 mg/m³ (skin) NIOSH. 0.001 mg/m³ IDLH 5 mg/m³	Inadequate - However due to the low volatility it is assumed unless agitated this substance does not present a volatile vapor or gas respiratory threat For dusty conditions where this material may cling to particulates, use a HEPA filter APRs are approved for escape only when concentrations exceed the exposure limits Concentrations greater than the exposure limits require PAPR or supplied air respirators. **Recommended glove:** Butyl rubber >24 hrs; Neoprene rubber >24 00 hrs, Silver shield or Viton (for pure product).	**Boiling Pt:** distillation range 689- 734°F, 365-390°C **Melting Pt:** -2 to 50°F, -19 to 10°C **Solubility:** Insoluble **Flash Pt:** Not applicable **LEL/LFL:** Not applicable **UEL/UFL:** Not applicable Nonflammable liquid, however, exposure to fire results in black soot containing PCBs, dibenzofurans, & chlorinated dibenzo-p-dioxins **Vapor Density:** Not available **Vapor Pressure:** 0 00006 - 0 001 mmHg **Specific Gravity:** 1 566 @ 60°F, 15 5°C **Incompatibilities:** Strong oxidizers **Appearance and Odor:** Colorless to pale yellow, viscous liquid or solid (Aroclor 54 below 50°F) with a mild, hydrocarbon odor	This substance is irritating to the eyes and skin. Chronic effects of overexposure may include potential to cause liver damage, chloracne, and reproductive effects. Recognized as possessing carcinogenic properties by NIOSH, and NTP

6.2 PHYSICAL HAZARDS

The physical hazards that may be present during the performance of site activities are summarized below:

- Heavy equipment hazards (pinch/compression points, rotating equipment, etc.)
- Slips, trips, and falls
- Energized systems (contact with underground or overhead utilities)
- Lifting (strain/muscle pulls)
- Noise exceeding 85 decibels (dBAs)
- Ambient temperature extremes (heat or cold stress)
- Eye (flying projectiles) and foot hazards
- Unexploded Ordnance (UXO) hazards
- Excavation hazards
- Pinches and compressions
- Contact with sharp objects (glass, metal, etc.)
- Vehicular and foot traffic

These physical hazards are discussed in Table 5-1 as applicable to each site task. Furthermore, many of these hazards are discussed in detail in Section 4.0 of the Health and Safety Guidance Manual. Specific discussion on some of these hazards is presented below.

6.2.1 Heavy Equipment Hazards (Pinch/Compression Points, Rotating Equipment, etc.)

Often the hazards associated with drilling operations are the most dangerous to be encountered during site activities. The SSO will thoroughly discuss safe drilling procedures during the pre-activities training session. All site personnel will sign the form in Figure 8-2 documenting that they received the training and understand the procedures. The following rules will apply to drilling operations:

- Each rig must be equipped with emergency stop devices that will be tested daily to ensure that they are operational.
- Long handled shovels or equivalent shall be used to clear cuttings from the borehole and rotating equipment.
- The driller may not leave the controls when the augers are rotating.

6.2.2 Energized Systems (Contact with Underground or Ov rh ad Utilities)

Underground utilities such as pressurized lines, water lines, telephone lines, buried utility lines, and high voltage power lines are known to be present throughout the facility. Clearance of underground and overhead utilities for each sample location will be coordinated with NWS Earle personnel. All work must be consistent with the SOP for Utility Locating and Excavation Clearance (See Attachment II of this HASP). Additionally, drilling operations will be conducted at a safe distance (>20 feet) from overhead power lines. Whenever underground utilities are suspected to be close to subsurface sampling locations, the borehole will be advanced to a minimum of 5 feet with a hand auger before drilling. As built drawings may also be used for additional clarification. In certain cases, NWS Earle personnel may need to de-energize electrical cables using facility lockout/tagout procedures to ensure electrical hazards are eliminated.

New Jersey One Call

In New Jersey the law requires you to call New Jersey One-Call at least three but no more than 10 business days before you dig (even with a shovel). New Jersey One-Call is a free utility locating service for homeowners and contractors throughout New Jersey. Within three business days of your call, the location of underground utilities will be marked. Call 1-800-272-1000 before you dig.

6.2.3 Ambient Temperature Extremes

Overexposure to high or low ambient temperatures (heat or cold stress) may exist during performance of this work depending on the project schedule. Work performed when ambient temperatures exceed 70°F may result in varying levels of heat stress (heat rash, heat cramps, heat exhaustion, and/or heat stroke) depending on variables such as wind speed, humidity, and percent sunshine, as well as physiological factors such as metabolic rate and skin moisture content. Additionally, work load and level of protective equipment will affect the degree of exposure. Site personnel will be encouraged to drink plenty of fluids to replace those lost through perspiration. Work performed when ambient temperatures are below 40°F may result in varying levels of cold stress (tremors, frostbite, wind burn, etc.) depending on variables such as wind speed, humidity, and percent sunshine, as well as physiological factors such as metabolic rate and skin moisture content. Additional information such as Work-Rest Regimens and personnel monitoring may be found in Section 4.0 of the Health and Safety Guidance Manual. The SSO will recommend additional heat or cold stress control measures as they are deemed necessary per American Conference of Governmental Industrial Hygienists (ACGIH) guidelines.

6.2.4 UXO Hazards

Site 13 is partially located with explosive safety quantity distance (ESQD) arcs. Although the primary function of the site was scrap metal storage, it is unlikely that any UXO would be present in the fill material, however, ordinance shapes have been encountered at the site during intrusive operations. As a result, Explosive Ordnance Disposal (EOD) specialists from TtNUS will be used for intrusive operations (test trench excavations, soil borings, etc.) conducted at Site 13. The TtNUS UXO SOP, presented in Attachment VI will be followed for all intrusive operations conducted at Site 13.

6.2.5 Excavation Hazards

Numerous test trenches will be excavated to determine the lateral extent of Site 13. It is anticipated that a total of eight test trenches will be excavated to a depth of up to 12 feet or until the bottom of the waste can be identified. No samples will be collected and site personnel will not be permitted, under any circumstance, to enter an excavation. Entry into excavations will require modification of this HASP that including the use of protective systems (benching, sloping, shoring, trench boxes, etc.) to minimize the potential for cave-ins; the use of a qualified person to classify soil types and design protective systems; and additional air monitoring procedures in accordance with Subpart P of 29 CFR 1926 and other applicable OSHA regulations. Equipment, personnel, and site vehicles will be restricted from the edges of excavations (at least a distance of 3 feet from the edge of the excavation) to minimize the potential for cave-ins due to increase loading on unstable/unsupported ground. All excavations will be backfilled after the completion of the test trench. No open excavation will be left unattended. Open excavations and areas where excavations are being performed shall be barricaded or otherwise marked.

6.3 NATURAL HAZARDS

6.3.1 Insect/Animal Bites and Stings, Poisonous Plants, etc.

Contact with poisonous plants and bites or stings from poisonous insects are other natural hazards that must be considered. All site personnel who are allergic to stinging insects such as bees, wasps, and hornets must be particularly careful because severe illness and death may result from allergic reactions. As with a medical condition or allergy, information regarding the condition must be listed on the Medical Data Sheet and the FOL and SSO must be notified.

Ticks

During warm months (spring through early fall), tick-borne Lyme Disease may pose a potential health hazard. The longer a disease-carrying tick remains attached to the body, the greater the potential for contracting the disease. Wearing long sleeved shirts and long pants (tucked into boots) as well as performing frequent body checks will prevent long-term attachment. Site first aid kits should be equipped with medical forceps and rubbing alcohol to assist in tick removal. If necessary, tyvek coveralls can be worn to provide a barrier between the skin and ticks that may come into contact with clothing. Commercially available insect repellents have been shown to be effective at repelling ticks and other biting insects. For information regarding tick removal procedures and symptoms of exposure consult Attachment VII of this HASP or Section 4.0 of the Health and Safety Guidance Manual.

West Nile Virus

West Nile Virus (WNV) can spread to people and animals through the bite of an infected mosquito. Mosquitoes acquire the virus from infected birds. **Infected mosquitoes then transmit the West Nile virus to humans and animals when biting (or taking a blood-meal). West Nile encephalitis is NOT transmitted from person-to-person. There is no evidence that a person can get the virus from handling live or dead infected birds. However, avoid bare-handed contact when handling any dead animals, including dead birds. Ticks have not been implicated as vectors of West Nile-lik virus.**

Prior to the detection of the virus in New York City, the virus, which can cause the brain infection encephalitis, WNV was found only in Africa, Eastern Europe and West Asia. **Mild infections are common and include fever, headache, and body aches, often with skin rash and swollen lymph glands. More severe infection is marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, occasional convulsions, paralysis and, rarely, death (especially in the elderly and very young). The incubation period of West Nile encephalitis is usually 3 to 12 days. There is no specific therapy or vaccine against West Nile encephalitis.** The vast majority of people who are bitten by an infected mosquito will develop only mild symptoms, if any.

In New Jersey, the legislation that established mosquito control, did so at the level of county government. All 21 counties have a mosquito control program of some kind. This network of county agencies interact with state government via the Departments of Health and Senior Services, Agriculture, Environmental Protection and the Agricultural Experiment Station at Rutgers University. New Jersey has a comprehensive plan for dealing with a possible return of the West Nile Virus. It includes enhanced

mosquito control efforts; increased human, animal and mosquito surveillance; a streamlined system for testing collected samples, and a public education program.

Additional information can be obtained from the Monmouth County Mosquito Extermination Commission at (723) 542-3630.

Precautions

- **Limit outdoor activities during peak mosquito times – at dusk and dawn.**
- **Avoid standing water**
- **Wear long-sleeved shirts and long pants whenever you are outdoors.**
- **Apply insect repellent to exposed skin according to manufacturer instruction. An eff ctive repellent will contain 20% to 30% DEET (N,N-diethyl-meta-toluamide). Avoid products containing more than 30% DEET.**
- **Spray clothing with repellents containing permethrin or DEET, mosquitoes may bite through thin clothing.**

6.3.2 Inclement Weather

Many of the project tasks will be performed outdoors. As a result, inclement weather may be encountered. If adverse weather (e.g., electrical storms, hurricanes, etc.) conditions arise, the FOL and/or SSO will temporarily suspend or terminate activities until hazardous conditions cease.

Tropical Storms and Hurricanes

As the NWS Earle, New Jersey area is in a tropical storm, hurricane prone area, the following information is supplied to explain the potential severity of these natural hazards. The decision to curtail operations and evacuate the area should be made by the FOL, PM, and the HSM.

During the early summer to late fall months, typically from the first of June through the end of November, disturbances migrating off the West Coast of Africa move into the Atlantic Ocean and develop into tropical cyclones known as tropical storms and hurricanes. Many of these cyclones become strong enough to threaten life and property along the Eastern Seaboard and Gulf Coast. There are three main threats associated with tropical storms and hurricanes:

- High winds
- Excessive rainfall
- Storm surge

The impacts of high winds and excessive rainfall occur hours, maybe days, before the tropical storm or hurricane makes landfall. However, the storm surge accompanies the storm or hurricane at the time that landfall occurs.

High Winds

Sustained winds vary greatly from storm to storm, but can range from 39 to 73 miles per hour (wind speeds associated with a tropical storm) to greater than 74 miles per hour (minimal wind speed for a Category 1 hurricane). The table below compares the type of storm or hurricane and the corresponding wind speed.

TABLE 6-2
TROPICAL STORM/HURRICANE RATING SCALE

TYPE	CATEGORY*	WINDS (MPH)
Tropical Depression	NA	>35-38
Tropical Storm	NA	39 – 73
Hurricane	1	74 – 95
Hurricane	2	96 – 110
Hurricane	3	111 – 130
Hurricane	4	131 – 155
Hurricane	5	>155

NA – Not Applicable
* Based on the Saffir-Simpson scale

In addition to strong winds, there is the threat of debris (i.e. building material, trees, etc.) becoming airborne projectiles as they are carried by the high winds. Thunderstorms and tornadoes embedded within the tropical storm or hurricane can further increase the wind speeds on a localized level.

Excessive Rainfall

Heavy rains associated with tropical storms and hurricanes also vary greatly from storm to storm. On average, an inch of rainfall an hour is not uncommon with major hurricanes, somewhat lesser amounts with tropical storms. However, the primary threat is not the intensity of rain, but the duration of rainfall. Since many tropical storms and hurricanes are slow-movers, they are capable of producing sustained

heavy rainfall over a long period of time. It is not uncommon for an area to receive nearly 20 inches of rain in 24 hours. Under these conditions, street; stream and creek flooding is inevitable only to be exacerbated by locally heavier rains from thunderstorms.

Storm Surge

The storm surge is an abnormal rise in sea level accompanying a hurricane or tropical storm. The height of the storm surge (usually measured in feet) is the difference in sea level from the observed level (during the storm) and the level that would have occurred in the absence of the storm or hurricane. The more intense the storm or hurricane the higher the storm surge. Storm surges become even higher if they occur during periods of high tide.

The following table defines some of the terminology and possible calls to action regarding tropical cyclones:

TABLE 6-3
TROPICAL STORM/HURRICANE
WATCH AND WARNING

STORM DESCRIPTION	DEFINITION	CALL TO ACTION
Tropical Storm Watch	Tropical storm conditions are possible in the specified area of the watch, usually within 36 hours	Weather conditions should be monitored for further advisories. Prepare for possible evacuation by local officials
Tropical Storm Warning	Tropical storm conditions are expected in the specified area of the warning, usually within 24 hours.	Work should be suspended in areas where lightning, high winds and rainfall could pose a threat to life. Mandatory evacuations may be enforced by local officials.
Hurricane Watch	Hurricane conditions are possible in the specified area of the watch, usually within 36 hours.	Weather conditions should be monitored for further advisories. Prepare for possible evacuation by local officials
Hurricane Warning	Hurricane conditions are expected in the specified area of the warning, usually within 24 hours.	Mandatory evacuations will most likely be enforced by local officials.

A NOAA Weather Radio is the best means to receive watches and warnings from the National Weather Service. The National Weather Service continuously broadcasts updated hurricane advisories that can be received by widely available NOAA Weather Radios.

7.0 AIR MONITORING

Direct reading instruments will be used at the site to detect and evaluate the presence of site contaminants and other potentially hazardous conditions. As a result, specific air monitoring measures and requirements are established in Table 5-1 pertaining to the hazards and tasks of an identified operation. Additionally Section 1.0, the Health and Safety Guidance Manual contains detailed information regarding direct reading instrumentation, as well as general calibration procedures of various instruments.

7.1 INSTRUMENTS AND USE

Instruments will be used primarily to monitor source points and worker breathing zone areas while observing instrument action levels. Action levels are discussed in Table 5-1 as they may apply to a specific task or location.

7.1.1 Photoionization Detector

VOC contaminants of concern were previously detected at concentrations that are unlikely to present an inhalation exposure hazard to site workers. However, as a precautionary measure, a Photoionization Detector (PID) using a lamp energy of 10.6 electron volts (eV) or higher, will be used to monitor for VOCs that may be present at source areas (soil boring, test trenches, samples, etc.) and within worker breathing zones during site activities. The PID has been selected because it is capable of detecting the organic vapors of concern (specifically chlorinated solvents and associated degradation products). This instrument will only detect the presence of ionizing contaminants. This instrument will not detect the explosive compounds and metals.

Before starting field activities, the background levels of the site must be determined and noted. Daily background readings will be taken away from areas of potential contamination. These readings, influencing conditions (weather, temperature, humidity, etc.), and site location must be documented in the field operations logbook or other site documentation (e.g., sample log sheet).

7.1.2 Hazard Monitoring Frequency

Table 5-1 presents the frequencies in which hazard monitoring will be performed as well as the action levels that will initiate the use of elevated levels of protection. The SSO may decide to increase these frequencies based on instrument responses and site observations. The frequency in which monitoring is performed will not be reduced without the prior consent of the PHSO or HSM.

7.2 INSTRUMENT MAINTENANCE AND CALIBRATION

Hazard monitoring instruments will be maintained and pre-field calibrated by the TtNUS Equipment Manager. Operational checks and field calibration will be performed on instruments each day before use. Field calibration will be performed on instruments according to manufacturer's recommendations (for example, the PID must be field calibrated daily and an additional field calibration must be performed at the end of each day to determine significant instrument drift). These operational checks and calibration efforts will be performed in a manner that complies with the employees health and safety training, the manufacturer's recommendations, and with the applicable manufacturer SOP (copies of which can be found in the Health and Safety Guidance Manual that will be maintained onsite for reference). All calibration efforts must be documented. Figure 7-1 is provided for documenting these calibration efforts. This information may instead be recorded in a field operations logbook, provided that the information specified in Figure 7-1 is recorded. This required information includes the following:

- Date calibration was performed
- Individual calibrating the instrument
- Instrument name, model, and serial number
- Relevant instrument settings and resultant readings (before and after) calibration
- Identification of the calibration standard (lot no., source concentration, supplier)
- Relevant comments or remarks

Figure 7-1
Documentation of Field Calibration

SITE NAME: _____ **PROJECT NO.:**_____

Dat of Calibration	Instrument Name and Model	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot Number)	Remarks/ Comments
				Pre-Calibration	Post-Calibration	Pre-Calibration	Post-Calibration		

8.0 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

8.1 INTRODUCTORY/REFRESHER/SUPERVISORY TRAINING

This section is included to specify health and safety training and medical surveillance requirements for both TtNUS and subcontractor personnel participating in site activities.

8.1.1 Requirements for TtNUS Personnel

All TtNUS personnel must complete 40 hours of introductory hazardous waste site training before working at Site 13 at NWS Earle. Additionally, TtNUS personnel who have had introductory training more than 12 months before site work must have completed 8 hours of refresher training within the past 12 months before being cleared for site work. In addition, 8-hour supervisory training in accordance with 29 CFR 1910.120(e)(4) will be required for site supervisory personnel.

Documentation of TtNUS introductory, supervisory, and refresher training as well as site-specific training will be maintained onsite. Copies of certificates or other official documentation will be used to fulfill this requirement.

TtNUS will conduct a pre-activities training session before initiating site work. Additionally, a brief meeting will be held daily to discuss operations planned for that day. At the end of the workday, a short meeting will be held to discuss the operations completed and problems encountered. This activity will be supported through the use of Safe Work Permits (See Section 10.10).

8.1.2 Requirements for Subcontractors

All TtNUS subcontractor personnel must have completed introductory hazardous waste site training or equivalent work experience as defined in OSHA Standard 29 CFR 1910.120(e) and 8 hours of refresher training meeting the requirements of 29 CFR 1910.120(e)(8) before performing field work at NWS Earle. TtNUS subcontractors must certify that each employee has had such training by sending TtNUS a letter on company letterhead containing the information in the example letter provided in Figure 8-1 and by providing copies of certificates for subcontractor personnel participating in site activities.

FIGURE 8-1.

TRAINING LETTER

The following statements must be typed on company letterhead, signed by an officer of the company, and accompanied by copies of personnel training certificates:

LOGO
XYZ CORPORATION
555 E. 5th Street
Nowheresville, Kansas 55555

Month, day, year

Mr. Daniel Witt, P.E.
Project Manager
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, PA 15220

Subject: HAZWOPER Training for NWS Earle, New Jersey

Dear Mr. Witt,

As an officer of XYZ Corporation, I hereby state that I am aware of the potential hazardous nature of the subject project. I also understand that it is our responsibility to comply with applicable occupational safety and health regulations, including those stipulated in Title 29 of the Code of Federal Regulations (CFR), Parts 1900 through 1910 and Part 1926.

I also understand that Title 29 CFR 1910.120, titled "Hazardous Waste Operations and Emergency Response," requires an appropriate level of training for certain employees engaged in hazardous waste operations. In this regard, I hereby state that the following employees have had 40 hours of introductory hazardous waste site training or equivalent work experience as requested by 29 CFR 1910.120(e) and have had 8 hours of refresher training as applicable and as required by 29 CFR 1910.120(e)(8) and that site supervisory personnel have had training in accordance with 29 CFR 1910.120(e)(4).

LIST FULL NAMES OF EMPLOYEES AND THEIR SOCIAL SECURITY NUMBERS HERE.

Should you have questions, please contact me at (555) 555-5555.

Sincerely,

(Name and Title of Company Officer)

8.2 SITE-SPECIFIC TRAINING

TtNUS will provide site-specific training to site personnel who will perform work on this project. Site-specific training will also be provided to other personnel [U.S. Department of Defense (DoD), Environmental Protection Agency (EPA), etc.] who may enter the site to perform functions that may or may not be directly related to site operations. Site-specific training will include:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present onsite
- Use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Contents of the HASP
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of the contents of relevant MSDSs
- Review of Safe Work Permits

Site-specific documentation will be established through the use of Figure 8-2. All site personnel and visitors must sign this document upon receiving site-specific training.

8.3 MEDICAL SURVEILLANCE

8.3.1 Medical Surveillance Requirements for TtNUS Personnel

All TtNUS personnel participating in project field activities will have had a physical examination meeting the requirements of the TtNUS medical surveillance program and will be medically qualified to perform hazardous waste site work using respiratory protection.

Documentation for medical clearances will be maintained in the TtNUS Pittsburgh office and made available, as necessary.

FIGURE 8-2

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing site investigation activities at NWS Earle, New Jersey, and that I have received site-specific training that included the elements presented below:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present onsite
- Use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Contents of the HASP
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of contents of relevant MSDSs
- Review of the use of Safe Work Permits

I further state that I have been given the opportunity to ask questions, that my questions have been answered to my satisfaction, and that I agree to abide by the procedures and policies addressed in this plan. The date of my training (introductory, refresher, and supervisory, as applicable) and my medical surveillance requirements are accurate and correct to the best of my knowledge.

Name (Printed and Signature)	Site-Specific Training Date	40-Hour Training (Date)	8-Hour Refresher Training (Date)	8-Hour Supervisory Training (Date)	Medical Exam

8.3.2 M dical Surv illanc Requirements for Subcontractors

Subcontractors are required to obtain a certificate of their ability to perform hazardous waste site work and to wear respiratory protection. The "Subcontractor Medical Approval Form" provided in Figure 8-3 shall be used to satisfy this requirement, providing it is properly completed and signed by a licensed physician.

Subcontractors who have a company medical surveillance program meeting the requirements of paragraph (f) of OSHA 29 CFR 1910.120 can substitute "Subcontractor Medical Approval Form" with a letter on company letterhead containing the information in the example letter presented in Figure 8-4 of this HASP.

8.3.3 Requirements for All Field Personnel

Each field team member (including subcontractors) and visitors entering the exclusion zone(s) shall be required to complete and submit a copy of the Medical Data Sheet presented in Section 7 of the Health and Safety Guidance Manual. This shall be provided to the SSO, before participating in site activities. The purpose of this document is to provide site personnel and emergency responders with additional information that may be necessary to administer medical attention.

8.4 SUBCONTRACTOR EXCEPTIONS

Subcontractors who will not enter the exclusion zone during operation and whose activities involve no potential for exposure to site contaminants will not be required to meet the requirements for training/medical surveillance other than site-specific training as stipulated in Section 8.2.

FIGURE 8-3

SUBCONTRACTOR MEDICAL APPROVAL FORM

For employees of _____
Company Name

Participant Name: _____ Date of Exam: _____

Part A

The above-named individual has:

1. Undergone a physical examination in accordance with OSHA Standard 29 CFR 1910.120, paragraph (f), and was found to be medically -

   ( ) qualified to perform work at the NWS Earle work site
   ( ) not qualified to perform work at the NWS Earle work site

   and,

2. Undergone a physical examination in accordance with OSHA 29 CFR 1910.134(b)(10) and was found to be medically -

   ( ) qualified to wear respiratory protection
   ( ) not qualified to wear respiratory protection

My evaluation has been based on the following information, as provided to me by the employer.

( ) A copy of OSHA Standard 29 CFR 1910.120 and appendices.
( ) A description of the employee's duties as they relate to the employee's exposures.
( ) A list of known/suspected contaminants and their concentrations (if known).
( ) A description of any PPE used or to be used.
( ) Information from previous medical examinations of the employee that is not readily available to the examining physician.

Part B

I, _____, have examined _____
Physician's Name (print) Participant's Name (print)

and have determined the following information:

FIGURE 8-3.

SUBCONTRACTOR MEDICAL APPROVAL FORM (CONTINUED)

1. Results of the medical examination and tests (excluding findings or diagnoses unrelated to occupational exposure):

   _____
   _____
   _____

2. Any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health:

   _____
   _____
   _____

3. Recommended limitations on the employee's assigned work:

   _____
   _____
   _____

I have informed this participant of the results of this medical examination and any medical conditions that require further examination of treatment.

Based on the information provided to me, and in view of the activities and hazard potentials involved at the NWS Earle work site, this participant

( ) may
( ) may not

perform his/her assigned task.

Physician's Signature _____

Address _____

Phone Number _____

NOTE: Copies of test results are maintained and available at:

_____
Address

FIGURE 8-4

MEDICAL SURVEILLANCE LETTER

The following statements must be typed on company letterhead and signed by an officer of the company:

LOGO
XYZ CORPORATION
555 E. 5th Street
Nowheresville, Kansas 55555

Month, day, year

Mr. Daniel Witt, P.E.
Project Manager
Tetra Tech NUS, Inc.
661 Andersen Drive
Pittsburgh, PA 15220

Subject: Medical Surveillance for NWS Earle, New Jersey

Dear Mr. Witt:

As an officer of XYZ Corporation, I hereby state that the persons listed below participated in a medical surveillance program meeting the requirements contained in paragraph (f) of Title 29 of the Code of Federal Regulations (CFR), Part 1910.120, titled "Hazardous Waste Operations and Emergency Response: Final Rule." I further state that the persons listed below have had physical examinations under this program within the past 12 months and that they have been cleared by a licensed physician to perform hazardous waste site work and to wear positive- and negative-pressure respiratory protection. I also state that, to my knowledge, no person listed below has any medical restriction that would preclude him/her from working at the NWS Earle, New Jersey site.

LIST FULL NAMES OF EMPLOYEES AND THEIR SOCIAL SECURITY NUMBERS HERE.

Should you have questions, please contact me at (555) 555-5555.

Sincerely,

(Name and Title of Company Officer)

9.0 SPILL CONTAINMENT PROGRAM

9.1 SCOPE AND APPLICATION

It is not anticipated that quantities of bulk potentially hazardous materials (greater than 55 gallons) will be handled during site activities conducted as part of the scope of work. Small quantities of waste water (decontamination) and Investigative-Derived Waste (IDW) may be generated as part of site activities. It is not anticipated, however, that spillage of these materials would constitute a significant danger to human health or the environment. Furthermore, it is possible that as the job progresses disposable PPE and other nonreusable items may be generated. As needed, 55-gallon drums will be used to contain waste water, IDW, and other unwanted items generated during investigation activities. These drums will be labeled with the site name and address, the type of contents, and the date the container was filled as well as contact person. Samples will be collected and analyzed to characterize the material and determine appropriate disposal measures. Once characterized they can be removed from the staging area and disposed of in accordance with Federal, state, and local regulations.

9.2 POTENTIAL SPILL AREAS

Potential spill areas will be monitored in an ongoing attempt to prevent and control further potential contamination of the environment. Currently, various areas are vulnerable to this hazard including the areas used for central staging and decontamination activities. Additionally, areas designated for handling, loading, and unloading of potentially contaminated soils, waters, and debris present limited potential for leaks or spills. It is anticipated that IDW generated as a result of this scope of work will be containerized, labeled, and staged to await chemical analyses. The results of these analyses will determine appropriate disposal methods.

9.3 LEAK AND SPILL DETECTION

To establish an early detection of potential spills or leaks, periodic inspections by the SSO will be conducted during working hours to visually determine that containers are not leaking. If a leak is detected, the first approach will be to transfer the container contents using a hand pump into a new container. Other provisions for the transfer of container contents will be made and appropriate emergency contacts will be notified, if necessary. In most instances, leaks will be collected and contained using absorbents such as Oil-dry, vermiculite, or sand, which will be stored at the staging area in a conspicuously marked drum. This material, too, will be containerized for disposal pending analyses. All inspections will be documented in the Project Logbook.

9.4 PERSONNEL TRAINING AND SPILL PREVENTION

All personnel will be instructed on the procedures for spill prevention, containment, and collection of hazardous materials in the site-specific training. The FOL and/or the SSO will serve as the Spill Response Coordinator for this operation if necessary.

9.5 SPILL PREVENTION AND CONTAINMENT EQUIPMENT

The following represents the types of equipment that may be maintained at the staging area for the purpose of supporting this Spill Prevention/Containment Program.

- Sand, clean fill, vermiculite, or other noncombustible absorbent (oil-dry);
- Drums (55-gallon U.S. DOT 17-E or 17-H)
- Shovels, rakes, and brooms
- Labels

9.6 SPILL CONTROL PLAN

This section describes the procedures the TtNUS field crewmembers will use when detecting a spill or leak.

1) Notify the SSO or FOL immediately.

2) Use PPE stored at the staging area. Take immediate actions to stop the leak or spill by plugging or patching the drum or raising the leak to the highest point. Spread the absorbent material in the area of the spill covering completely.

3) Transfer the material to a new container, and collect and containerize the absorbent material. Label the new container appropriately. Await analyses for treatment or disposal options.

4) All spills will be recontainerized with 2 inches of top cover and await test results for treatment or disposal options.

It is not anticipated that a spill will occur that the field crews cannot handle. Should this occur, however, the FOL or SSO will notify the NWS Earle Emergency Coordinator who will notify the appropriate emergency response agencies.

10.0 SITE CONTROL

This section outlines the means by which TtNUS will delineate work zones and use these work zones in conjunction with decontamination procedures to prevent the spread of contaminants into previously unaffected areas of the site. It is anticipated that a three-zone approach will be used during work at this site. This three-zone approach will use an exclusion zone, a contamination reduction zone, and a support zone. It is also anticipated that this control measure will be used to control access to site work areas. Use of such controls will restrict the general public, minimize the potential for the spread of contaminants, and protect individuals who are not cleared to enter work areas.

10.1 EXCLUSION ZONE

The exclusion zone will be considered those areas of the site of known or suspected contamination. It is not anticipated that significant amounts of surface contamination are present in the proposed work areas of this site. It is anticipated that this will remain so until/unless contaminants are brought to the surface by intrusive activities, such as test trench excavation, soil boring, or sampling operations. Furthermore, once intrusive activities have been completed and surface contamination has been removed, the potential for exposure is again diminished and the area can then be reclassified as part of the contamination reduction zone. Therefore, the exclusion zones for this project will be limited to those areas of the site where active work is being performed plus a designated area surrounding the point of operation. When possible, exclusion zones will be delineated using barrier tape, cones and/or drive poles, and postings to inform site personnel.

The exclusion zone will be considered those areas of active operations plus an established safety zone depending on the task. The following represent the exclusion zone boundaries for the following identified tasks:

- Soil Boring – The boundary perimeter will be established by determining the height of the mast, plus five feet. Therefore, if it is a 35-foot mast plus 5 feet equals a 40-foot boundary surrounding the point of operation.

- Test Trench Excavations – The boundary perimeter will be established as a distance equivalent to the maximum extended distance of the arm (or boom) of the excavator plus a distance of 5 feet.

- Sediment sampling – 5 feet surrounding the sampling location.

- Decontamination (heavy equipment – steam/pressure washers) – 35 feet surrounding the point of operation. This will take place at a centralized location.

10.1.1 Exclusion Zone Clearance

Before the initiation of site activities, utility locations will be identified following the guidance provided in the TtNUS SOP For Utility Locating and Excavation Clearance (see Attachment II). Additional utility surveys may be conducted by TtNUS through the use of available documentation provided by NWS Earle and/or local utility companies. The positions of identified utilities will be field located and staked to minimize the potential for damage during intrusive activities. Sample locations can be located to avoid buried utilities. In the event that a utility is struck during a subsurface investigative activity, the emergency numbers provided in Table 2-1 will be notified.

Access to work areas will be controlled by TtNUS personnel. No personnel will be permitted to enter site exclusion zones without site-specific training. Site visitors will be provided site-specific training and will be escorted by TtNUS personnel (see section 10.4).

10.2 CONTAMINATION REDUCTION ZONE

The contamination reduction zone (CRZ) is a buffer area between the exclusion zone and areas of the site where contamination is not suspected. The personnel and equipment decontamination will not take place in this area, but will take place at a central location established for this project. This area instead will serve as a focal point in supporting exclusion zone activities. When applicable, this area will be delineated using barrier tape, cones and/or drive poles, and postings to inform and direct facility personnel.

10.3 SUPPORT ZONE

The support zone for this project will include a staging area where site vehicles will be parked, equipment will be unloaded, and food and drink containers will be maintained. The support zones will be established at areas of the site where exposure to site contaminants would not be expected during normal working conditions or foreseeable emergencies.

10.4 SITE VISITORS

Site visitors for the purpose of this document are identified as representing the following groups of individuals:

- Personnel invited to observe or participate in operations by TtNUS
- Regulatory personnel (NJDEP, EPA, OSHA, etc.)
- NWS Earle personnel
- Other authorized visitors

All personnel working on this project are required to gain initial access to the site by coordinating with the TtNUS FOL or designee and following established site access procedures.

Upon gaining access to the site, site visitors wishing to observe operations in progress will be escorted by a TtNUS representative (arranged for by the FOL) and shall be required to meet the minimum requirements discussed below:

- All site visitors will be routed to the FOL, who will sign them into the field logbook. Information to be recorded in the logbook will include the individual's name (proper identification required), the entity which they represent, and the purpose of the visit.

- All site visitors will be required to produce the necessary information supporting clearance to the site. This shall include information attesting to applicable training (40 hours of HAZWOPER training) and medical surveillance as stipulated in Section 8.0 of this document. In addition, to enter the site operational zones during planned activities, visitors will be required to first go through site-specific training covering the topics stipulated in Section 8.2 of this HASP.

Once the site visitors have completed the above items, they will be permitted to enter the operational zone. All visitors are required to observe the protective equipment and site restrictions in effect at the site at the time of their visit. Visitors not meeting the requirements stipulated in this plan will not be permitted to enter the site operational zones during planned activities. Incidences of unauthorized site visitation will cause the termination of onsite activities until the unauthorized visitor is removed from the premises. Removal of unauthorized visitors will be accomplished with support from the FOL, SSO, or on-site security personnel.

10.5 SITE SECURITY

Site security will be accomplished using existing NWS Earle security resources and procedures, supplemented by TtNUS or subcontractor personnel, if necessary. TtNUS will retain control over active operational areas. The first line of security will take place at the base boundaries restricting the general

public. The second line of security will take place at the work site referring interested parties to the FOL. The FOL will serve as a focal point for site personnel and will serve as the final line of security and the primary enforcement contact.

10.6 SITE MAPS

Once the areas of contamination, access routes, utilities, topography, and dispersion routes are determined, a site map will be generated and adjusted as site conditions change. These maps will show utility locations, potential points of contact with the public, roadways, and other significant characteristics that may impact site operations and safety. Site maps will be posted to illustrate up-to-date collection of contaminants and adjustment of zones and access points.

10.7 BUDDY SYSTEM

Personnel engaged in onsite activities will practice the "buddy system" to ensure the safety during this operation.

10.8 MATERIAL SAFETY DATA SHEET (MSDS) REQUIREMENTS

TtNUS and subcontractor personnel will provide MSDSs for chemicals brought onsite. The contents of these documents will be reviewed by the SSO with the user(s) of the chemical substances before an actual use or application of the substances onsite. A chemical inventory of chemicals used onsite will be developed using Section 5.0 of the Health and Safety Guidance Manual. The MSDSs will then be maintained in a central location and will be available for anyone to review on request.

10.9 COMMUNICATION

As TtNUS personnel may not be working in close proximity to each other at NWS Earle a combination of communication methods will be used. Two-way radios, cellular and conventional telephone, hand signals, voice commands, and line of site will provide be utilized when most appropriate. When project tasks are performed simultaneously on different sites, vehicle horns will be used to communicate emergency situations as described in Section 2.6 of this HASP. All radio frequency transmitting devices, including cell phones and two way radios, must be approved by NWS Earle Radio Shop. All units cleared for Hazards of Electromagnetic Radiation to Ordnance (HERO) will be labeled as safe. Only these devices will be permitted in the OB/OD unit.

External communication will be accomplished by using provided telephones at the site. External communication will primarily be used for the purpose of resource and emergency resource communications.

10.10 SAFE WORK PERMITS

All exclusion zone work conducted in support of this project will be performed using Safe Work Permits to guide and direct field crews on a task-by-task basis. An example of the Safe Work Permit to be used is illustrated in Figure 10-1. The daily meetings conducted during their generation will further support these work permits. This effort will ensure site-specific considerations and changing conditions are incorporated into the planning effort.

Use of these permits will provide the communication line for reviewing protective measures and hazards associated with each operation. This HASP will be used as the primary reference for selecting levels of protection and control measures. The work permit will take precedence over the HASP when more conservative measures are required based on specific site conditions.

The FOL and/or the SSO will be responsible for completing the Safe Work Permit and issuing them to the appropriate parties. Site personnel at the end of each day will turn in the permit(s) used for that day to the SSO. All permits will be maintained as part of the permanent project files attesting to safety and health measures used for a given task at a given time and place. Problems encountered with the protective measures required should be documented on the permit and brought to the attention of the SSO.

FIGURE 10-1

SAFE WORK PERMIT

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope (To be filled in by person performing work)

I. Work limited to the following (description, area, equipment used): _____

II. Names: _____

III. Onsite Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ _____
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. 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 ☐
SAR ☐ Bottle Trailer ☐
Skid Rig ☐ None ☐

Modifications/Exceptions: _____

V. Chemicals of Concern | Action Level(s) | Response Measures
_____ _____ _____
_____ _____ _____

VI. Additional Safety Equipment/Procedures

Hardhat	☐ 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/shank Workboots	☐ Yes	☐ No	Work/rest regimen	☐ Yes	☐ No

Modifications/Exceptions: _____

VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

		Yes	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Equipment and Foot Traffic Routes Cleared and Established	☐	☐	☐
Physical Hazards Barricaded and Isolated	☐	☐	☐
Emergency Equipment Staged	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☐ No
If yes, fill out appropriate section(s) on safety work permit addendum

X. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____
Job Completed by: _____ Date. _____

11.0 CONFINED SPACE ENTRY

It is not anticipated, under the proposed scope of work, that confined space and permit-required confined space activities will be conducted. **Therefore, personnel under the provisions of this HASP are not allowed, under any circumstances, to enter confined spaces**. A confined space is defined as an area that has one or more of the following characteristics:

- Is large enough and so configured that an employee can bodily enter and perform assigned work.
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
- Is not designed for continuous employee occupancy.

A Permit-Required Confined Space is one that:

- Contains or has a potential to contain a hazardous atmosphere (including excavations deeper than 4 feet).
- Contains a material that has the potential to engulf an entrant (including excavations).
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains other recognized serious safety or health hazard.

For further information on confined space, consult the Health and Safety Guidance Manual or call the PHSO. If confined space operations are to be performed as part of the scope of work, detailed procedures and training requirements will have to be addressed.

12.0 MATERIALS AND DOCUMENTATION

The TtNUS FOL shall ensure the following materials/documents are taken to the project site and used when required.

- A complete copy of this HASP
- Health and Safety Guidance Manual
- Incident Reports
- Medical Data Sheets
- MSDSs for chemicals brought onsite, including decon solutions, fuels, lime, sample preservatives, calibration gases, etc.
- A full-size OSHA Job Safety and Health Poster (posted in the site trailers)
- Training/Medical Surveillance Documentation Form (Blank)
- Emergency Reference Information (Section 2.0, extra copy for posting)

12.1 MATERIALS TO BE POSTED OR MAINTAINED AT THE SITE

The following documentation is to be posted or maintained at the site for quick reference purposes. In situations in which posting these documents is not feasible (such as no office trailer), these documents should be separated and immediately accessible.

Chemical Inventory Listing (posted) - This list represents chemicals brought onsite, including decontamination solutions, sample preservations, fuel, etc. This list should be posted in a central area.

Mat rial Safety Data Sheets (MSDSs) (maintained) - The MSDSs should also be in a central area accessible to site personnel. These documents should match the listings on the chemical inventory list for substances used onsite. It is acceptable to have these documents within a central folder and the chemical inventory as the table of contents.

The OSHA Job Safety & Health Protection Poster (posted) - This poster, as directed by 29 CFR 1903.2 (a)(1), should be conspicuously posted in places where notices to employees are normally posted. Each FOL shall ensure that this poster is not defaced, altered, or covered by other material.

Site Clearance (maintained) - This list is found within the training section of the HASP (See Figure 8-2). This list identifies site personnel, dates of training (including site-specific training), and medical

surveillance. The lists indicates not only clearance but also status. If personnel do not meet these requirements, they do not enter the site while site personnel are engaged in activities.

Emergency Phone Numbers and Directions to the Hospital(s) (posted) - This list of numbers and directions will be maintained at phone communications points and in each site vehicle.

Medical Data Sheets/Cards (maintained) - Medical Data Sheets will be completed by onsite personnel and filed in a central location. The Medical Data Sheet will accompany an injury or illness requiring medical attention to the medical facility. A copy of this sheet or a wallet card will be given to personnel to carry with them.

Hearing Conservation Standard (29 CFR 1910.95) (posted) - This standard will be posted when hearing protection or other noise abatement procedures are used.

Personnel Monitoring (maintained) - All results generated through personnel sampling (levels of airborne toxins, noise levels, etc.) will be posted to inform individuals of the results of that effort.

Placards and Labels (maintained) - Where chemical inventories have been separated because of quantities and incompatibilities, these areas will be conspicuously marked using Department of Transportation (DOT) placards and acceptable (Hazard Communication 29 CFR 1910.1200(f)) labels.

The purpose, as stated above, is to allow site personnel quick access to this information. Variations concerning location and methods of presentation are acceptable as long as the objection is accomplished.

13.0 GLOSSARY

ACGIH	American Conference of Governmental Industrial Hygienists
APR	Air Purifying Respirator
BGS	Below Ground Surface
C	Centigrade
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CNS	Central Nervous System
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
dBA	Decibel
DoD	Department of Defense
DOT	Department of Transportation
EOD	Explosives Ordnance Disposal
EPA	Environmental Protection Agency
eV	electron Volts
F	Fahrenheit
FID	Flame Ionization Detector
FOL	Field Operations Leader
GC	Gas Chromatograph
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High Efficiency Particulate Air
HAS	Hollow Stem Auger
HSM	Health and Safety Manager
IARC	International Agency for Research on Cancer
IDW	Investigative Derived Waste
IP	Ionization Potential
LEL	Lower Explosive Limit
LFL	Lower Flammable Limit
mg/m^3	Milligrams per cubic meter
mmHg	millimeters mercury
MSDS	Material Safety Data Sheet
NIOSH	National Institute of Occupational Safety and Health
NJDEP	New Jersey Department of Environmental Protection
NWS	Naval Weapons Station

OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PCB	Polychlorinated Biphenyls
PHSO	Project Health and Safety Officer
PID	Photoionization Detector
PPE	Personal Protective Equipment
PPM	Parts per Million
Pt	Point
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
SAR	Supplied Air Respirator
SI	Site Investigation
SCBA	Self Contained Breathing Apparatus
SOP	Standard Operating Procedure
SSO	Site Safety Officer
STEL	Short Term Exposure Limit
TAL	Target Analyte List
TCL	Target Compound List
TPH	Total Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
UEL	Upper Explosive Limit
UFL	Upper Flammable Limit
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

ATTACHMENT I

INJURY/ILLNESS PROCEDURE AND REPORT FORM

CASE NO. _____

TETRA TECH NUS, INC.

INJURY/ILLNESS PROCEDURE
WORKER'S COMPENSATION PROGRAM

WHAT YOU SHOULD DO IF YOU ARE INJURED OR DEVELOP AN ILLNESS AS A RESULT OF YOUR EMPLOYMENT:

- If injury is minor, obtain appropriate first aid treatment.
- If injury or illness is severe or life threatening, obtain professional medical treatment at the nearest hospital emergency room.
- If incident involves a chemical exposure on a project work site, follow instructions in the Health & Safety Plan.
- Immediately report any injury or illness to your supervisor or office manager. In addition, you must contact your Human Resources representative, Marilyn Diethorn at (412) 921-8475, and the Corporate Health and Safety Manager, Matt Soltis at (412) 921-8912 within 24 hours. You will be required to complete an Injury/Illness Report (attached). You may also be required to participate in a more detailed investigation from the Health Sciences Department.
- If further medical treatment is needed, The Hartford Network Referral Unit will furnish a list of network providers customized to the location of the injured employee. These providers are to be used for treatment of Worker's Compensation injuries subject to the laws of the state in which you work. Please call Marilyn Duffy at (412) 921-8475 for the number of the Referral Unit.

ADDITIONAL QUESTIONS REGARDING WORKER'S COMPENSATION:

Contact your local human resources representative, corporate health and safety coordinator, or Corporate Administration in Pasadena, California, at (626) 351-4664.

Worker's compensation is a state-mandated program that provides medical and disability benefits to employees who become disabled due to job related injury or illness. Tetra Tech, Inc. and its subsidiaries (Tetra Tech or Company) pay premiums on behalf of their employees. The type of injuries or illnesses covered and the amount of benefits paid are regulated by the state worker's compensation boards and vary from state to state. Corporate Administration in Pasadena is responsible for administering the Company's worker's compensation program. The following is a general explanation of worker's compensation provided in the event that you become injured or develop an illness as a result of your employment with Tetra Tech or any of its subsidiaries. Please be aware that the term used for worker's compensation varies from state to state.

WHO IS COVERED:

All employees of Tetra Tech, whether they are on a full-time, part-time or temporary status, working in an office or in the field, are entitled to worker's compensation benefits. All employees must follow the above injury/illness reporting procedures. Consultants, independent contractors, and employees of subcontractors are <u>not</u> covered by Tetra Tech's Worker's Compensation plan.

CASE NO. _____

WHAT IS COVERED:

If you are injured or develop an illness caused by your employment, worker's compensation benefits are available to you subject to the laws of the state you work in. Injuries do not have to be serious; even injuries treated by first aid practices are covered and must be reported. Please note that if you are working out-of-state and away from your home office, you are still eligible for worker's compensation benefits.

CASE NO. _____

Insert pdf of i/I form

ATTACHMENT II

STANDARD OPERATING PROCEDURE FOR UTILITY LOCATING AND EXCAVATION CLEARANCE

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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 the TtNUS Utility Locating and Clearance Policy. The TtNUS Utility Locating and Clearance Policy must be reviewed by anyone potentially involved with underground or overhead utility services.

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 or absence of 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 development of detailed operating procedures. This guidance is not intended to provide a detailed description of methodology and instrument operation. Specialized expertise during both planning and execution of several of the geophysical methods 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 and the TtNUS Utility Locating and Clearance Policy.

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 and the TtNUS Utility Locating and Clearance Policy. 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.

Site Personnel – Responsible for understanding and implementing this SOP and the TtNUS Utility Locating and Clearance 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. The following procedure must be followed prior to beginning any 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 such methods as passive and intrusive surveys, physical probing, or hand augering. Each method has advantages and disadvantages including complexity, applicability, and price. It also should be noted that in many 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 with a hand auger or pole (tile probe) made of non-conductive material. 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

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-auger Surveys

When the identification and location of underground utilities cannot be positively confirmed through document reviews and/or other methods, borings must be hand-augered for all locations where there is a potential to impact buried utilities. The minimum hand-auger 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-auger depths must be at least to the frost line depth plus two (2) feet, but never less than 4 feet below ground surface (bgs). For augering, the hole must be reamed by hand to 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-auger. It is important to note that a post-hole digger must not be used in place of a hand-auger.

Tile Probe Surveys

For some soil types, site conditions, and excavation requirements, tile probes may be used instead of or in addition to hand-augers. Tile probes must be performed to the same depth requirements as hand-augers. Depending upon the site conditions and intended probe usage, tile probes should be made of non-conductive material such as fiberglass.

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 subsurface 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. 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

TtNUS Utility Locating and Clearance Policy
TtNUS SOP GH-3.1; Resistivity and Electromagnetic Induction
TtNUS SOP GH-3.2; Magnetic and Metal Detection Surveys
TtNUS SOP GH-3.4; Ground-penetrating Radar Surveys

ATTACHMENT 1
LISTING OF UNDERGROUND UTILITY CLEARANCE RESOURCES

ALABAMA
Alabama Line Location (800) 292-8525

Tucson Blue Stake Center (800) 782-5348

Alaska
Locate Call Center of Alaska Inc. (800) 478-3121

Arizona
Arizona Blue Stake Inc (800) 782-5348

Arkansas
Arkansas One Call System Inc. (800) 482-8998

California
Underground Service Alert North (800) 227-2600

Underground Service Alert South (800) 227-2600

Colorado
Utility Notification Center of Colorado
(800) 922-1987

Connecticut
Call Before You Dig (800) 922-4455

Delaware
Miss Utility of Delmarva
(800) 282-8555

District of Columbia
Miss Utility (800) 257-7777

Florida
Call Sunshine (800) 432-4770

Georgia
Utilities Protection Center Inc.
(800) 282-7411

Idaho
Palouse Empire Underground Coordinating Council
(800) 882-1974

Utilities Underground Location Center
(800) 424-5555

Kootenai Country Utility Coordinating Council
(800) 428-4950

Shoshone County One Call (800) 398-3285

Dig Line (800) 342-1585

One Call Concepts (800) 626-4950

Illinois
Julie Inc. (800) 892-0123

Digger (Chicago Utility Alert Network)
(312) 744-7000

Indiana
Indiana Underground Plant Protection Services
(800) 382-5544

Iowa
Underground Plant Location Service Inc.
(800) 292-8989

Kansas
Kansas One-Call Center (800) 344-7233

Kentucky
Kentucky Underground Protection Inc.
(800) 752-6007

Louisiana
Louisiana One Call (800) 272-3020

Maine
Dig Safe – Maine (800) 225-4977

Maryland
Miss Utility (800) 257-777

Miss Utility of Delmarva (800) 282-8555

Massachusetts
Dig Safe – Massachusetts (800) 322-4844

Michigan
Miss Dig System (800) 482-7171

Minnesota
Gopher State One Call (800) 252-1166

Mississippi
Mississippi One-Call System Inc. (800) 227-6477

Missouri
Missouri One Call System Inc. (800) 344-7483

Montana
Utilities Underground Location Center
(800) 424-5555

Montana One Call Center (800) 551-8344

Nebraska
Diggers Hotline of Nebraska (800) 331-5666

Nevada
Underground Service Alert North (800) 227-2600

New Hampshire
Dig Safe – New Hampshire (800) 225-4977

New Jersey
New Jersey One Call (800) 272-1000

New Mexico
New Mexico One Call System Inc.
(800) 321-ALERT

Las Cruces-Dona Utility Council (505) 526-0400

New York
Underground Facilities Protection Organization
(800) 962-7962

New York City: Long Island One Call Center
(800) 272-4480

North Carolina
The North Carolina One-Call Center Inc
(800) 632-4949

North Dakota
Utilities Underground Location Center
(800) 795-0555

Ohio
Ohio Utilities Protection Service
(800) 362-2764

Oil & Gas Producers Underground Protection Service
(800) 925-0988

Oklahoma
Call Okie (800) 522-6543

Oregon
Utilities Underground Location Center
(800) 424-5555

Douglas Utilities Coordinating Council
(503) 673-6676

Josephine Utilities Coordinating Council
(503) 476-6676

Rogue Basin Utility Coordinating Council
(503) 779-6676

Utilities Notification Center
(800) 332-2344

Pennsylvania
Pennsylvania One Call System Inc.
(800) 242-1776

Rhode Island
Dig Safe – Rhode Island (800) 225-4977

South Carolina
Palmetto Utility Protection Service Inc
(800) 922-0983

South Dakota
South Dakota One Call (800) 781-7474

Tennessee
Tennessee One-Call System (800) 351-1111

Texas
Texas One Call System (800) 245-4545

Texas Excavation Safety System (800) 344-8377

Lone Star Notification Center (800) 669-8344

Utah
Blue Stakes Location Center (800) 662-4111

Vermont
Dig Safe – Vermont (800) 225-4977

Virginia
Miss Utility of Virginia (800) 552-7001

Miss Utility (800) 257-7777

Miss Utility of Delmarva (800) 441-8355

Washington
Utilities Underground Location Center
(800) 424-5555

Grays Harbor & Pacific County
Utility Coordinating Council
(206) 535-3550

Utilities County of Cowlitz County
(360) 425-2506

Chelan-Douglas Utilities Coordinating Council
(509) 663-6111

Upper Yakima County
Underground Utilities Council
(800) 553-4344

Inland Empire Utility Coordinating Council
(509) 456-8000

Palouse Empire Utilities Coordinating Council
(800) 822-1974

Utilities Notification Center (800) 332-2344

West Virginia
Miss Utility of West Virginia Inc. (800) 245-4848

Wisconsin
Diggers Hotline Inc. (800) 242-8511

Wyoming
West Park Utility Coordinating Council
(307) 587-4800

Call-In Dig-In Safety Council (800) 300-9811

Fremont County Utility Coordinating Council
(800) 489-8023

Central Wyoming Utilities Coordinating Council
(800) 759-8035

Southwest Wyoming One Call (307) 362-8888

Carbon County Utility
Utility Coordinating Council (307) 324-6666

Albany County Utility Coordinating Council
(307) 742-3615

Southeast Wyoming Utilities Coordinating Council
(307) 638-6666

Wyoming One-Call
(800) 348-1030

Utilities Underground Location Center
(800) 454-5555

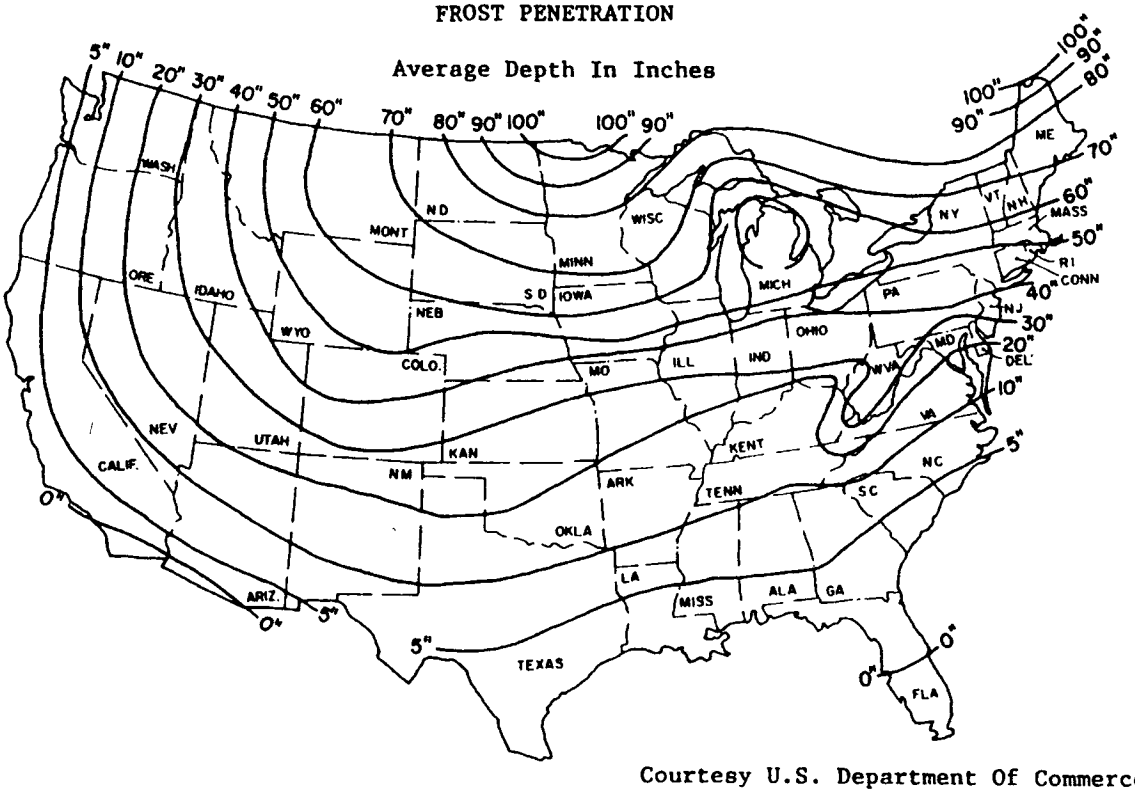
Converse County Utility Coordination Council
(800) 562-5561

ATTACHMENT 2

FROST LINE PENETRATION DEPTHS BY GEOGRAPHIC LOCATION

FROST PENETRATION

Average Depth In Inches



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 augering performed? Augering 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 III

EQUIPMENT INSPECTION CHECKLIST

EQUIPMENT INSPECTION

COMPANY:_____ **UNIT NO.**_____

FREQUENCY: Inspect daily, document prior to use and as repairs are needed.

Inspection Date: ____/____/____ Time: _____ Equipment Type:_____
(e.g., bulldozer)

	Good	Need Repair	N/A
Tires or tracks	❒	❒	❒
Hoses and belts	❒	❒	❒
Cab, mirrors, safety glass	❒	❒	❒
- Turn signals, lights, brake lights, etc. (front/rear) for equipment approved for highway use?	❒	❒	❒
- Is the equipment equipped with audible back-up alarms and back-up lights?	❒	❒	❒
Horn and gauges	❒	❒	❒
Brake condition (dynamic, park, etc.)	❒	❒	❒
Fire extinguisher (Type/Rating -_____)	❒	❒	❒
Fluid Levels:			
- Engine oil	❒	❒	❒
- Transmission fluid	❒	❒	❒
- Brake fluid	❒	❒	❒
- Cooling system fluid	❒	❒	❒
- Windshield wipers	❒	❒	❒
- Hydraulic oil	❒	❒	❒
Oil leak/lube	❒	❒	❒
Coupling devices and connectors	❒	❒	❒
Exhaust system	❒	❒	❒
Blade/boom/ripper condition	❒	❒	❒
Accessways: Frame, hand holds, ladders, walkways (non-slip surfaces), guardrails?	❒	❒	❒
Power cable and/or hoist cable	❒	❒	❒
Steering (standard and emergency)	❒	❒	❒

Safety Guards:

	Yes	No
– Around rotating apparatus (belts, pulleys, sprockets, spindles, drums, flywheels, chains) all points of operations protected from accidental contact?_____	❒	❒
– Hot pipes and surfaces exposed to accidental contact?_____	❒	❒
– All emergency shut offs have been identified and communicated to the field crew?_____	❒	❒
– Have emergency shutoffs been field tested? _____	❒	❒
– Results?_____	❒	❒
– Are any structural members bent, rusted, or otherwise show signs of damage?_____	❒	❒
– Are fueling cans used with this equipment approved type safety cans?_____	❒	❒

- Have the attachments designed for use (as per manufacturer's recommendation) with this equipment been inspected and are considered suitable for use?_____ ❒ ❒

Portable Power Tools:

- Tools and Equipment in Safe Condition?_____ ❒ ❒
- Saw blades, grinding wheels free from recognizable defects (grinding wheels have been sounded)? ❒ ❒
- Portable electric tools properly grounded?_____ ❒ ❒
- Damage to electrical power cords?_____ ❒ ❒
- Blade guards in place?_____ ❒ ❒
- Components adjusted as per manufacturers recommendation?_____ ❒ ❒

Cleanliness:

- Overall condition (is the decontamination performed prior to arrival on-site considered acceptable)?_____
- Where was this equipment used prior to its arrival on site?_____
- Site Contaminants of concern at the previous site?_____
- Inside debris (coffee cups, soda cans, tools and equipment) blocking free access to foot controls?_____

Operator Qualifications (as applicable for all heavy equipment):

- Does the operator have proper licensing where applicable, (e.g., CDL)?_____
- Does the operator, understand the equipments operating instructions?_____
- Is the operator experienced with this equipment? _____
- Does the operator have emotional and/or physical limitations which would prevent him/her from performing this task in a safe manner?_____
- Is the operator 21 years of age or more?_____

Id ntification:

- Is a tagging system available, for positive identification, for tools removed from service?___

Additional Inspection Required Prior to Use On-Site

	Yes	No
- Does equipment emit noise levels above 90 decibels?	❒	❒
- If so, has an 8-hour noise dosimetry test been performed?	❒	❒

- Results of noise dosimetry:_____
- Defects and repairs needed:_____
- General Safety Condition: _____
- Operator or mechanic signature:_____

Approved for Use: ❒ Yes ❒ No

_____
Site Safety Officer Signature

ATTACHMENT IV

SAFE WORK PERMITS

SAFE WORK PERMIT FOR MOBILIZATION AND DEMOBILIZATION ACTIVITIES AT NWS EARLE COLTS NECK, NEW JERSEY

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Mobilization and demobilization activities.

II. Required Monitoring Instruments: None

III. Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ _____
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. 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	☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, or coveralls, safety glasses and safety footwear. Hard hats, safety glasses and hearing protection will be worn when working near operating equipment.

V. Chemicals of Concern — Action Level(s) — Response Measures

None anticipated given the nature of activities and limited contact w/ media.

VI. 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 - Nitrile)	☐ Yes	☒ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Tyvek coverall to protect against natural hazards (e.g., ticks). If working in areas where snakes are a threat, wear snake chaps to protect against bites.

VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Equipment and Foot Traffic Routes Cleared and Established	☐	☐	☐
Physical Hazards Barricaded and Isolated	☐	☐	☐
Emergency Equipment Staged	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☐ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Avoid potential nesting areas. Wear light colored clothing so that ticks and other biting insects can be easily visible and can be removed. Inspect clothing and body for ticks. Minimize contact with potentially contaminated media. Suspend site activities in the event of inclement weather.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT FOR
MULTI-MEDIA SAMPLING
AT NWS EARLE COLTS NECK, NEW JERSEY

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Multi media sampling including sediment sampling and handling of split spoon cores for geotechnical analysis.

II. Required Monitoring Instrument(s): PID with 10.6 eV (or higher) lamp source

III. Field Crew: _____

IV. On-site Inspection conducted ☒ Yes ☐ No Initials of Inspector _____ _____
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. 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 ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety footwear, safety glasses and nitrile gloves. Hard hats and hearing protection will be worn when working near operating equipment and or when required by the facility.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Potential site contaminants include VOCs, metals, PCBs, and pesticides	Sustained breathing zone readings > 5.0 ppm	Retreat to an unaffected area Contact the PHSO for guidance.

VI. 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 - Nitrile)	☒ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Tyvek coverall if there is a potential for soiling work cloths and PVC or PE coated Tyvek and rubber boots if saturation or work cloths/boots may occur. Reflective vest for traffic areas.

VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Equipment and Foot Traffic Routes Cleared and Established	☐	☐	☐
Physical Hazards Barricaded and Isolated	☐	☐	☐
Emergency Equipment Staged	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: Contaminants were previously detected at low concentrations that are unlikely to present a significant exposure potential (particularly via inhalation). However, air monitoring with a PID will be performed as a precautionary measure. UXO hazards are unlikely to be present but UXO screening methods will be used for intrusive operations. Site personnel performing sediment sampling must be aware of the potential for encountering UXO shapes. Avoid any suspected UXO items and report them to the site contact immediately. Ticks are a known problem at this site. Refer to Attachment VII for guidance and use repellents and PPE to minimize contact.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT FOR
TEST TRENCH EXCAVATIONS
AT NWS EARLE COLTS NECK, NEW JERSEY

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Excavation of test trenches to determine lateral extent of Site 13

II. Required Monitoring Instruments: PID with 10.6 eV (or higher) lamp source

III. Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ _____
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. 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 ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety footwear, and nitrile gloves. Safety glasses, hard hats, and hearing protection will be worn when working near or operating equipment.

V. Chemicals of Concern	Action Level(s)	Response Measures
Potential site contaminants include VOCs, metals, PCBs, and pesticides	Sustained breathing zone readings > 5.0 ppm	Retreat to an unaffected area Contact the PHSO for guidance.

VI. 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 - Nitrile)	☒ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Tyvek coverall/rubber boots if there is a potential for soiling work cloths/boots. PVC or PE coated Tyvek and rubber boots if saturation or work cloths/boots may occur.

VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Equipment and Foot Traffic Routes Cleared and Established	☐	☐	☐
Physical Hazards Barricaded and Isolated	☐	☐	☐
Emergency Equipment Staged	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: The TtNUS SOPs on Utility Location and Excavation and UXO Clearance will be followed for all subsurface activities. Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Avoid potential nesting areas. Wear light colored clothing so that ticks and other biting insects can be easily visible and can be removed. Inspect clothing and body for ticks. Minimize contact with potentially contaminated media. Suspend site activities in the event of inclement weather. Personnel will not be permitted to enter any excavation. Excavations will not be left unattended and will be immediately backfilled upon completion.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT FOR
SOIL BORING AND SUBSURFACE SOIL SAMPLING OPRATIONS
AT NWS EARLE COLTS NECK, NEW JERSEY

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Soil boring and collection of soil cores for geotechnical analysis using hollow stem auger with split spoons.

II. Required Monitoring Instruments: PID with 10.6 eV (or higher) lamp source

III. Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ _____
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. 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 ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety footwear, and nitrile gloves. Safety glasses, hard hats, and hearing protection will be worn when working near or sampling in the vicinity of the drill rig or other operating equipment.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Potential site contaminants include VOCs, metals, PCBs, and pesticides	Sustained breathing zone readings > 5.0 ppm	Retreat to an unaffected area Contact the PHSO for guidance.

VI. 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 - Nitrile)	☒ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Tyvek coverall if there is a potential for soiling work cloths. PVC or PE coated Tyvek and rubber boots if saturation or work cloths/boots may occur.

VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Equipment and Foot Traffic Routes Cleared and Established	☐	☐	☐
Physical Hazards Barricaded and Isolated	☐	☐	☐
Emergency Equipment Staged	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: The TtNUS SOPs on Utility Location and Excavation and UXO Clearance will be followed for all subsurface activities. Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Avoid potential nesting areas. Wear light colored clothing so that ticks and other biting insects can be easily visible and can be removed. Inspect clothing and body for ticks. Minimize contact with potentially contaminated media. Suspend site activities in the event of inclement weather.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT FOR
SURVEYING AND WETLANDS DELINEATION ACTIVITIES
NWS EARLE COLTS NECK, NEW JERSEY

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Surveying and wetlands delineation activities.

II. Required Monitoring Instruments: None

III Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ _____
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. 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 ☒

Modifications/Exceptions: Minimum requirements include sleeved shirt and long pants and safety footwear. Safety glasses, hard hats, and hearing protection will be worn when working near operating equipment. Rubber boots or hip waders if activities place personnel in areas of water. Safety glasses if working in brush or wooded areas.

V. Chemicals of Concern	Action Level(s)	Response Measures
None anticipated given the nature of activities and limited contact w/ media.	None	

VI. 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 - Work)	☐ Yes	☐ No
Steel toe Work shoes or boots	☐ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Tyvek coverall to protect against natural hazards (e.g., ticks). If working in areas where snakes are a threat, wear snake chaps to protect against bites.

☐ VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Equipment and Foot Traffic Routes Cleared and Established	☐	☐	☐
Physical Hazards Barricaded and Isolated	☐	☐	☐
Emergency Equipment Staged	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Avoid potential nesting areas. Wear light colored clothing so that ticks and other biting insects can be easily visible and can be removed. Inspect clothing and body for ticks. Minimize contact with potentially contaminated media. Suspend site activities in the event of inclement weather.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
DECONTAMINATION ACTIVITIES
NWS EARLE COLTS NECK, NEW JERSEY

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Decontamination of sampling equipment and machinery (i.e., drill rigs, augers, excavating equipment, etc.). Brushes and spray bottles will be used to decon small sampling equipment. Pressure washers or steam cleaning units will be used to decon the augers, drill rigs, and other heavy equipment such as the backhoe or excavator.

II. Required Monitoring Instrument(s): PID with 10.6 eV (or higher) lamp source (used to screen equipment)

III. Field Crew: _____

IV. On-site Inspection conducted ☒ Yes ☐ No Initials of Inspector _____ _____
TtNUS

SECTION II: General Safety Requirements (To be filled in by permit issuer)

IV. 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 ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety glasses, safety footwear, and nitrile gloves. When using pressure washers, steam cleaners field crews will wear hearing protection, and face shields.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Potential site contaminants include VOCs, metals, PCBs, and pesticides	Elevated readings are not anticipated to be encountered	If airborne readings are observed, repeat decon procedure

VI. 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 - Nitrile)	☒ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: PVC rain suits or PE or PVC coated Tyvek for protection against splashes and overspray. Chemical resistant boot covers if excessive liquids are generated or to protected footwear. Hard hats may be necessary when using a face shield.

VII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☐	Emergency alarms	☐	☐
Procedure for safe job completion	☐	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

VIII. Equipment Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	☐	☐	☐
Equipment and Foot Traffic Routes Cleared and Established	☐	☐	☐
Physical Hazards Barricaded and Isolated	☐	☐	☐
Emergency Equipment Staged	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No
If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: Chemical hazards may exist with decontamination procedures given the use of fluids such as isopropyl alcohol, etc. To minimize the potential for exposure, site personnel will use PPE and prevent contact with potentially contaminated equipment. Previous analytical data indicates low concentrations of potential contaminants of concern. Refer to the manufacturer's MSDS regarding PPE, handling, storage, and first-aid measures related to decontamination fluids. Use caution when using pressure washers.

Permit Issued by: _____ Permit Accepted by: _____

ATTACHMENT V

MEDICAL DATA SHEET

MEDICAL DATA SHEET

This Medical Data Sheet must be completed by all on-site personnel and kept in a central location during the execution of site operations. This data sheet will accompany any personnel when medical assistance is needed or if transport to hospital facilities is required.

Project _____

Name _____ Home Telephone _____

Address _____

Age _____ Height _____ Weight _____

Name of Next Kin _____

Drug or other Allergies _____

Particular Sensitivities _____

Do You Wear Contacts? _____

Provide a Checklist of Previous Illnesses or Exposure to Hazardous Chemicals _____

_____

_____

What medications are you presently using? _____

_____

_____

Do you have any medical restrictions? _____

_____

_____

_____

Name, Address, and Phone Number of personal physician: _____

_____

_____

I am the individual described above. I have read and understand this HASP.

_____ _____

Signature Date

ATTACHMENT VI

UXO CLEARANCE SOP

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1.0 GENERAL

This Standard Operating Procedure (SOP) was prepared as outlined in references (a) and (b) above, for conducting field activities requiring unexploded ordnance (UXO) and chemical warfare agent (CWA) support under the Comprehensive Long-term Environmental Action Navy (CLEAN) contract. All personnel conducting operations under this SOP must read and understand applicable parts of references (a) through (j) prior to commencing any work described within this SOP. The work plan, health and safety plan, and other referenced SOPs submitted for the purpose of accomplishing work covered by this SOP are to be considered supporting documents to this SOP.

2.0 PURPOSE

This SOP is generic in nature and applies to all operations involving UXOs and/or CWAs support during field operations at various U.S. Navy installations throughout the United States under the CLEAN contract. It provides procedural requirements for any activity involving UXO and CWA. It provides detailed procedures for the location, identification, documentation, and emergency actions on UXO/CWA activities.

3.0 APPLICABILITY

This SOP applies to all personnel performing activities associated with UXOs and CWAs. This includes personnel of the prime contractor as well as personnel of any subcontractor. This SOP also applies to persons who may visit the site during the conduct of UXO/CWA activities. Compliance is mandatory for all Tetra Tech NUS, Inc. (TtNUS) personnel, subcontractors, and visitors to the site where UXO/CWA activities are in progress.

4.0 RESPONSIBILITIES

The TtNUS Project Manager is directly responsible for seeing that all applicable rules and regulations are complied with, and that all necessary safety precautions are taken to conduct operations in accordance with this SOP.

It is the responsibility of the Project Manager to ensure that all personnel conducting field activities in accordance with this SOP have the proper training (including hazard control briefings) and, if required, the proper certifications for the job being performed. The onsite TtNUS Health and Safety Officer will assume these responsibilities in the absence of the Project Manager.

5.0 LOCATIONS OF OPERATIONS

The field activities to be conducted during support of the CLEAN contracts can be performed at a variety of locations throughout the United States. Wherever the installation is located, a detailed site description, discussions of known and/or suspected contamination sources, and results of previous studies will be provided to field personnel.

If available, the initial evaluation, consisting of preliminary risk assessments (including discussions of probable contaminants, transport pathways, identification of potential receptors, and preliminary evaluation of human health and environmental concerns), preliminary identification and evaluation of remedial action alternatives, and preliminary identification of applicable or relevant and appropriate requirements (ARARs) will also be made available to field personnel conducting activities at the installation.

6.0 PERSONNEL QUALIFICATIONS AND REQUIREMENTS

6.1 Personnel Qualifications: Qualifications for those personnel actively involved in UXO/CWA operations shall be as follows:

a. UXO personnel shall be graduates of the U.S. Naval Explosive Ordnance Disposal (EOD) School, Indian Head, Maryland.

b. The lead UXO Supervisor for the operation will have been awarded the Master EOD Badge and have served at least 15 years in military EOD assignments, of which more than 10 years were in a supervisory position.

c. UXO personnel must meet the requirements as stated in the Site Health and Safety Plan, consistent with OSHA 29 CFR 1910.120, paragraph (e).

6.2 Personnel Requirements: During any activity where the possibility that UXOs and/or CWAs may be encountered (no matter how remote), the following requirements will be met:

a. One EOD-qualified technician will be required to support each field team engaged in operations in areas that might contain UXOs/CWAs.

b. One EOD-qualified person will be present at the site during all activities to provide UXO/CWA support in the event their services are required.

7.0 PERSONNEL LIMITS

The activities to be conducted under the CLEAN contract will not normally be conducted in areas requiring maximum personnel limitations. Work will not be permitted unless at least two persons are present in the work area. The provisions of 29 CFR 1910.120 concerning personnel qualifications and requirements will be followed while working on site. Any personnel limitation requirements that may be in force by the Installation Safety office will be adhered to at all times.

During all hazardous operations related to searching or screening for UXO or any hazardous UXO/explosive related service, the "buddy system" (29 CFR 1910.120, paragraph (d) (3)) must be used, with one of these persons being a qualified and approved TtNUS EOD technician.

8.0 MATERIAL LIMITS

Explosive materials will not be used during the operations covered by this SOP. Bulk liquids to be used for the decontamination of equipment will be in 2-gallon containers or less. Material Safety Data Sheets (MSDSs) will be kept on file in the Installation Fire Department and at the TtNUS Command Post.

9.0 SAFETY REQUIREMENTS

9.1 Reference Safety Requirements: The safety requirements that apply to the UXO/CWA operations covered under this SOP are:

a. NAVSWCINST 5100.6; Subj: Occupational Safety and Health Program.

b. NSWCDDINST 5104.1; Subj: Control of Emissions (EMCON) Causing Hazards of Electromagnetic Radiation to Ordnance (HERO).

c. OSHA 29 CFR 1910-120 and 1910.134.

d. NRC 10 CFR, Part 19, 20, and 40.

e. NAVSEA SO420-AA-RAD-010, dated 01 October 1991.

9.2 Specific Safety Requirements: The specific safety requirements for UXO/CWA operations are as follows:

a. All operations will be suspended if so ordered by the Installations Range Control.

b. If UXO/CWA or suspected UXO/CWA is encountered, all operations in the affected area will cease, the affected area will be evaluated, and notification will be made in accordance with Section 11.0 of this SOP.

c. TtNUS UXO technicians (EOD-qualified) will be present during UXO-related activities.

d. Installation approved communications equipment (two-way radios) will be onsite during any operation. HERO restrictions will comply with Reference 9.1 b. above.

e. Standard work practices as outlined in the site work plan will apply.

10.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The following PPE will be worn by personnel on site. Items marked with an asterisk (*) will be available and will be used, if necessary, as determined by the TtNUS Site Safety Officer.

a. Safety glasses

b. Safety shoes (and protective overboots/or steel-toe rubber boots*)

c. Cotton clothing (with protective coveralls*)

d. Gloves (type to be determined by TtNUS Site Safety Officer)

e. Respiratory protection equipment* (29 CFR 1910.134)

f. Hearing protection*

g. Hard hats*

Additional equipment may be required on a site-specific basis. Equipment will be selected by the Site Safety Officer (SSO) and the Project Manager in accordance with the Work Plan and appendices.

11.0 EMERGENCY RESPONSE AND CONTINGENCY PLANS

11.1 Emergency Contacts: In the event of an emergency, notification will be made to the following in the order presented or in the order dictated by the installation:

a. Emergency Fire and Medical Assistance

b. Installation Safety Office

c. Installation EOD Office

d. Installation Environmental Office

e. TtNUS Site Supervisor (Field Operations Leader)

f. TtNUS Project Manager

Most activities to be performed during field work should not be conducted within buildings. In the event of an emergency, all site personnel will be evacuated to a predetermined location away from the work place. Emergency Response Planning will follow in accordance with 29 CFR 1910.38(a). TtNUS will utilize the Installations Base Fire Protection and Emergency Services in emergencies or potential emergencies.

11.2 Contingency Plans: The following contingency plans will be implemented:

a. Pre-Planning - Upon arrival at the base, the TtNUS Field Operations Leader and/or Site Safety Officer will meet with the Base Fire Protection Department, Base Security Personnel, and Emergency Services to notify them what activities are to be undertaken and where. All site personnel will be required to follow base emergency procedures and will rely on base services to handle emergency calls when needed. Medical services will be provided by the base if available or off site by local medical services.

Hand-held radios will be available at the work site for communications between field teams and Range Control.

b. Emergency Escape Procedures and Assignments - Upon notification of a site emergency that requires evacuation, all site personnel will proceed to predetermined locations based on emergency location and wind directions. If personnel cannot reach these locations without danger to their lives or health, and alternate meeting place will be designated during the daily hazard control briefing. Personnel will be trained to remain at the refuge location until directed to resume work, or leave the site.

c. Procedure to Account for Site Personnel - The site work force will be small enough that accounting for personnel will not be a problem. Accounting for personnel will be the Field Operations Leader's responsibility. This will be accomplished by taking a roll call using the site log book.

d. Rescue and Medical Duties - A physician-approved first aid kit, an ANSI-approved eye wash station, and a Class ABC fire extinguisher will be readily available on site. Site personnel will not be authorized to participate in emergency rescue operations.

e. Activation of Emergency Response Procedures - Should any emergency occur which requires the support of outside services, the appropriate contacts will be made by the Field Operations Leader. A list of the appropriate contacts will be posted at the Command Post. Hand-held radios will be the primary means of communications.

f. Airborne Chemical Release Contingency Plan -

(1) Chemical Release Monitoring - every member of the site team will be responsible for observing and reporting any gross chemical releases or conditions that could lead to releases. Air monitoring will be performed as described in the site work plans and the site health and safety plan.

(2) Response to Measured Airborne Chemical Releases - the readings on monitoring instrumentation will be compared to the action levels specified in the work plans and the site health and safety plan for the purpose of protecting the health and safety of onsite personnel. If the concentrations shown on the instruments suggest that the hazardous materials can exceed the following levels at the perimeter of neighboring residential or commercial property, the TtNUS Field Operations Leader and/or the Site Safety Officer will notify the base fire department.

Parameter	Action Level	Note:
Total Organic Vapors	50 ppm	SUGGESTED LEVELS ONLY
Flammable Vapors	10% of the Lower Explosive Limit (LEL)	

(3) Response to Sudden Airborne Chemical Releases - if a field operation onsite results in a release of a concentrated vapor from a pressurized container (which will normally result in a visible plume), personnel will leave the area for the predetermined-upwind assembly point quickly, but without panic. TtNUS Field Operations Leader and/or the Site Safety Officer will notify the base fire department as soon as possible. The potential for such an event to occur during planned activities is not considered to be significant.

g. Liquid Release Monitoring - Every member of the site team will be responsible for observing and reporting any liquid chemical releases or conditions that could lead to a release. If field operations on site result in a release of liquid chemicals in the absence of vapors, field personnel will attempt to contain the liquid by means of berms constructed with available equipment. If the work team cannot control the spill, they will leave the area for the assembly point quickly, but without panic. The TtNUS Field Operations Leader and/or the Site Safety Officer will notify the base fir department. This is not considered to be a significant event during operations, however, in the unlikely instance that it should occur, field personnel may effect defensive efforts, providing that such a response does not appear to present a chemical overexposure or other personal health or safety concern.

12.0 SAFETY POINTS OF CONTACT

a. Installation Safety Management Branch

b. Installation Ordnance Officer and/or EOD Officer

c. Installation Radiation Officer

d. Installation Environmental Office

13.0 TOOLS AND EQUIPMENT

Major items of equipment and instrumentation that may be required for UXO/CWA operations covered by this SOP are presented below by category:

13.1 Protective Equipment

a. Respiratory Protective Equipment (APR or SCBA)

b. Dermal (chemical resistant) protective equipment

c. Other items (hard hats, safety glasses, etc.)

13.2 Air Monitoring Equipment

a. Explosive/O_2 Meter (Combustible Gas Indicator)

b. Direct reading Organic Vapor Analyzer (PID or FID)

c. Radiation Survey Meters and TLD Badges

13.3 Geophysical/hydrology/Survey Instrumentation

a. Magnetometer (G-856 AG)

b. Electromagnetic Terrain Conductivity Meter (EM-31)

c. Water Level Indicator/Recorder

d. Survey equipment (transit, tripod, etc.) as required

e. pH/Temperature/Conductivity Meter for water samples

13.4 UXO Support Equipment

a. GA-72CV Magnetic Locator (passive instrument) will be used for UXO surface survey during UXO activities. The GA-72CV detects the magnetic field of any ferromagnetic object.

b. MG-220 Magnetic Gradiometer (Down-Hole Magnetometer) will be used to conduct downhole UXO checks. The MG-220 detects the magnetic field of any ferromagnetic object as it is lowered into a borehole.

c. Marking tape, pin flags, stakes

13.5 CWA Support Equipment

a. Chemical Agent Identification Kits (M18A2 Kit)

b. ICADs (Individual Chemical Agent Detector)

13.6 Decontamination Equipment

As required by the level of protection for each site. See Site Health and Safety Plan.

13.7 Hand Tools

As may be required.

13.8 Miscellaneous

As may be required.

14.0 ENVIRONMENTAL CONCERNS

The field operations covered by this SOP will be performed in such a manner as to minimize the effects of pollution of air, water, or land and to control noise and dust within reasonable limits.

Every effort will be made to:

a. Protect the land areas and to preserve them in their existing condition.

b. Protect water resources, including measures for run-off or run-off controls if applicable.

c. Implement sediment control measures, where warranted. These measures will also be implemented to control erosion.

Usually, field operations will generate solid and liquid waste requiring onsite handling and possible offsite disposal. The major types of waste to be generated, their environmental concerns, and their handling and disposition are summarized below:

a. Personnel and equipment decontamination fluid containers will be disposed off site following a thorough decontamination. Liquid waste will be included with the well purging and development fluids.

b. PPE will be double-bagged and will be the responsibility of TtNUS to dispose of according to applicable regulations. Disposal will be off site.

It is not anticipated that any chemical releases will occur during the field activities.

The MSDSs for chemicals being brought onto the installation for use in field operations will be located at the Fire Department and at the TtNUS Field Command Post.

15.0 UXO/CWA PROCEDURES FOR FIELD OPERATIONS

15.1 General - field procedure for work on the CLEAN contract can include any or all of the following tasks:

a. Initial entry into suspect areas for

b. Surface and subsurface sampling,

c. Monitoring well installation,

d. Exploratory trenching,

e. Geophysical surveys, and

f. Other miscellaneous operations.

15.2 Initial entry - initial entry into suspect areas require an EOD-qualified technician with a magnetometer (GA-72CV) to screen a path into the area. The screened area is marked with lanes using either pin flags or marking tape. Suspect items on the surface and subsurface magnetic anomalies will be marked, usually with a different color tape or pin flag, and will be avoided by team members. The site where the work is to be conducted will be thoroughly screened for UXO/CWA contamination prior to any work commencing. All personnel will stay within the cleared areas and not venture out into areas not screened. If an area that has magnetic anomalies cannot be avoided, the EOD-qualified technician will hand excavate down to the anomaly to check to see if a hazard exists. If the excavation reveals a hazard, the emergency notification procedures in paragraph 11.0 will apply.

15.3 Sampling - sampling will be conducted in accordance with established protocols and methodologies. Site specific sampling requirements will be presented in the work plans and in the Fieldwork Standard Operating Procedure.

Sites potentially contaminated with UXO/CWA will be screened by EOD-qualified technicians prior to sampling. A magnetometer (GA-72CV) will be used to screen entry into a suspect area as in paragraph 15.2 above. Lanes will be marked and suspect items and subsurface anomalies will be identified and avoided. The immediate sampling area will be surface screened for the sampling team.

Prior to any subsurface intrusive sampling, another check with a magnetometer needs to be accomplished. The GA-72CV Magnetic Locator can be used for collecting subsurface samples not greater than 0.5 feet. If excavation of a bore hole or hand auguring hole is to exceed this depth than the MG-220 Magnetic Gradiometer (downhole magnetometer) should be utilized and a reading taken at every two feet of depth.

If an anomaly is detected then the location will be marked and avoided and the sampling location relocated to a clean area. If the sampling location cannot be relocated then the EOD-qualified technician will hand excavate down to the anomaly to determine if it is hazardous. If it is not hazardous, the object will be set aside and the sampling event will continue. If the object has been determined to be hazardous or suspect, the sampling team will move out of the area and the emergency procedures listed in paragraph 11.0 will be implemented.

15.4 Monitoring Well Installation - the area within a 50-foot radius of the borehole and the off-road access path will be screened with the GA-72CV magnetometer and be cleared of all metal objects found. Once this is accomplished, the area should be clear of all UXO and the area around the borehole site will be marked using colored marking tape and/or pin flags. Heavy equipment such as front-end loaders, backhoes, and bulldozers will not be used to develop or establish drill sites. The following action will be followed:

a. The GA-72CV magnetometer will be used directly over the borehole site to check for

buried items down to 0.5 feet. After a surface check, the EOD-qualified technician will hand auger down to a depth of two feet and check down the hole using the MG-220 magnetometer.

b. Once the hand auguring hole has been cleared,the drill rig will be positioned over the proposed borehole. Drilling will commence to a depth four feet, the drill auger will be removed from the borehole, the drill crew chief and UXO personnel will make observations of the soil from the core barrel and the soil removed from the hole by hand auger (if needed). The drilling log and lithologic log will be maintained in accordance with standard practices, noting any metal objects that may be found.

c. The drilling derrick will be secured and the drill rig moved to a position at least 20 feet from the borehole.

d. The borehole will be checked again with the MG-220 magnetometer.

e. If UXO or magnetic anomaly is present, the borehole will be abandoned and another location selected. The new borehole should be at least six feet from the original borehole. If an UXO or anomaly is not detected and the clearance is given, the drill rig shall be positioned back over the borehole, and drilling will proceed to the next depth (6 feet).

f. Repeat above steps, at intervals of 2 feet, until a depth of 10 feet is reached. At the 10 foot interval, a magnetometer reading shall be taken with the MG-220 set on the maximum sensitivity. The instrument will detect larger objects, approximately 100 lbs., that would be expected at this depth depending on density from 4 to 8 feet.

g. After reaching the depth of 10 feet, the above steps will be repeated at intervals of 4 feet, until the desired depth is reached.

15.5 Exploratory Trenching and Excavation - at times, exploratory trenching will be utilized to determine the lateral extent of a landfill, burial pit, or subsurface geophysical anomaly. Trenching and excavation to uncover a subsurface area will be conducted using a backhoe, an excavator, or sometimes a front-end loader. The following procedures will be utilized to conduct these operations:

a. The surface of the area to be trenched or excavated will first be swept with the GA-72CV magnetometer. Anomalies will be hand excavated to determine if hazardous.

b. No more than 0.5 feet of surface soil will then be removed from the area of concern.

c. The heavy equipment will be removed at least 20 feet away from the area, and the area will be checked with the MG-220 magnetometer. If the area is a trench, the entire length of the trench will be checked with the MG-220 and the excavation can continue two feet at a time. If the area is a wide open area, it can once again be checked with the GA-72CV, but only 0.5 feet of soil removal can be excavated at a time.

d. Anomalies will continue to be uncovered by hand excavation until the desired results are obtained and the trench/area is abandoned and refilled.

e. Excavation will continue another 2 feet if using the MG-220 or 0.5 feet if using the GA-

72CV magnetometer. Once again after the proper depth of soil is excavated the heavy equipment is removed from the area (>20 feet) and the area is rechecked with the magnetometer.

f. The above procedures are followed until the desired depth is reached and/or the desired results are obtained.

Once the area or trench has been cleared, excavation can continue to the proper depth before the equipment is again moved away (at least 20 feet) and the area/trench

15.6 Geophysical Surveys - two instruments will be used to conduct geophysical surveys under the CLEAN contract. The EG & G Geometrics magnetometer (G-856 AG) and a Geonics Terrain Conductivity Meter (EM-31). The magnetometer is a passive instrument, and the EM-31 is a active instrument and is commonly used to measure subsurface terrain conductivity. This information can be used for geophysical surveys, as well as for locating voids, discontinuities in soil structures such as boundaries of disposal pits and buried conducting objects.. An Ordnance Safety Analysis of the Geonics Model EM-31-D, Non-Contacting Terrain Conductivity Meter was conducted by the Naval Surface Warfare Center at the request of TtNUS in April 1993. The analysis concluded, in summary, that the "Geonics EM-31-D poses no ordnance safety hazard when operated in the normal survey mode, where the device is held at hip height." However, the Geonics EM-31-D should not be used with the boom on the ground if ordnance is "present".

When using the magnetometer or the EM-31-D, an EOD-qualified technician will conduct a surface sweep of the area to be surveyed to ensure that no surface ordnance or other hazards exist. The magnetometer is a passive instrument, therefore, no special ordnance safety precautions are required.

The following procedure will be used to ensure the safe operation of the EM-31-D during the geophysical survey:

a. The instrument will be turned on and calibrated off site.

b. Background readings will be taken off site and recorded in the field logbook.

c. The instrument will be turned off and taken to the first survey point.

d. The instrument will be placed on a stand or held at waist height (at least 1 meter off ground), turned on, and readings taken and recorded.

e. After all readings have been taken at the survey point, the instrument will be turned off, removed from the stand, and taken to the next survey point.

f. Steps c. and d. above will be repeated until all points have been surveyed.

g. The instrument will be turned off and taken off site, turned on, and background readings again taken.

h. The geophysical survey is now complete.

15.7 Miscellaneous Operations - due to the potential of UXO/CWA material being encountered during field activities, UXO support will be provided at all site locations. UXO support will be provided for

any and all field activities that are in areas suspected to contain UXO and/or CWA. These areas also include those areas covered with water and creeks, canals, etc..

16.0 HAZARD CONTROL BRIEF

A Health and Safety Hazard Control Briefing will be conducted prior to the start of onsite activities. The briefing will be detailed and will cover the information contained in the SOP and the Health and Safety Plan. Refresher briefings will be conducted as necessary for specific or unique activities. New personnel assigned to the project will receive an in-depth briefing prior to starting work. The following information will be given during the briefing:

a. Overview of Task to be Performed

b. Overview of Hazards

- Unexploded Ordnance Hazards
- Chemical Warfare Agents
- Physical Hazards

c. Overview of Standard Work Practices

d. Overview of Training Requirements

e. Overview of Emergency Response Actions

f. Location of MSDSs

17.0 SECURITY

There are no special security requirements. Field activities under the CLEAN contract are unclassified and normal security measures apply in accordance with references (e) and (i). TtNUS personnel and their subcontractors will check in with the installation's security office and be badged for entry into the work areas.

ATTACHMENT VII

TICK / LYME'S DISEASE INFORMATION

TICK CONTROL
AND
LYME DISEASE

The occurrence of Lyme disease has become a worldwide problem since its identification in 1976. This disease is characteristically recognized as being transmitted by ticks, which may be encountered by field personnel while working at this site. As a result, this discussion has been included with this Health and Safety Plan to provide for adequate recognition, evaluation, and control efforts to minimize the occurrence and effects of this potential hazard.

The discovery of Lyme disease is credited to Dr. Allen Steere of Yale University Medical School, and is named after the community where it was (reportedly) first encountered, Lyme, Connecticut. This disease can be transmitted to man through the bite of ticks that are infected with a cork screw-shaped microbe (spirochete). The spread of this disease has been so rapid that in 1984 it surpassed Rocky Mountain Spotted fever as the most common tick-borne disease in the United States. In this country, most of the incidents of this disease have been recorded in the Northeast, and the tick species most commonly attributed with its spread is the deer tick.

Recognition

This hazard potential exists primarily in the spring and summer months, as these are the seasons that tick populations and activity flourish. In fact, 90 percent of the reported cases have occurred from early June through September. Also, this concern exists primarily in heavily vegetated areas. Therefore, recognition of these factors can aid in the awareness and control of this threat.

To aid in the recognition and identification of these insects, an example illustration of the tick species common to the region where this site is located has been included with this discussion. This species (the American Dog tick) is common in the eastern half of the United States, and typically exists in areas covered with grass or underbrush. These insects will attach themselves to animals (including man) that pass through the area and rub against them. After finding a host, the tick inserts its mouthparts and sucks blood until it is fully engorged. This requires a time period of three to twelve days, then the tick will drop off. In addition to Lyme disease concerns, this tick has also been identified as a transmitter of Rocky Mountain Spotted Fever, and the organisms of tularemia and possibly relapsing fever. The wounds left by tick bites can be painful, and can also have a paralyzing effect commonly referred to as tick paralysis.

The earliest symptom of the onset of this disease is the occurrence of an unusual red skin rash. This is commonly the first indication since it has been evidenced that many persons who have contracted this disease were, in fact, unaware that they had been bitten. This rash can appear at the site of the bite anywhere from several days to a few weeks after the bite. It typically starts as a small red spot, and then expands as the spirochetes expand from the bite location. Rash sizes can vary, but have been most commonly associated in a 2 to 3 inch diameter size range. This rash will fade (with or without treatment) after a few weeks. Close inspection is necessary to detect this symptom as the rashes are easy to miss because they're often very faint. Body sites where rashes frequently occur include the thigh areas, groin, and armpits. Also, it is not uncommon for a rash to develop in more than one place.

Other early symptoms include profound fatigue, a stiff neck, and flu-like symptoms such as headache, chills, fever, and muscle aches. Recognition of the onset of any of these symptoms is important since tick bites do not always produce a rash. If left untreated, the disease will progress to its second stage within weeks or months after the infection. This stage involves affects to the heart and nervous system. A common second stage symptom is a paralysis on one or both sides of the face. Others include severe headache, encephalitis, or meningitis. The third and final stage involves the development of chronic inflammatory arthritis, which can occur up to a year or more after the bite.

Evaluation

Evaluation of this hazard potential principally involves field personnel performing close self-inspections for the presence of ticks each time they leave the site. This should involve careful examination, especially of the individuals' heads. Personnel should be aware that when a tick attaches itself to its host, it inserts its entire head under the surface of the skin.

Control

Control of this threat involves several components. First, field personnel must be aware of the climate and area conditions which are commonly associated with being conducive to tick infestation. Second, when working in or walking through potential infested areas, personnel must ensure that they do not have exposed body parts (i.e. at least long sleeved shirts and long pants, particularly when protective coveralls are not worn). In heavily vegetated areas where infestation is likely, Tyvek coveralls will be required to minimize this hazard potential. Also, several commercial products have been demonstrated as being effective in repelling ticks. Examples include Permanone, Off!, and Cutter. These types of repellents will be used at the direction and discretion of the Tetra Tech NUS Health and Safety Officer, and only in accordance and observation of manufacturer's recommendations. In most instances, however, such repellents are typically applied to the outside surfaces of clothing (and not directly onto the skin), and should be applied also to shoe tops, socks, pants cuffs, and other areas most susceptible to ticks.

Tick R moval

In the event that a tick is discovered to be attached to a member of the field team, timely removal of the insect is critical to reducing the potential for contracting the disease. According to available information and research, there is apparently a grace period of at least a few hours from the time of the bite before the tick transmits the microbe (the spirochetes are not present in the mouth parts of the tick). However, the incident of a tick bite is frequently unnoticed, and the discovery of the tick may not occur until after this suspected grace period has already elapsed. Therefore, timely removal is very important. The preferred method of tick removal is to pull it out using tweezers or small forceps. In this method, the tick should be grasped as close to the mouth as possible, and then pulled steadily upward. Care must be exercised so as not to pull in a jerking motion as this can result in the head becoming detached. After the tick has been removed, disinfect the bite with rubbing alcohol or povidone iodine (Betadine). The tick must not be handled as the microbes can enter the body through any breaks in intact skin. The bite should be checked occasionally for at least a two-week period to see if a rash forms. If it does, medical attention must be promptly sought.

In order to provide for proper and timely response to the occurrence of a tick bite, the SSO will ensure that the site First Aid kit is properly equipped with medical forceps and rubbing alcohol, in addition to the standard kit contents. Also, an adequate supply of commercial insect (tick) repellents will be maintained on-site, and all personnel will be trained in its proper application and will be required to use it, at the direction of FOL.

APPENDIX B

FIELD FORMS

Tetra Tech NUS, Inc.

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:

	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
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):

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

PROJECT NAME : ____________________

SITE NAME: ____________________

PROJECT No.: ____________________

INSTRUMENT NAME/MODEL: ____________________

MANUFACTURER: ____________________

SERIAL NUMBER: ____________________

Date of Calibration	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot No.)	Remarks and Comments
			Pre-calibration	Post-calibration	Pre-calibration	Post-calibration		

APPENDIX C

TtNUS STANDARD OPERATING PROCEDURES

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number SA-1.2	Page 1 of 10
		Effective Date 06/99	Revision 4
		Applicability Tetra Tech NUS, Inc.	
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Subject SURFACE WATER AND SEDIMENT SAMPLING		Approved D Senovich	

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1.0 PURPOSE

This procedure describes methods and equipment commonly used for collecting environmental samples of surface water and aquatic sediment for either onsite examination and chemical testing, or for subsequent laboratory analysis.

2.0 SCOPE

The information presented in this guideline is generally applicable to all environmental sampling of surface waters (Section 5.3) and aquatic sediments (Section 5.5), except where the analyte(s) may interact with the sampling equipment. The collection of concentrated sludges or hazardous waste samples from disposal or process lagoons often requires methods, precautions and equipment different from those described herein.

3.0 GLOSSARY

Environmental Sample - a sample containing (or suspected to contain) low-level concentrations of contaminants, which does not require special handling or transport considerations as detailed in SOP SA-6 1.

Hazardous Waste Sample - a sample containing (or suspected to contain) higher concentrations of contaminants thus requiring special handling and/or transport considerations per SOP SA-6.1.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager has the overall responsibility for seeing that all surface water and sediment sampling activities are properly conducted by appropriately trained personnel.

Field Operations Leader - The Field Operations Leader (FOL) is responsible for the in-field supervision of the conduct of onsite water quality analyses, ensuring the completion and accuracy of all field documentation, and making sure that custody of all samples obtained is maintained according to proper procedures.

5.0 PROCEDURES

5.1 Introduction

Collecting a representative sample from surface water or sediments is difficult because of water movement, stratification, or patchiness. To collect representative samples, one must standardize sampling bias related to site selection, sampling frequency, sample collection, sampling devices, and sample handling, preservation, and identification.

Representativeness is 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 taken. Regardless of quality control applied during laboratory analyses and subsequent scrutiny of analytical data packages, reported data are no better than the confidence that can be placed in the representativeness of the samples.

5.2 Defining the Sampling Program

Many factors must be considered in developing a sampling program for surface water or sediments including study objectives, accessibility, site topography, physical characteristics of the water body (such as flow and mixing), point and diffuse sources of contamination, and personnel and equipment available to conduct the study. For waterborne constituents, dispersion depends on the vertical and lateral mixing within the body of water. For sediments, dispersion depends on bottom current or flow characteristics, sediment characteristics (density, size) and geochemical properties (which affect adsorption/desorption) The hydrogeologist developing the sampling plan must therefore know not only the mixing characteristics of streams and lakes, but also must understand the role of fluvial-sediment transport, deposition, and chemical sorption.

5.2.1 Sampling Program Objectives

The objective of surface water sampling is to determine the surface water quality entering, leaving or remaining within the site. The scope of the sampling program must consider the sources and potential pathways for transport of contamination to or within a surface water body. Sources may include point sources (leaky tanks, outfalls, etc.) or nonpoint sources (e.g., spills). The major pathways for surface water contamination (not including airborne deposition) are overland runoff, leachate influx to the waterbody, direct waste disposal (solid or liquid) into the water body; and groundwater flow influx from upgradient. The relative importance of these pathways, and therefore the design of the sampling program, is controlled by the physiographic and hydrologic features of the site, the drainage basin(s) which encompass the site, and the history of site activities.

Physiographic and hydrologic features to be considered include slopes and runoff direction, areas of temporary flooding or pooling, tidal effects, artificial surface runoff controls such as berms or drainage ditches (and when they were constructed relative to site operation), and locations of springs, seeps, marshes, etc. In addition, the obvious considerations such as the location of man-made discharge points to the nearest stream (intermittent or flowing), pond, lake, estuary, etc., shall be considered.

A more subtle consideration in designing the sampling program is the potential for dispersion of dissolved or sediment-associated contaminants away from the source. The dispersion could lead to a more homogeneous distribution of contamination at low or possibly non-detectable concentrations. Such dispersion does not, however, always readily occur. For example, obtaining a representative sample of contamination from a main stream immediately below an outfall or a tributary is difficult because the inflow frequently follows a stream bank with little lateral mixing for some distance. Sampling alternatives to overcome this situation are: (1) move the site far enough downstream to allow for adequate mixing, or (2) collect integrated samples in a cross section. Also, nonhomogeneous distribution is a particular problem with regard to sediment-associated contaminants, which may accumulate in low-energy environments (coves, river bends, deep spots, or even behind boulders) near or distant from the source while higher-energy areas (main stream channels) near the source may show no contaminant accumulation.

The distribution of particulates within a sample itself is an important consideration. Many organic compounds are only slightly water soluble and tend to adsorb onto particulate matter. Nitrogen, phosphorus, and the heavy metals may also be transported by particulates. Samples must be collected with a representative amount of suspended material; transfer from the sampling device shall include transferring a proportionate amount of the suspended material.

5.2.2 Location of Sampling Stations

Accessibility is the primary factor affecting sampling costs. The desirability and utility of a sample for analysis and consideration of site conditions must be balanced against the costs of collection as controlled by accessibility. Bridges or piers are the first choice for locating a sampling station on a stream, because bridges provide ready access and also permit the sampling technician to sample any point across the stream A boat or pontoon (with an associated increase in cost) may be needed to sample locations on lakes and reservoirs, as well as those on larger rivers. Frequently, however, a boat will take longer to cross a water body and will hinder manipulation of the sampling equipment. Wading for samples is not recommended unless it is known that contaminant levels are low so that skin contact will not produce adverse health effects. This provides a built in margin of safety in the event that wading boots or other protective equipment should fail to function properly. If it is necessary to wade into the water body to obtain a sample, the sampler shall be careful to minimize disturbance of bottom sediments and must enter the water body downstream of the sampling location. If necessary, the sampling technician shall wait for the sediments to settle before taking a sample.

Sampling in marshes or tidal areas may require the use of an all-terrain vehicle (ATV). The same precautions mentioned above with regard to sediment disturbance apply.

Under ideal and uniform contaminant dispersion conditions in a flowing stream, the same concentrations of each would occur at all points along the cross section. This situation is most likely downstream of areas of high turbulence. Careful site selection is needed in order to ensure, as nearly as possible, that samples are taken where uniform flow or deposition and good mixing conditions exist

The availability of streamflow and sediment discharge records can be an important consideration in choosing sampling sites in streams. Streamflow data in association with contaminant concentration data are essential for estimating the total contaminant loads carried by the stream. If a gaging station is not conveniently located on a selected stream, the project hydrogeologist shall explore the possibility of obtaining streamflow data by direct or indirect methods.

5.2.3 Frequency of Sampling

The sampling frequency and the objectives of the sampling event will be defined by the project plan documents. For single-event site or area characterization sampling, both bottom material and overlying water samples shall be collected at the specified sampling stations. If valid data are available on the distribution of the contaminant between the solid and aqueous phases, it may be appropriate to sample only one phase, although this is not often recommended. If samples are collected primarily for monitoring purposes (i.e., consisting of repetitive, continuing measurements to define variations and trends at a given location), water samples shall be collected at a pre-established and constant interval as specified in the project plans (often monthly or quarterly, and during droughts and floods). Samples of bottom material shall be collected from fresh deposits at least yearly, and preferably seasonally, during both spring and fall.

The variability in available water-quality data shall be evaluated before determining the number and collection frequency of samples required to maintain an effective monitoring program

5.3 Surface Water Sample Collection

5.3.1 Streams, Rivers, Outfalls and Drainage Features (Ditches, Culverts)

Methods for sampling streams, rivers, outfalls, and drainage features at a single point vary from the simplest of hand-sampling procedures to the more sophisticated multi-point sampling techniques known as the equal-width-increment (EWI) method or the equal-discharge-increment (EDI) methods (see below).

Samples from different depths or cross-sectional locations in the watercourse taken during the same sampling episode, shall be composited. However, samples collected along the length of the watercourse or at different times may reflect differing inputs or dilutions and therefore shall not be composited. Generally, the number and type of samples to be taken depend on the river's width, depth, discharge and on the suspended sediment the stream or river transports. The greater the number of individual points that are sampled, the more likely that the composite sample will truly represent the overall characteristics of the water.

In small streams less than about 20 feet wide, a sampling site can generally be found where the water is well mixed. In such cases, a single grab sample taken at mid-depth in the center of the channel is adequate to represent the entire cross section.

For larger streams, at least one vertical composite shall be taken with one sample each from just below the surface, at mid-depth, and just above the bottom. The measurement of DO, pH, temperature, conductivity, etc., shall be made on each aliquot of the vertical composite and on the composite itself. For rivers, several vertical composites shall be collected, as directed in the project plan documents.

5.3.2 Lakes, Ponds and Reservoirs

Lakes, ponds, and reservoirs have a much greater tendency to stratify than rivers and streams. The relative lack of mixing requires that more samples be obtained.

The number of water sampling sites on a lake, pond, or impoundment will vary with the size and shape of the basin. In ponds and small lakes, a single vertical composite at the deepest point may be sufficient. Similarly, the measurement of DO, pH, temperature, etc., is to be conducted on each aliquot of the vertical composite and on the composite itself. In naturally-formed ponds, the deepest point may have to be determined empirically; in impoundments, the deepest point is usually near the dam.

In lakes and larger reservoirs, several vertical composites shall be composited to form a single sample. These verticals are often taken along a transect or grid. In some cases, it may be of interest to form separate composites of epilimnetic and hypolimnetic zones. In a stratified lake, the epilimnion is the thermocline which is exposed to the atmosphere. The hypolimnion is the lower, "confined" layer which is only mixed with the epilimnion and vented to the atmosphere during seasonal "overturn" (when density stratification disappears). These two zones may thus have very different concentrations of contaminants if input is only to one zone, if the contaminants are volatile (and therefore vented from the epilimnion but not the hypolimnion), or if the epilimnion only is involved in short-term flushing (i.e., inflow from or outflow to shallow streams). Normally, however, a composite consists of several verticals with samples collected at various depths.

In lakes with irregular shape and with bays and coves that are protected from the wind, separate composite samples may be needed to adequately represent water quality since it is likely that only poor mixing will occur. Similarly, additional samples are recommended where discharges, tributaries, land use characteristics, and other such factors are suspected of influencing water quality.

Many lake measurements are now made in-situ using sensors and automatic readout or recording devices. Single and multi-parameter instruments are available for measuring temperature, depth, pH, oxidation-reduction potential (ORP), specific conductance, dissolved oxygen, some cations and anions, and light penetration.

5.3.3 Estuaries

Estuarine areas are by definition, zones where inland freshwaters (both surface and ground) mix with oceanic saline waters. Estuaries are generally categorized into three types dependent upon freshwater inflow and mixing properties. Knowledge of the estuary type is necessary to determine sampling locations. Each type of estuarine area is described below:

- Mixed Estuary - characterized by the absence of a vertical halocline (gradual or no marked increase in salinity in the water column) and a gradual increase in salinity seaward. Typically this type of estuary is shallow and is found in major freshwater sheetflow areas. Being well mixed, the sampling locations are not critical in this type of estuary.

- Salt Wedge Estuary - characterized by a sharp vertical increase in salinity and stratified freshwater flow along the surface In these estuaries, the vertical mixing forces cannot override the density differential between fresh and saline waters. In effect, a salt wedge tapering inland moves horizontally, back and forth, with the tidal phase. If contamination is being introduced into the estuary from upstream, water sampling from the salt wedge may miss it entirely.

- Oceanic Estuary - characterized by salinities approaching full-strength oceanic waters. Seasonally, freshwater inflow is small with the preponderance of the fresh-saline water mixing occurring near, or at, the shore line.

Sampling in estuarine areas is normally based upon the tidal phases, with samples collected on successive slack tides (i.e., when the tide turns). Estuarine sampling programs shall include vertical salinity measurements at 1- to 5-foot increments, coupled with vertical dissolved oxygen and temperature profiles.

5.3.4 Surface Water Sampling Equipment

The selection of sampling equipment depends on the site conditions and sample type to be acquired. The most frequently used samplers are:

- Open tube.
- Dip sampler.
- Weighted bottle.
- Hand pump.
- Kemmerer.
- Depth-Integrating Sampler.

The dip sampler and the weighted bottle sampler are used most often, and detailed discussions for these devices only (and the Kemmerer sampler) are addressed subsequently in this section.

The criteria for selecting a sampler include:

1. Disposability and/or easy decontamination
2. Inexpensive cost (if the item is to be disposed).
3. Ease of operation.
4. Nonreactive/noncontaminating properties - Teflon-coated, glass, stainless-steel or PVC sample chambers are preferred (in that order).

As specified in the project plan document plan documents, each sample (grab or each aliquot collected for compositing) shall be measured for

- Specific conductance.
- Temperature.
- pH.
- Dissolved oxygen (optional).

Sample measurements shall be conducted as soon as the sample is acquired. Measurement techniques described in SOP SA-1.1 shall be followed. All pertinent data and results shall be recorded in a field notebook or on sample logsheets (see SOP SA-6.3). These analyses will provide information on water mixing/stratification and potential contamination.

Dip Sampling

Water is often sampled by filling a container either attached to a pole or held directly, from just beneath the surface of the water (a dip or grab sample). Constituents measured in grab samples are only indicative of conditions near the surface of the water and may not be a true representation of the total concentration that is distributed throughout the water column and in the cross section. Therefore, whenever possible, it is recommended to augment dip samples with samples that represent both dissolved and suspended constituents and both vertical and horizontal distributions.

Weighted Bottle Sampling

A grab sample can also be taken using a weighted holder that allows a bottle to be lowered to any desired depth, opened for filling, closed, and returned to the surface. This allows discrete sampling with depth. Several of these samples can be combined to provide a vertical composite. Alternatively, an open bottle can be lowered to the bottom and raised to the surface at a uniform rate so that the bottle collects sample throughout the total depth and is just filled on reaching the surface. The resulting sample using either method will roughly approach what is known as a depth-integrated sample.

A closed weighted bottle sampler consists of a stopped glass or plastic bottle, a weight and/or holding device, and lines to open the stopper and lower or raise the bottle. The procedure for sampling with this device is:

- Gently lower the sampler to the desired depth so as not to remove the stopper prematurely (watch for bubbles).
- Pull out the stopper with a sharp jerk of the stopper line.
- Allow the bottle to fill completely, as evidenced by the absence of air bubbles.
- Raise the sampler and cap the bottle.

- Decontaminate the outside of the bottle. This bottle can be used as the sample container as long as the bottle is an approved container type.

Kemmerer

If samples are desired at a specific depth, and the parameters to be measured do not require a Teflon coated sampler, a standard Kemmerer sampler may be used. The Kemmerer sampler is a brass, stainless-steel or acrylic cylinder, with rubber stoppers that leave the ends open while being lowered in a vertical position (thus allowing free passage of water through the cylinder). A "messenger" is sent down the line when the sampler is at the designated depth, to cause the stoppers to close the cylinder, which is then raised Water is removed through a valve to fill sample bottles.

5.3.5 Surface Water Sampling Techniques

Most samples taken during site investigations are grab samples. Typically, surface water sampling involves immersing the sample container in the body of water; however, the following suggestions are made to help ensure that the samples obtained are representative of site conditions:

- The most representative samples are obtained from mid-channel at a 0.6 foot stream depth in a well-mixed stream.

- Even though the containers used to obtain the samples are previously laboratory cleaned, it is suggested that the sample container be rinsed at least once with the water to be sampled before the sample is taken. This is not applicable when sample containers are provided "pre-preserved."

- For sampling running water, it is suggested that the farthest downstream sample be obtained first, and that subsequent samples be taken as one works upstream. In general, work from zones suspected of low contamination to zones of high contamination.

- To sample a pond or other standing body of water, the surface area may be divided into grids. A series of samples taken from each grid node is combined into one sample, or several grid nodes are selected at random.

- Care should be taken to avoid excessive agitation of the water, as loss of volatile constituents could result.

- When obtaining samples in 40 mL septum vials for volatile organics analysis, it is important to exclude any air space in the top of the bottle and to be sure that the Teflon liner of the septum faces in after the vial is filled and capped. The vial can be turned upside down to check for air bubbles.

- Do not sample at the surface, unless sampling specifically for a known constituent which is immiscible and on top of the water. Instead, the sample container should be inverted, lowered to the approximate depth, and held at about a 45-degree angle with the mouth of the bottle facing upstream. When sample containers are provided "pre-preserved," use a dedicated, clean, un-preserved bottle for sampling and transfer to an appropriately-preserved container.

5.4 Onsite Water Quality Testing

Onsite water quality testing shall be conducted as described in SOP SA-1.1.

5.5 Sediment Sampling

5.5.1 General

Sediment samples are usually collected at the same verticals at which water samples were collected. If only one sediment sample is to be collected, the sampling location shall be approximately at the center of the water body

Generally, the coarser grained sediments are deposited near the headwaters of the reservoir Bed sediments near the center of a water body will be composed of fine-grained materials which may, because of their lower porosity and greater surface area available for adsorption, contain greater concentrations of contaminants. The shape, flow pattern, bathometry (i.e., depth distribution), and water circulation patterns must all be considered when selecting sediment sampling sites. In streams, areas likely to have sediment accumulation (e.g., bends, behind islands or boulders, quiet shallow areas or very deep, low-velocity areas) shall be sampled while areas likely to show net erosion (i.e., high-velocity, turbulent areas) and suspension of fine solid materials, shall be avoided.

Chemical constituents associated with bottom material may reflect an integration of chemical and biological processes. Bottom samples reflect the historical input to streams, lakes, and estuaries with respect to time, application of chemicals, and land use. Bottom sediments (especially fine-grained material) may act as a sink or reservoir for adsorbed heavy metals and organic contaminants (even if water column concentrations are below detection limits) Therefore, it is important to minimize the loss of low-density "fines" during any sampling process.

All relevant information pertaining to sediment sampling shall be documented as applicably described in SOP SA-6.3.

5.5.2 Sampling Equipment and Techniques

A bottom-material sample may consist of a single scoop or core, or may be a composite of several individual samples in the cross section. Sediment samples may be obtained using onshore or offshore techniques.

When boats are used for sampling, life preservers must be provided and two individuals must undertake the sampling. An additional person shall remain onshore in visual contact at all times.

The following samplers may be used to collect bottom materials:

- Scoop sampler.
- Dredge samplers.

Each type of sampler is discussed subsequently

Scoop Sampler

A scoop sampler consists of a pole to which a jar or scoop is attached. The pole may be made of bamboo, wood or aluminum and be either telescoping or of fixed length. The scoop or jar at the end of the pole is usually attached using a clamp.

If the water body can be sampled from the shore or if it can be waded, the easiest and best way to collect a sediment sample is to use a scoop sampler. This reduces the potential for cross-contamination. This method is accomplished by reaching over or wading into the water body and, while facing upstream (into the current), scooping the sampler along the bottom in the upstream direction. It is very difficult not to disturb fine-grained materials of the sediment-water interface when using this method.

Dredges

Dredges are generally used to sample sediments which cannot easily be obtained using coring devices (i.e., coarse-grained or partially-cemented materials) or when large quantities of sample are required. Dredges generally consist of a clam shell arrangement of two buckets. The buckets may either close upon impact or be activated by use of a "messenger". Most dredges are heavy (up to several hundred pounds) and require use of a winch and crane assembly for sample retrieval. There are three major types of dredges: Peterson, Eckman and Ponar dredges.

The Peterson dredge is used when the bottom is rocky, in very deep water, or when the flow velocity is high. The Peterson dredge shall be lowered very slowly as it approaches bottom, because it can force out and miss lighter materials if allowed to drop freely.

The Eckman dredge has only limited usefulness. It performs well where bottom material is unusually soft, as when covered with organic sludge or light mud. It is unsuitable, however, for sandy, rocky, and hard bottoms and is too light for use in streams with high flow velocities.

The Ponar dredge is a Peterson dredge modified by the addition of side plates and a screen on the top of the sample compartment. The screen over the sample compartment permits water to pass through the sampler as it descends thus reducing the "shock wave" and permitting direct access to the secured sample without opening the closed jaws. The Ponar dredge is easily operated by one person in the same fashion as the Peterson dredge. The Ponar dredge is one of the most effective samplers for general use on all types of substrates.

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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.
- Provides instruction for sample packaging and shipping in accordance with current U.S. Department of Transportation (DOT) and International Air Transportation Association (IATA) regulations. IATA regulates transportation of hazardous materials by air (which is the mode of transportation used for shipping nearly all samples derived during TtNUS projects).

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 (ÿ261.30 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 (ÿ261.20 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.

ORM - Other regulated material (see DOT 49 CFR 173.144).

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 4°C. 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 4°C, 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.

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 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

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 and hazardous material 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 (e.g. "garbage" bag). Drain plugs on coolers must be taped shut.

- Pack with enough noncombustible, absorbent, cushioning materials such as vermiculite (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), double-bag ice in Ziploc baggies and place around sample container shoulders, and on top of absorbent 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) and extra carbonless copies 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 first cooler. 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.

5.4.2 Hazardous Material Samples

Samples not determined to be environmental samples, or samples known or expected to contain hazardous materials, must be considered hazardous material samples and transported according to the requirements listed below.

NOTE: Packaging and shipping of hazardous materials can only be performed by personnel who have participated in the TtNUS training course "Shipping Hazardous Materials" (or equivalent training approved by Health Sciences).

5.4.2.1 Known Substances

If the substance in the sample is known or can be identified, package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table (49 CFR 172.101) or the IATA List of Dangerous Goods Table (IATA Dangerous Goods Regulations). DOT Guide for shippers can be found in Attachment D of this document.

To determine the proper shipping name, use the following steps to help locate the shipping name on the Hazardous Materials Table, DOT 49 CFR 172.101.

1. Look first for the chemical or technical name of the material, for example, ethyl alcohol. Note that many chemicals have more than one technical name, for example, perchloroethylene (not listed in 172.101) is listed as tetrachloroethylene (listed 172.101). It may be useful to consult Health Sciences or a chemist for all possible technical names a material can have. If your material is not listed by its technical name, then . . .

2. Look for the chemical family name. For example, pentyl alcohol is not listed but the chemical family name is: alcohol, n.o.s. (not otherwise specified). If the chemical family name is not listed, then . . .

3. Look for a generic name based on end use. For example, Paint, n.o.s. If a generic name based on end use is not listed, then . . .

4. Look for a generic family name based on end use, for example, drugs, n.o.s. or cosmetics, n.o.s. Finally, if your material is not listed by a generic family name but you suspect or know the material is hazardous because it meets the definition of one or more hazardous classes, then . . .

5. You will have to use the general hazard class for a proper shipping name. For example, Flammable Liquid, n.o.s, or Oxidizer, n.o.s.

If you have any doubt regarding the proper shipping name, contact Health Sciences in Pittsburgh, Pennsylvania for assistance.

5.4.2.2 Unknown Substances

For samples of hazardous substances that are not listed on the Hazardous Materials Table, or are of unknown content, the shipper is required to:

1. Determine that the substance is not forbidden for shipment. Items forbidden include explosives (solid and liquid), substances liable to produce a dangerous evolution of heat or gas, and listed "unusual" compounds (which TtNUS fortunately does not typically handle). If the substance is in any way atypical of routine shipments, contact Health Sciences for further information on determining if the substance is forbidden.

2. Classify the substance by assessing whether it is anticipated to exhibit any unusual physical properties as defined by DOT (flammability, explosivity, etc.). If the substance has more than one hazard, follow the hazardous materials classification scheme identified in Attachment C of this SOP.

3. Use the generic or "n.o.s." proper shipping name that most accurately describes the article or substance. There are two types of general proper shipping names:

   - Generic, e.g., Alcohols, n.o.s. *
   - Hazard description, e.g., Flammable liquid, n.o.s.*

   Generic or n.o.s. proper shipping names marked with an "*" require the addition of the technical name in parenthesis () immediately following the proper shipping name. For example, most of our instrument calibration gases are not listed by name and must be declared under the most accurately descriptive name, which is "Compressed Gas, n.o.s. (Mixture Nitrogen and Oxygen)".

The correct shipping classification for an unknown sample is therefore selected through a process of elimination as described above (and detailed in 49 CFR 172.101(c)(11). By using the provisions in this paragraph, the proper shipping name and description will be determined. A step-by-step guide is provided by the DOT and can be found in Attachment D of this SOP. Again, if you have any doubt regarding the proper shipping name, contact Health Sciences for assistance.

5.4.3 Packaging and Shipping of Samples Classified as Flammable Liquid (or Solid)

5.4.3.1 Packaging

Applying the word "flammable" to a sample does not necessarily mean that it is in fact flammable. The word prescribes the class of packaging according to DOT regulations and classification schemes. The DOT defines flammable liquids as substances with a flash point less than 140°F (60°C). For shipping purposes, liquids with a flash point exceeding 95°F (35°C) need not be considered as flammable liquids if they are miscible solutions and have a water content of more than 90% by weight. For solutions classified as flammable liquids:

1. Containerize sample as required (see Attachments A and B). To prevent leakage, fill container no more than 90 percent full. Seal lid with teflon tape or wire.

2. Complete sample label and attach securely to sample container.

3. Seal container and place in 2-mil-thick (or thicker) polyethylene bag (e.g., Ziploc baggie), one sample per bag. Position sample identification label so that it can be read through bag. Seal bag.

4. For soil jars, place sealed bag inside metal can (available from laboratory or laboratory supplier) and cushion it with enough noncombustible, absorbent material (for example, vermiculite or diatomaceous earth) between the bottom and sides of the can and bag to prevent breakage and absorb leakage. Pack one bag per can. Use clips, tape, or other positive means to hold can lid securely, tightly and permanently. Mark can as indicated in Paragraph 1 of Section 5.3.4.2, below. Single 1-gallon bottles do not need to be placed in metal cans.

5. Place one or more metal cans (or a single 1-gallon bottle) into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround cans (or bottle) with noncombustible, absorbent cushioning materials for stability during transport. The absorbent material should be able to absorb the entire contents of the container. Mark container as indicated in Paragraph 2 below.

5.4.3.2 Marking/Labeling

1. Use abbreviations only where specified. Place the following information, either hand-printed or in label form, on the metal can (or 1-gallon bottle):

   - Laboratory name and address.
   - Proper shipping name from the hazardous materials table (DOT Regulation CFR 49 172.101). Example: "Flammable Liquid, n.o.s. (with the technical name in parentheses).

2. Determine packing group. The packing group must be included on the shipping papers in the description section. Packaging groups are classified as follows:

   Group I. Most Hazardous
   Group II. Medium Hazard
   Group III. Least Hazardous

   The packing group will be listed in the hazardous materials table, column 5.

3. Place the following information on outside shipping container per the instructions provided in the "Shipping Hazardous Materials" course:

   - Proper shipping name
   - UN or NA number
   - Proper label(s)
   - Addressee and sender

For flammable liquids, the following are the proper labels to be placed on the outside shipping container:

- DOT "Flammable liquid" label
- Package orientation label (arrows pointing upward) on at least two opposite sides of the package
- "Cargo Aircraft Only" label if shipping more than 30L of flammable liquids in the package.

5.4.3.3 Shipping Papers

Principally because of limitations in sample holding times, TtNUS almost exclusively uses air transportation to ship hazardous materials and other environmental samples. The "Dangerous Goods Airbill" is the shipping paper used to document the information associated with the shipment. As identified previously, only personnel who have participated in "Shipping Hazardous Materials" training (or equivalent course) are authorized to prepare hazardous materials for shipment - including preparation of associated shipping papers. Included in this training are instructions on what specific information is to be provided on the Airbill for hazardous materials typically shipped by TtNUS. Refer to the training course Student Manual or contact Health Sciences for this information.

The properly executed Chain-of-Custody Report must be included in the container. Use custody seals.

Using the Airbill of our common carrier (i.e., Federal Express) as an example, the following instructions apply to the information to be provided under "Transport Details", "Nature and Quantity of Dangerous Goods", and other associated fields.

a) Transport Details

- Select "Passenger and Cargo" or "Cargo Aircraft Only" (This is based on the type and quantity of dangerous goods you are shipping). X-out the non-applicable selection.
- Airport of Departure - Enter the full name of the airport or city of departure.
- Airport of Destination - Enter the full name of the airport or city of destination.

b) Shipment Type – Delete the option that does not apply (Non-Radioactive/Radioactive)

c) Nature and Quantity of Dangerous Goods

1. Dangerous Goods Identification

   - Proper Shipping Name - List the proper shipping name (this is the name as it appears on the List of Dangerous Goods Table and NOT the product or trade name), and if applicable, the technical name in parenthesis.
   - Class or Division - List the class or division number and, if applicable, compatibility group.
   - UN or ID No - List the UN or I.D. number, preceded with "UN" or "I.D." This selection may change when shipping in accordance with 49 CFR regulations that permit the shipment under NA (North American Continental Shipments) designations for certain substances.
   - Packing Group – List the appropriate packing group, if applicable. This is the level of anticipated hazard of the shipment. It does not apply for all shipments. When no information is available, leave the space blank.
   - Subsidiary Risk – List the class or division number of the subsidiary risk, if applicable. The subsidiary risk is any additional hazard beyond the most significant (or primary) hazard. This information is obtained from the List of Dangerous Goods Table.

2. Quantity and Type of Packaging – List the number of packages, the type of package, and the net quantity in each package. The type of packaging you are shipping the hazardous material in is presented first, followed by the amount (Kg, L, etc.). For example, "1 fiberboard box X 2 Kg". When no outer packaging is identified, the packaging selected must provide limited protection of the inner packaging by securing and cushioning during shipment. NOTE: Always use the package that the hazardous material was shipped to the site in. If it is not available, contact the Health Sciences Department in Pittsburgh for further instruction.

3. Packing Instructions – Enter the Packing Instruction number. These instructions are provided in Section 5 of the IATA Dangerous Goods Regulations. They provide the exact type of packaging required by the industry for various hazard classes. When no addition packaging considerations are given, the shipper may use their best judgment for the shipment of an identified substance and/or article.

4. Authorization – List the words " Limited Quantity," if applicable; list any special provision(s) or approval(s) if applicable. This section provides for exceptions to this transportation regulation and the conditions for those exceptions.

d) Additional handling Information - Enter any required special handling information.

e) Prepared for Air Transport according to: Check the ICAO/IATA box.

f) Emergency Telephone Number - Enter the 24-hour emergency contact number. This number is required of all US Origin or Destination Shipments. List the number for InfoTRAC (1-800-535-5053). InfoTRAC is a company retained by TtNUS to provide 24-Hour Emergency Hotline service for dangerous goods shipment. This company has MSDSs for the substances routinely shipped by TtNUS. They provide information to FedEx or any other emergency responders, should situations arise with one of our shipments. In addition, they have telephone numbers of certain Tetra Tech NUS Health Science Department personnel in the Pittsburgh Office in the event of an emergency.

g) Name/Title of the Signatory - Enter name and job title (Field Operations Leader, Geologist, Health & Safety Specialist, etc.)

h) Place and date - Enter the city and date of shipment

i) Signature - Sign the form (must be a complete signature). All alterations must be signed with the same signature used to sign the declaration.

5.4.3.4 Transportation

1. The majority of unknown hazardous substance samples will be classified as flammable liquids. The samples will be transported by rented or common carrier truck, railroad, or express overnight package services. Do not transport samples on any passenger-carrying air transport system, even if the system has cargo-only aircraft. DOT regulations permit regular airline cargo-only aircraft, but difficulties with most suggest avoiding them. Instead, ship by airline carriers that carry only cargo. If unsure of what mode of transportation to use, consult Health Sciences.1

2. For transport by government-owned vehicle, including aircraft, DOT regulations do not apply. However, procedures described above, with the exception of execution of the bill of lading with certification, shall still be followed.

3. Use the hazardous materials shipping check list (Attachment E) as a guidance to ensure that all sample-handling requirements are satisfied.

4. In some cases, various materials may react if they break during shipment. To determine if you are shipping such materials, refer to the DOT compatibility chart in Attachment F.

5.5 Shipment of Lithium Batteries

Monitoring well data are analyzed using either the Hermit SE 1000 or the Hermit SE 2000 environmental data logger. These instruments are typically powered by lithium batteries in sufficient quantity to make the unit subject to hazardous material shipping requirements. The DOT determined that lithium batteries are to be shipped using the following information:

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1 Note: If you are unsure as how to ship the sample (hazardous or environmental sample), contact Health Sciences so that a decision can be made as to the proper shipping practices. The DOT and IATA penalties for improper shipment of a hazardous material are stringent and may include a prison term for intentional violations.

- Product Designation
  - Hermit SE 1000
  - Hermit SE 2000

- Proper Shipping Name
  - Lithium batteries, contained in equipment, UN3091

- UN No - UN-3091

- Classification or Division
  - Class 9

Shipment of equipment containing lithium batteries must be accompanied by shipping papers completed as indicated in Attachment G. The instrument will be shipped by Federal Express as a Hazardous Material. Place the instrument in the same container in which it was received. This container or case is a DOT-approved shipping container. For Federal Express procedures to ship hazardous materials, call 1-800-238-5355, extension 922-1666. In most cases, the return shipping papers and DOT labels will be shipped to you from the company warehouse or the vendor. An example of the types of labels used for shipment and the wording are shown in Attachment G. These labels will be attached to the outside container and include all the information noted under Section 5.4.3.2. Instead of the Flammable Liquid information, however, the following will be presented with the following wording:

- Lithium Batteries Contained in Equipment
  - UN-3091

- DOT Miscellaneous Hazardous Materials (Class 9) label

- "Cargo Aircraft Only" label

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 4°C HCl to ≤ 2	14 days[9]
	Extractables SVOCs and pesticide/PCBs)	(Low	Amber glass	2x2 L or 4x1 L	Cool to 4°C	7 days to extraction, 40 days after extraction
	Extractables SVOCs and pesticide/PCBs)	(Medium	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		Wide-mouth glass with teflon liner	2 x 4 oz.	Cool to 4°C	14 days
	Extractables SVOCs and pesticides/PCBs)	(Low	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
	Extractables SVOCs and pesticides/PCBs)	(Medium	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium		Wide-mouth glass	8 oz.	Cool to 4°C	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	7 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 4°C	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, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Chemical Oxygen Demand (COD)	P, G	Cool, 4°C; 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, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C; 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, 4°C; H_2SO_4 to pH 2	28 days
Nitrate - Nitrogen	P, G	None required	48 hours
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrite - Nitrogen	P, G	Cool, 4°C	48 hours
Oil & Grease	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Total Organic Carbon (TOC)	P, G	Cool, 4°C; HCl or H_2SO_4 to pH 2	28 days
Orthophosphate	P, G	Filter immediately; Cool, 4°C	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, 4°C; H_2SO_4 to pH 2	28 days
Phosphorus, Total	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Residue, Total	P, G	Cool, 4°C	7 days
Residue, Filterable (TDS)	P, G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, Volatile (Ash Content)	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific Conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	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, 4°C; add zinc acetate plus sodium hydroxide to pH 9	7 days
Sulfite	P, G	None required	Analyze immediately
Turbidity	P, G	Cool, 4°C	48 hours
METALS:[7]			
Chromium VI (Hexachrome)	P, G	Cool, 4°C	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, 4°C; 0.008% $Na_2S_2O_3$[5]	14 days
Purgeable Aromatic Hydrocarbons	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[5] HCl to pH 2 [9]	14 days
Acrolein and Acrylonitrile	G, Teflon-lined septum	Cool, 4°C; 0.008% $Na_2S_2O_3$[5] adjust pH to 4-5 [10]	14 days
Phenols[11]	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]	7 days until extraction; 40 days after extraction
Benzidines[11], [12]	G, Teflon-lined cap	Cool, 4°C; 0.008% $Na_2S_2O_3$[5]	7 days until extraction[13]
Phthalate esters[11]	G, Teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction
Nitrosamines[11], [14]	G, Teflon-lined cap	Cool, 4°C, 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, 4°C	7 days until extraction; 40 days after extraction
Nitroaromatics & Isophorone[11]	G, Teflon-lined cap	Cool, 4°C; 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, 4°C; 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, 4°C; 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, 4°C; 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 4°C 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 4°C, 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% $Na_2S_2O_3$.

ATTACHMENT C

DOT HAZARDOUS MATERIAL CLASSIFICATION
(49 CFR 173.2a)

1. Radioactive material (except a limited quantity)
2. Division 2.3, Poisonous Gases
3. Division 2.1, Flammable Gas
4. Division 2.2, Nonflammable gas
5. Division 6.1, Poisonous Liquids, Packing Group 1 (poison by inhalation only)
6. Division 4.2, Pyrophoric Material
7. Division 4.1, Self-Reactive Material
8. Class 3, Flammable Liquids*
9. Class 8, Corrosive Material
10. Division 4.1, Flammable Solid*
11. Division 4.2, Spontaneously Combustible Materials*
12. Division 4.3, Dangerous When Wet Materials*
13. Division 5.1, Oxidizers*
14. Division 6.1, Poisonous Liquids or Solids (other than Packing Group 1)*
15. Combustible liquid
16. Class 9, Miscellaneous Hazardous Materials

* If a material has or meets the criteria for more than one hazard class, use the precedence of hazardous table on the following page for Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1. The following table ranks those materials that meet the definition of Classes 3 and 8 and Divisions 4.1, 4.2, 4.3, 5.1, and 6.1.

ATTACHMENT C (Continued)

DOT HAZARDOUS MATERIAL CLASSIFICATION (49 CFR 173.2a)

Class	Packing Group	4.2	4.3	5.1 I[a]	5.1 II[a]	5.1 III[a]	6.1 I (Dermal)	6.1 I (Oral)	6.1 II	6.1 III	8 I (Liquid)	8 I (Solid)	8 II (Liquid)	8 II (Solid)	8 III (Liquid)	8 III (Solid)
3	I						3	3	3	3	3	[c]	3	[c]	3	[c]
3	II						3	3	3	3	8	[c]	3	[c]	3	[c]
3	III						6.1	6.1	6.1	3[d]	8	[c]	8	[c]	3	[c]
4.1	II[b]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	4.1	4.1	[c]	8	[c]	4.1	[c]	4.1
4.1	III[b]	4.2	4.3	5.1	4.1	4.1	6.1	6.1	6.1	4.1	[c]	8	[c]	8	[c]	4.1
4.2	II		4.3	5.1	4.2	4.2	6.1	6.1	4.2	4.2	[c]	8	[c]	4.2	[c]	4.2
4.2	III		4.3	5.1	4.2	4.2	6.1	6.1	6.1	4.2	[c]	8	[c]	8	[c]	4.2
4.3	I			5.1	4.3	4.3	6.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
4.3	II			5.1	4.3	4.3	6.1	4.3	4.3	4.3	8	8	8	4.3	4.3	4.3
4.3	III			5.1	4.3	4.3	6.1	6.1	6.1	4 3	8	8	8	8	4.3	4.3
5.1	I[a]						5.1	5.1	5.1	5 1	5.1	5.1	5.1	5.1	5.1	5.1
5.1	II[a]						6.1	5.1	5.1	5.1	8	8	8	5.1	5.1	5.1
5.1	III[a]						6 1	6.1	6.1	5.1	8	8	8	8	5.1	5.1
6.1	I, Dermal										8	6.1	6.1	6.1	6.1	6.1
6.1	I, Oral										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Inhalation										8	6.1	6.1	6.1	6.1	6.1
6.1	II, Dermal										8	6.1	8	6.1	6.1	6.1
6.1	II, Oral										8	8	8	6.1	6.1	6.1
6.1	III										8	8	8	8	8	8

(a) There are at present no established criteria for determining Packing Groups for liquids in Division 5.1. At present, the degree of hazard is to be assessed by analogy with listed substances, allocating the substances to Packing Group I, Great; Group II, Medium; or Group III, Minor Danger.

(b) Substances of Division 4.1 other than self-reactive substances.

(c) Denotes an impossible combination.

(d) For pesticides only, where a material has the hazards of Class 3, Packing Group III, and Division 6.1, Packing Group III, the primary hazard is Division 6.1, Packing Group III.

ATTACHMENT D

GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

USE OF GUIDE - This guide is presented as an aid to shippers of hazardous materials. It does not contain or refer to all of the DOT requirements for shipping hazardous materials. For specific details, refer to all of the DOT requirements for shipping hazardous materials, as provided in the Code of Federal Regulations (CFR), Title 49, Transportation, Parts 100-199.

The following is offered as a step-by-step procedure to aid in compliance with the applicable DOT regulations.

STEP 1 - DETERMINE THE PROPER SHIPPING NAME. The shipper must determine the proper shipping name of the materials as listed in the Hazardous Materials Table, 49 CFR 172.101, Column (2).

STEP 2 - DETERMINE THE HAZARD CLASS OR CLASSES.

a. Refer to the Table, 49 CFR 172.101, Column (3), and locate the hazard class of the material.
b. If more than one class is shown for the proper shipping name, determine the proper class by definition.
c. If the materials have more than one hazard, classify the material based on the order of hazards in 49 CFR 173.2.

STEP 3 - SELECT THE PROPER IDENTIFICATION NUMBERS.

a. Refer to the Table, 49 CFR 172.101, Column (3a), and select the Identification Number (ID) that corresponds to the proper shipping name and hazard class.
b. Enter the ID number(s) on the shipping papers and display them, as required, on packagings, placards and/or orange panels.

STEP 4 - DETERMINE THE MODE(S) OF TRANSPORT TO ULTIMATE DESTINATION.

a. As a shipper, you must assure yourself that the shipment complies with various modal requirements.
b. The modal requirements may affect the following: (1) Packaging; (2) Quantity per Package; (3) Marking; (4) Labeling; (5) Shipping Papers; and (6) Certification.

STEP 5 - SELECT THE PROPER LABEL(S) AND APPLY AS REQUIRED.

a. Refer to the Table, 49 CFR 172.101, Column (4) for required labels.
b. For details on labeling refer to (1) Additional Labels, 49 CFR 172.402; (2) Placement of Labels, 49 CFR 172.406; (3) Packagings (Mixed or Consolidated), 49 CFR 172.404(a) and (h); (4) Packages Containing Samples, 49 CFR 172.402(h); (5) Radioactive Materials, 49 CFR 172.403; and (6) Authorized Label Modifications, 49 CFR 172.405.

STEP 6 - DETERMINE AND SELECT THE PROPER PACKAGES.

a. Refer to the Table, 49 CFR 172.101, Column (5a) for exceptions and Column (5b) for specification packagings. Consider the following when selecting an authorized package: Quantity per Package; Cushioning Material, if required; Proper Closure and Reinforcement; Proper Pressure; Outage; etc., as required.
b. If packaged by a prior shipper, make sure the packaging is correct and in proper condition for transportation.

ATTACHMENT D (Continued)
GUIDE FOR HAZARDOUS MATERIALS SHIPPERS

STEP 7 - MARK THE PACKAGING (INCLUDING OVERPACKS).

a. Apply the required markings (49 CFR 172.300); Proper shipping name and ID number, when required (49 CFR 172.301); Name and address of Consignee or Consignor (49 CFR 172.306).
b. For details and other required markings, see 49 CFR 172.300 through 172.338.

STEP 8 - PREPARE THE SHIPPING PAPERS.

a. The basic requirements for preparing shipping papers include Proper Shipping Name; Hazard Class; ID Number; Total Quantity; Shipper's Certification; and Emergency Response Telephone Number.
b. Make all entries on the shipping papers using the information required and in proper sequence (49 CFR 172.202).

STEP 9 - CERTIFICATION.

a. Each shipper must certify by printing (manually or mechanically) on the shipping papers that the materials being offered for shipment are properly classified, described, packaged, marked and labeled, and in proper condition for transportation according to the applicable DOT Regulations (49 CFR 172.202).

STEP 10 - LOADING, BLOCKING, AND BRACING. When hazardous materials are loaded into the transport vehicle or freight container, each package must be loaded, blocked, and braced in accordance with the requirements for mode of transport.

a. If the shipper loads the freight container or transport vehicle, the shipper is responsible for the proper loading, blocking, and bracing of the materials.
b. If the carrier does the loading, the carrier is responsible.

STEP 11 - DETERMINE THE PROPER PLACARD(S). Each person who offers hazardous materials for transportation must determine that the placarding requirements have been met.

a. For Highway, unless the vehicle is already correctly placarded, the shipper must provide the required placard(s) and required ID number(s) (49 CFR 172.506).
b. For Rail, if loaded by the shipper, the shipper must placard the rail car if placards are required (49 CFR 172.508).
c. For Air and Water shipments, the shipper has the responsibility to apply the proper placards.

STEP 12 - HAZARDOUS WASTE/HAZARDOUS SUBSTANCE.

a. If the material is classed as a hazardous waste or hazardous substance, most of the above steps will be applicable.
b. Pertinent Environmental Protection Agency regulations are found in the Code of Federal Regulations, Title 40, Part 262.

As a final check and before offering the shipment for transportation, visually inspect the shipment. Th shipper should ensure that emergency response information is on the vehicle for transportation of hazardous materials.

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Revised March 1995.

ATTACHMENT E

HAZARDOUS MATERIALS SHIPPING CHECK LIST

PACKAGING

1. Check DOT 173.24 for appropriate type of package for hazardous substance.
2. Check for container integrity, especially the closure.
3. Check for sufficient absorbent material in package.
4. Check for sample tags and log sheets for each sample and for chain-of-custody record.

SHIPPING PAPERS

1. Check that entries contain only approved DOT abbreviations.
2. Check that entries are in English.
3. Check that hazardous material entries are specially marked to differentiate them from any nonhazardous materials being sent using same shipping paper.
4. Be careful that all hazardous classes are shown for multiclass materials.
5. Check total amounts by weight, quantity, or other measures used.
6. Check that any limited-quantity exemptions are so designated on the shipping paper.
7. Check that certification is signed by shipper.
8. Make certain driver signs for shipment.

RCRA MANIFEST

1. Check that approved state/federal manifests are prepared.
2. Check that transporter has the following: valid EPA identification number, valid driver's license, valid vehicle registration, insurance protection, and proper DOT labels for materials being shipped.
3. Check that destination address is correct.
4. Check that driver knows where shipment is going.
5. Check that the driver is aware of emergency procedures for spills and accidents.
6. Make certain driver signs for shipment.
7. Make certain one copy of executed manifest and shipping document is retained by shipper.

ATTACHMENT F
DOT SEGREGATION AND SEPARATON CHART

Class or Division	Notes	1.1-1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3 gas Zone A*	2.3 gas Zone B*	3	4.1	4.2	4.3	5.1	5.2	6.1 liquids PG-I Zone A*	7	8 liquids only
Explosives... 1.1 and 1.2	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Explosives..... 1.3		*	*	*	*	*	X		X	X	X		X	X	X	X	X		X
Explosives..... 1.4		*	*	*	*	*	O		O	O	O		O				O		O
Very insensitive explosives 1.5	A	*	*	*	*	*	X	X	X	X	X	X	X	X	X	X	X	X	X
Extremely insensitive explosives 1.6		*	*	*	*	*													
Flammable gases 2.1		X	X	O	X				X	O							O	O	
Non-toxic, non-flammable gases 2.2		X			X														
Poisonous gas - Zone A** 2.3		X	X	O	X		X				X	X	X	X	X	X			X
Poisonous gas - Zone B** 2.3		X	X	O	X		O				O	O	O	O	O	O			O
Flammable liquids..... 3		X	X	O	X				X	O					O		X		
Flammable solids..... 4.1		X			X				X	O							X		O
Spontaneously combustible materials 4.2		X	X	O	X				X	O							X		X
Dangerous-when-wet materials 4.3		X	X		X				X	O							X		O
Oxidizers..... 5.1	A	X	X		X				X	O	O						X		O
Organic peroxides.... 5.2		X	X		X				X	O							X		O
Poisonous liquids PG I - Zone A** 6.1		X	X	O	X		O				X	X	X	X	X	X			X
Radioactive materials . 7		X			X		O												
Corrosive liquids 8		X	X	O	X				X	O		O	X	O	O	O	X		

No entry means that the materials are compatible (have no restrictions).

X These materials may not be loaded, transported, or stored together in the same vehicle or facility.
O The materials may not be loaded, transported, or stored together in the same vehicle or facility unless they are separated for 4 feet on all sides.
* Check the explosives compatibility chart in 49 CFR 179.848(f).
A Ammonium nitrate fertilizers may be stored with Division 1.1 materials.
** Denotes inhalation hazardous for poisons; consult field team leader or project manager if you encounter a material in this class
1 before shipment.

ATTACHMENT G
LITHIUM BATTERY SHIPPING PAPERS

3224637861

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS

This shipment is within the limitations prescribed for: *(delete non applicable)*

[redacted] | CARGO AIRCRAFT ONLY

Airport of Departure

Airport of Destination: 19CYS

Shipment type: *(delete non-applicable)*

NON-RADIOACTIVE | [redacted]

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification						
Proper Shipping Name	Class or Division	UN or ID No.	Subsidiary Risk	Quantity and type of packing	Packing Inst.	Authorization
LITHIUM BATTERIES CONTAINED IN EQUIPMENT	9	UN3091		1 PLASTIC BOX X 55 GRAMS	912 II	PER CA-9206009

Additional Handling Information

1 HERMIT SERIES DATALOGGER X 55 GRAMS (11 GRAMS/CELL)

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in the proper condition for transport by air according to the applicable International and National Government Regulations.

Name/Title of Signatory

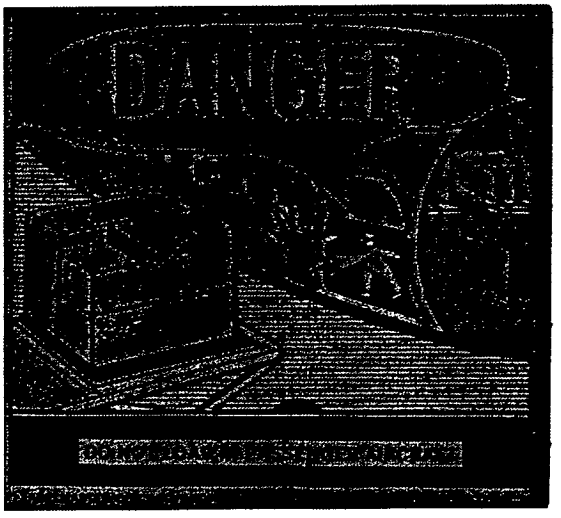
Place and Date

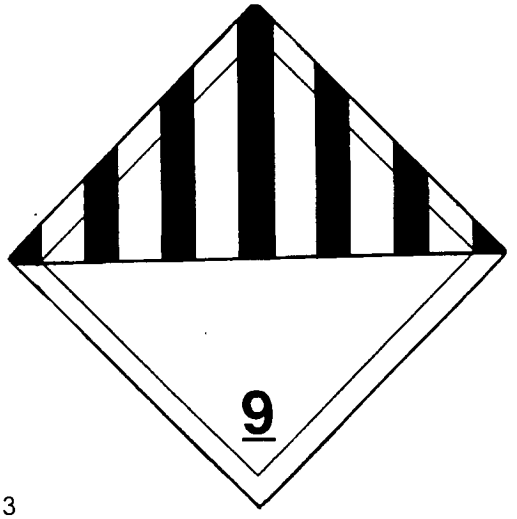
Signature *(see warning above)*

Emergency Telephone Number (Required for US Origin or Destination Shipments)
800-535-5053

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

ATTACHMENT G (CONTINUED)
LITHIUM BATTERY SHIPPING PAPERS





3

LITHIUM BATTERIES CONTAINED IN EQUIPMENT.
UN-3091.
SHIPPED UNDER CA-9206009

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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 field activities.

2.0 SCOPE

Documents presented within this procedure (or equivalents) shall be used for all Tetra Tech NUS 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

Project Manager (PM) - The Project Manager 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 Field Operations Leader is responsible for ensuring that the site logbook, notebooks, and all appropriate and current forms and field reports illustrated in this guideline (and any additional forms required by the contract) are correctly used, accurately filled out, and completed in the required time-frame.

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 onsite activities are documented. At a minimum, the following activities/events shall be recorded or referenced (daily) in the site logbook:

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start and/or completion of borehole, trench, monitoring well installation, etc.
- Daily onsite activities performed each day
- Sample pickup information
- Health and Safety issues (level of protection observed, etc.)
- Weather conditions

A site logbook shall be maintained for each project. The site logbook shall be initiated at the start of the first onsite activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that onsite activities take place which involve Tetra Tech NUS or subcontractor personnel. Upon completion of the fieldwork, the site logbook must become part of the project's central file.

The following information must be recorded on the cover of each site logbook:

- Project name
- Tetra Tech NUS 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, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the field notebook in which the measurements are recorded (see Attachment A).

All logbook, notebook, and log sheet entries shall be made in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook pages used must be signed and dated. The site logbook must also be signed by the Field Operations Leader at the end of each day.

5.1.2 Photographs

When movies, slides, or photographs are taken of a site or any monitoring location, they must be numbered sequentially to correspond to logbook/notebook entries. The name of the photographer, date, time, site location, site description, and weather conditions must be entered 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, since they can adversely affect the accuracy of photographs. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing it requires. Film used for aerial photography, confidential information, or criminal investigation require chain-of-custody procedures. Once processed, the slides of photographic prints shall be consecutively numbered and labeled according to the logbook/notebook descriptions. The site photographs and associated negatives must be docketed 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 Sample Forms

A summary of the forms illustrated in this procedure is shown as the listing of Attachments in the Table of Contents for this SOP. Forms may be altered or revised for project-specific needs contingent upon 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 SOP.

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. Attachments B-1 to B-4 are examples of Sample Log Sheets. The data recorded on these sheets are useful in describing the waste source and sample as well as pointing out any problems, difficulties, or irregularities encountered during sampling. A log sheet must be completed 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-5. Adhesive labels must be completed and applied to every sample container. Sample labels can usually be obtained from the appropriate Program source electronically generated in-house, or are supplied from the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record Form

The Chain-of-Custody (COC) 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 for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site. One carbonless copy of the completed COC form is retained by the field crew, one copy is sent to the Project Manager, while the original is sent to the laboratory. 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 first cooler. The COC form should then state how many coolers are included with that shipment. An example of a Chain-of-Custody Record form is provided as Attachment B-6. Once the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed COC form (any discrepancies between the sample labels and COC form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the Tetra Tech NUS Project Manager). The COC form is signed and copied. The laboratory will retain the copy while the original becomes part of the samples' corresponding analytical data package.

5.3.1.4 Chain-of-Custody Seal

Attachment B-7 is an example of a custody seal. The Custody seal is an adhesive-backed label. It 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. The COC seals are signed and dated by the samplers and affixed across the opening edges of each cooler containing environmental samples. COC seals may be available from the laboratory; these seals may also be purchased from a supplier.

5.3.1.5 Field Analytical Log Sheets for Geochemical Parameters

Field Analytical Log Sheets (Attachment B-8) are used to record geochemical and/or natural attenuation field test results. Attachments B-8 (3-page form) should be used when applicable.

5.3.2 Hydrogeological and Geotechnical Forms

5.3.2.1 Groundwater Level Measurement Sheet

A groundwater level measurement sheet, shown in Attachment C-1 must be filled out 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. The pumping test data sheet (Attachment C-2) facilitates this task by standardizing the data collection format, and allowing the time interval for collection to be laid out in advance.

5.3.2.3 Packer Test Report Form

A packer test report form shown in Attachment C-3 must be completed for each well upon which a packer test is conducted.

5.3.2.4 Summary Log of Boring

During the progress of each boring, a log of the materials encountered, operation and driving of casing, and location of samples must be kept. The Summary Log of Boring, or Boring Log, (Attachment C-4) is used for this purpose and must be completed for each soil boring performed. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a PID or FID), these results must be entered on the boring log at the appropriate depth. The "Remarks" column can be used to subsequently enter the laboratory sample number, the concentration of key analytical results, or other pertinent information. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

A Monitoring Well Construction Details Form must be completed 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), different forms are used (see Attachments C-5 through C-9). Similar forms are used for flush-mount well completions.

5.3.2.6 Test Pit Log

When a test pit or trench is constructed for investigative or sampling purposes, a Test Pit Log (Attachment C-10) must be filled out by the responsible field geologist or sampling technician.

5.3.2.7 Miscellaneous Monitoring Well Forms

Monitoring Well Materials Certificate of Conformance (Attachment C-11) should be used as the project directs to document all materials utilized during each monitoring well installation.

The Monitoring Well Development Record (Attachment C-12) should be used as the project directs to document all well development activities.

5.3.3 Equipment Calibration and Maintenance Form

The calibration or standardization of monitoring, measuring or test equipment is necessary to assure the proper operation and response of the equipment, to document the accuracy, precision or sensitivity of the measurement, 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 (Attachment D) which documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device used in the field; entries must be made for each day the equipment is used.

5.4 Field Reports

The primary means of recording onsite 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 useful for tracking and reporting of progress. Furthermore, the field logbook/notebooks remain onsite for extended periods of time and are thus not accessible for timely review by project management.

5.4.1 Daily Activities Report

To provide timely oversight of onsite contractors, Daily Activities Reports are completed and submitted as described below.

5.4.1.1 Description

The Daily Activities Report (DAR) documents the activities and progress for each day's field work. This report must be filled out on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring which involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors (Attachment E is an example of a Daily Activities Report).

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 Daily Activities Report to the Field Operations Leader (FOL) for review and filing. The Daily Activities Report is not a formal report and thus requires no further approval. The DAR reports are retained by the FOL for use in preparing the site logbook and in preparing weekly status reports for submission to the Project Manager.

5.4.2 Weekly Status Reports

To facilitate timely review by project management, photocopies of logbook/notebook entries may be made for internal use.

It should be noted that in addition to the summaries described herein, other summary reports may also be contractually required Attachment F is an example of a Field Trip Summary Report form.

6.0 ATTACHMENTS

Attachment A	TYPICAL SITE LOGBOOK ENTRY
Attachment B-1	EXAMPLE GROUNDWATER SAMPLE LOG SHEET
Attachment B-2	EXAMPLE SURFACE WATER SAMPLE LOG SHEET
Attachment B-3	EXAMPLE SOIL/SEDIMENT SAMPLE LOG SHEET
Attachment B-4	CONTAINER SAMPLE LOG SHEET FORM
Attachment B-5	SAMPLE LABEL
Attachment B-6	CHAIN-OF-CUSTODY RECORD FORM
Attachment B-7	CHAIN-OF-CUSTODY SEAL
Attachment B-8	FIELD ANALYTICAL LOG SHEET
Attachment C-1	EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET
Attachment C-2	EXAMPLE PUMPING TEST DATA SHEET
Attachment C-3	PACKER TEST REPORT FORM
Attachment C-4	EXAMPLE BORING LOG
Attachment C-5	EXAMPLE OVERBURDEN MONITORING WELL SHEET
Attachment C-5A	EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)
Attachment C-6	EXAMPLE CONFINING LAYER MONITORING WELL SHEET
Attachment C-7	EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL
Attachment C-8	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK
Attachment C-9	EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK (FLUSHMOUNT)
Attachment C-10	EXAMPLE TEST PIT LOG
Attachment C-11	MONITORING WELL MATERIALS CERTIFICATE OF CONFORMANCE
Attachment C-12	MONITORING WELL DEVELOPMENT RECORD
Attachment D	EXAMPLE EQUIPMENT CALIBRATION LOG
Attachment E	EXAMPLE DAILY ACTIVITIES RECORD
Attachment F	FIELD TRIP SUMMARY REPORT

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-1

Tetra Tech NUS, Inc.

GROUNDWATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Domestic Well Data
[] Monitoring Well Data
[] Other Well Type: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date:	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time:	(Visual)	(S.U.)	(mS/cm)	(°C)	(NTU)	(mg/l)	(%)	
Method:								

PURGE DATA:

Date:	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Method:								
Monitor Reading (ppm):								
Well Casing Diameter & Material								
Type:								
Total Well Depth (TD):								
Static Water Level (WL):								
One Casing Volume(gal/L):								
Start Purge (hrs):								
End Purge (hrs):								
Total Purge Time (min):								
Total Vol. Purged (gal/L):								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:	Signature(s):

ATTACHMENT B-2

Tetra Tech NUS, Inc.

SURFACE WATER SAMPLE LOG SHEET

Page___ of ___

Project Site Name: _____
Project No.: _____

[] Stream
[] Spring
[] Pond
[] Lake
[] Other: _____
[] QA Sample Type: _____

Sample ID No.: _____
Sample Location: _____
Sampled By: _____
C.O.C. No.: _____

Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Date:								
Time:								
Depth:								
Method:								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

ATTACHMENT B-3

Tetra Tech NUS, Inc.

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 Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time:			
Method.			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	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-4

Tetra Tech NUS, Inc

CONTAINER SAMPLE & INSPECTION SHEET

Page____ of ____

Project Site Name: _____
Project Number: _____
Site Identification: _____
Container Number(s) _____
Sample Type: 0 Grab
0 Composite

Sample ID No _____
Sampled By: _____
C.O.C. No. _____
Concentration: 0 High
0 Medium
0 Low

CONTAINER SOURCE	CONTAINER DESCRIPTION
DRUM: 0 Bung Top 0 Lever Lock 0 Bolted Ring 0 Other _____	COLOR: _____ CONDITION: _____
TANK: 0 Plastic 0 Metal 0 Other _____	MARKINGS: _____ VOL. OF CONTENTS: _____
OTHER: _____	OTHER: _____

CONTAINER DISPOSITION	CONTENTS DESCRIPTION
SAMPLED: _____ OPENED BUT NOT SAMPLED: Reason _____ NOT OPENED: Reason _____	SINGLE PHASED: _____ MULTIPHASE : Layer 1 / Layer 2 / Layer 3 Phase (Sol. or Liq.) _____ Color _____ Viscosity L, M or H / L, M or H / L, M or H % of Total Volume _____
MONITOR READING:	SAMPLE and /or INSPECTION DATE & TIME: _____HRS. METHOD:_____
SAMPLER(S) and / or INSPECTOR(S) SIGNATURE:	ANALYSIS:

ATTACHMENT B-5

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 B-6

TETRA TECH NUS, INC. CHAIN OF CUSTODY | NUMBER | PAGE ____ OF _____

PROJECT NO.	SITE NAME.	PROJECT MANAGER AND PHONE NUMBER	LABORATORY NAME AND CONTACT
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER AND 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

DATE YEAR	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No OF CONTAINERS	TYPE OF ANALYSIS								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)

3/99
FORM NO TINUS-001

ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL

CUSTODY SEAL	**CUSTODY SEAL**
Date	**Date**
Signature	**Signature**

ATTACHMENT B-8

Tetra Tech NUS, Inc

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By _____ Duplicate: ☐

Field Analyst: _____ Blank: ☐

Field Form Checked as per QA/QC Checklist (initials): _____

SAMPLING DATA:

	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (°C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other
Date								
Time								
Method.								

SAMPLE COLLECTION/ANALYSIS INFORMATION:

ORP (Eh) (+/- mv): _____ Electrode Make & Model: _____

Reference Electrode (circle one): Silver-Silver Chloride / Calomel / Hydrogen

Dissolved Oxygen:

Equipment. HACH Digital Titrator OX-DT CHEMetrics (Range: _____ mg/L) Analysis Time: _____

Range Used:	Range	Sample Vol	Cartridge	Multiplier
☐	1-5 mg/L	200 ml	0.200 N	0.01
☐	2-10 mg/L	100 ml	0 200 N	0 02

Titration Count	Multiplier		Concentration
_____	x 0 01	=	mg/L
_____	x 0 02	=	mg/L

CHEMetrics: _____ mg/L

Notes:

Alkalinity:

Equipment HACH Digital Titrator AL-DT CHEMetrics (Range: _____ mg/L) Analysis Time: _____ Filtered. ☐

Range Used:	Range	Sample Vol.	Cartridge	Multiplier	Titration Count	Multiplier		Concentration
☐	10-40 mg/L	100 ml	0.1600 N	0.1	_____ & _____	x 0 1	=	mg/L
☐	40-160 mg/L	25 ml	0.1600 N	0.4	_____ & _____	x 0.4	=	mg/L
☐	100-400 mg/L	100 ml	1.600 N	1.0	_____ & _____	x 1.0	=	mg/L
☐	200-800 mg/L	50 ml	1.600 N	2.0	_____ & _____	x 2.0	=	mg/L
☐	500-2000 mg/L	20 ml	1.600 N	5 0	_____ & _____	x 5.0	=	mg/L
☐	1000-4000 mg/L	10 ml	1.600 N	10.0	_____ & _____	x 10.0	=	mg/L

Parameter:	Hydroxide	Carbonate	Bicarbonate
Relationship:			

CHEMetrics: _____ mg/L

Notes:

Standard Additions: ☐ Titrant Molarity: _____ Digits Required: 1st. _____ 2nd. _____ 3rd. _____

Carbon Dioxide:

Equipment HACH Digital Titrator CA-DT CHEMetrics (Range: _____ mg/L) Analysis Time: _____

Range Used:	Range	Sample Vol.	Cartridge	Multiplier
☐	10-50 mg/L	200 ml	0.3636 N	0.1
☐	20-100 mg/L	100 ml	0.3636 N	0.2
☐	100-400 mg/L	200 ml	3.636 N	1.0
☐	200-1000 mg/L	100 ml	3.636 N	2.0

Titration Count			Concentration
_____	x 0 1	=	mg/L
_____	x 0.2	=	mg/L
_____	x 1.0	=	mg/L
_____	x 2.0	=	mg/L

CHEMetrics _____ mg/L

Notes

Standard Additions: ☐ Titrant Molarity: _____ Digits Required: 1st. _____ 2nd. _____ 3rd. _____

ATTACHMENT B-8 (Continued)

Tetra Tech NUS, Inc

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

Field Analyst: _____ Blank: ☐

Field Form Checked as per QA/QC Checklist (initials): ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Sulfide (S^{2-}):

Equipment: DR-700 DR-8 __ HS-WR Color Wheel Other _____ Analysis Time: _____

Program/Module: 610nm 93

Concentration: _____ mg/L Filtered: ☐

Notes: _____

Sulfate (SO_4^{2-}):

Equipment: DR-700 DR-8 __ Other. _____ Analysis Time: _____

Program/Module: 91

Concentration: _____ mg/L Filtered: ☐

Standard Solution: ☐ Results. _____

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes: _____

Nitrite (NO_2^--N):

Analysis Time: _____

Equipment: DR-700 DR-8 __ Other _____ Filtered: ☐

Program/Module: 60

Concentration: _____ mg/L Reagent Blank Correction: ☐

Standard Solution ☐ Results: ☐

Notes: _____

Nitrate (NO_3^--N):

Analysis Time: _____

Equipment: DR-700 DR-8 __ Other: _____ Filtered: ☐

Program/Module: 55

Concentration: _____ mg/L

Nitrite Interference Treatment: ☐

Standard Solution: ☐ Results: _____ Reagent Blank Correction: ☐

Standard Additions: ☐ Digits Required: 0.1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes: _____

ATTACHMENT B-8 (Continued)

Tetra Tech NUS, Inc

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Page __ of __

Project Site Name: _____ Sample ID No.: _____

Project No.: _____ Sample Location: _____

Sampled By: _____ Duplicate: ☐

Field Analyst. _____ Blank: ☐

Field Form Checked as per QA/QC Checklist (initials): ☐

SAMPLE COLLECTION/ANALYSIS INFORMATION:

Manganese (Mn^{2+}):

Equipment: DR-700 DR-8 __ HACH MN-5 Other. _____ Analysis Time: _____

Program/Module: 525nm 41

Concentration _____ mg/L Filtered: ☐

Digestion: ☐

Standard Solution ☐ Results: _____ Reagent Blank Correction. ☐

Standard Additions. ☐ Digits Required: 0 1ml:_____ 0.2ml:_____ 0.3ml:_____

Notes: _____

Ferrous Iron (Fe^{2+}):

Equipment. DR-700 DR-8 __ IR-18C Color Wheel Other: _____ Analysis Time: _____

Program/Module 500nm 33

Concentration: _____ mg/L Filtered: ☐

Notes: _____

Hydrogen Sulfide (H_2S):

Equipment: HS-C Other: _____ Analysis Time: _____

Concentration: _____ mg/L Exceeded 5.0 mg/L range on color chart: ☐

Notes _____

QA/QC Checklist:

All data fields have been completed as necessary: ☐

Correct measurement units are cited in the SAMPLING DATA block: ☐

Values cited in the SAMPLING DATA block are consistent with the Groundwater Sample Log Sheet: ☐

Mulitplication is correct for each *Multiplier* table: ☐

Final calulated concentration is within the appropriate *Range Used* block: ☐

Alkalinity *Relationship* is determined appropriatly as per manufacturer (HACH) instructions: ☐

QA/QC sample (e.g., Std. Additions, etc.) frequency is appropriate as per the project planning documents: ☐

Nitrite Interference treatment was used for Nitrate test if Nitrite was detected: ☐

Title block on each page of form is initialized by person who performed this QA/QC Checklist: ☐

ATTACHMENT C-1
EXAMPLE GROUNDWATER LEVEL MEASUREMENT SHEET

Tetra Tech NUS, Inc

GROUNDWATER LEVEL MEASUREMENT SHEET

Project Name: _____ **Project No.:** _____
Location: _____ **Personnel:** _____
Weather Conditions: _____ **Measuring Device:** _____
Tidally Influenced: Yes ___ No ___ **Remarks:** _____

Well or Piezometer Number	Date	Time	Elevation of Reference Point (feet)*	Total Well Depth (feet)*	Water Level Indicator Reading (feet)*	Thickness of Free Product (feet)*	Groundwater Elevation (feet)*	Comments

* All measurements to the nearest 0.01 foot

Page ___ of ___

ATTACHMENT C-2
EXAMPLE PUMPING TEST DATA SHEET

Tetra Tech NUS, Inc

PUMPING TEST DATA SHEET

PROJECT NAME _____ PUMPING WELL NUMBER _____
PROJECT NUMBER _____ MEASURED WELL NUMBER _____

[ ] PUMPING TEST [ ] STEP DRAW DOWN TEST

DATE(s) _____ MONITORING POINT _____
MEASUREMENT METHOD DEPTH CORRECTION (ft)
TEST NUMBER PUMP SETTING (Ft below monitoring point)
STATIC WATER LEVEL (ft) DISTANCE FROM PUMPING WELL (ft)
PERSONNEL
REMARKS

MILITARY TIME	ELAPSED TIME SINCE PUMP START, OR STOP (Min.)	WATER LEVEL (Ft)	CORRECTION (Ft)	DRAW DOWN OR RECOVERY (Ft)	PUMPING RATE (GPM)	FLOW METER READING (Gals)	REMARKS

NOTE All measurements to nearest 0 01 foot measured from top of well riser pipe unless otherwise noted

ATTACHMENT C-3

ATTACHMENT C-3

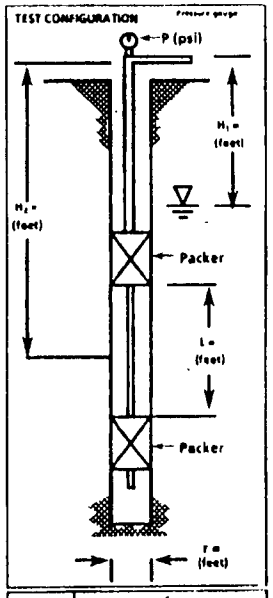
PACKER TEST REPORT FORM

PROJECT: _____ PROJECT NO.: _____ TEST NO: _____ PAGE ____ OF ____

BORING NO.: _____ CASING DEPTH: _____ CONTRACTOR: _____ STATIC WATER LEVEL _____

TEST INTERVAL: _____ BY: _____ CHECKED: _____ PACKER PRESSURE _____

Flow Test					Calculated Results							
Pressure, P (psi)	Elapsed Time (min)	Flow Reading	Δ Flow, ΔQ (ft³)	Δ Flow, ΔQ (gal)	Flow Rate Q (gal/min)	H_1* (ft)	Hp(ft) = 2.31 (psi)	H_2* (ft)	H = Hp + (H1 or H2)	Cp	K (ft/yr) = Cp Q/H	K (cm/sec) = 9.67 x 10⁻⁷ K (ft/yr)



Length of test section in feet L	Cp Drilling Bit Size			
	r = (1.5")	r = (1.875")	r = (2.3/4")	r = (3")
1	31,000	28,500	25,800	23,300
2	19,400	18,100	16,800	15,500
5	9,800	9,300	8,800	8,300
8	6,800	6,500	6,100	5,800
10	5,700	5,400	5,100	4,900
15	4,100	3,900	3,700	3,600
20	3,200	3,100	3,000	2,800

CP = (1/(2 π L)) ln(L/r) (70.315 5)
7.48 Gallons = 1 Ft³
1 psi = 2.31 ft head

* H_1 is used when the test length is below the water table
H_2 is used when the test length is above the water table

Remarks _____

ATTACHMENT C-4

Tetra Tech NUS, Inc

BORING LOG

Page ___ of ___

PROJECT NAME: _____
PROJECT NUMBER _____
DRILLING COMPANY: _____
DRILLING RIG _____

BORING No _____
DATE. _____
GEOLOGIST _____
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	Sampler BZ	Borehole**	Driller BZ**

* When rock coring, enter rock brokeness

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

Drilling Area Background (ppm): ____

Remarks: _____

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

ATTACHMENT C4 (Continued)

LEGEND
SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE-GRAINED SOILS — More Than Half of Material is LARGER Than No 200 Sieve Size

FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES
GRAVELS (50%(+)>1/4"⌀	CLEAN GRAVELS (Low % 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
		Predominantly one size or a range of sizes with some intermediate sizes missing	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
	GRAVELS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures
		Plastic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand clay mixtures
SANDS 50%(+)<1/4"⌀	CLEAN SANDS (Low % Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	SW	Well graded sand, gravelly sands, little or no fines
		Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Poorly graded sands, gravelly sands, little or no fines
	SANDS W/FINES (High % Fines)	Non-plastic fines (for identification procedures, see MCL)	SM	Silty sands, poorly graded sand-silt mixtures
		Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay mixtures

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)	Identification Procedures on Fraction Smaller than No 40 Sieve Size: DAY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)	GROUP SYMBOL	TYPICAL NAMES
SILTS AND CLAYS Liquid Limit <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
	Medium to High	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays sandy clays, silty clays lean clays
	Slight to Medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity
SILTS AND CLAYS Liquid Limit >50	Slight to Medium	Slow to None	Slight to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	High to Very High	None	High	CH	Inorganic clays of high plasticity, fat clays
	Medium to High	None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture			Pt	Peat and other organic soils

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	UNC COMPRESSIVE STRENGTH (TONS/SQ FT)	STANDARD PENETRATION RESISTANCE BLOWS/FOOT	FIELD IDENTIFICATION METHODS
Very Soft	Less than 0 25	0 to 2	Easily pentrated 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 BROKENESS		
Descriptive Terms	Screwdriver 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 conchoidally (several blows) sharp edges	Massive	(M)	3'-10'

LEGEND

SOIL SAMPLES - TYPES

5 2" Split-Barrel Sample

ST-3" O D Undisturbed Sample
O - Other Samples, Specify in Remarks

ROCK SAMPLES - TYPES

X-NX (Conventional) Core (~2 1/8" O D)

0-NQ (Wireline) Core (1-7/8" O D)
Z - Other Core Sizes, Specify in Remarks

12/18

WATER LEVELS

12/18
▽ 12.6'Initial Level w/Date & Depth

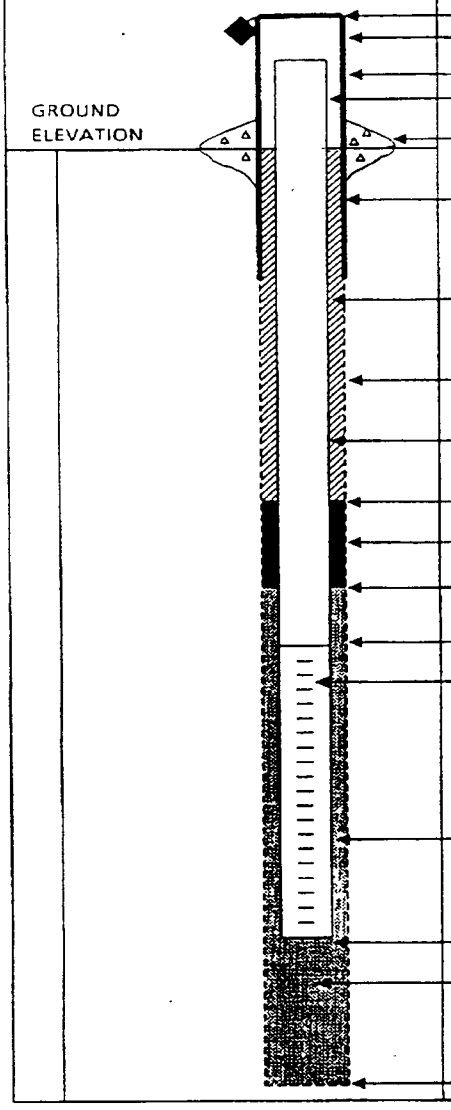
ATTACHMENT C-5
EXAMPLE OVERBURDEN MONITORING WELL SHEET

BORING NO.: _____

OVERBURDEN
MONITORING WELL SHEET

PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF SURFACE CASING : _____
ELEVATION OF TOP OF RISER PIPE: _____

STICK - UP TOP OF SURFACE CASING _____
STICK - UP RISER PIPE _____

TYPE OF SURFACE SEAL. _____

I. D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____

RISER PIPE I.D. _____
TYPE OF RISER PIPE: _____

BOREHOLE DIAMETER: _____

TYPE OF BACKFILL: _____

ELEVATION / DEPTH TOP OF SEAL: ____/____

TYPE OF SEAL: _____

DEPTH TOP OF SAND PACK: _____

ELEVATION / DEPTH TOP OF SCREEN: ____/____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

I.D. OF SCREEN: _____

TYPE OF SAND PACK: _____

ELEVATION / DEPTH BOTTOM OF SCREEN: ____/____

ELEVATION / DEPTH BOTTOM OF SAND PACK: ____/____

TYPE OF BACKFILL BELOW OBSERVATION WELL: _____

ELEVATION / DEPTH OF HOLE: ____/____

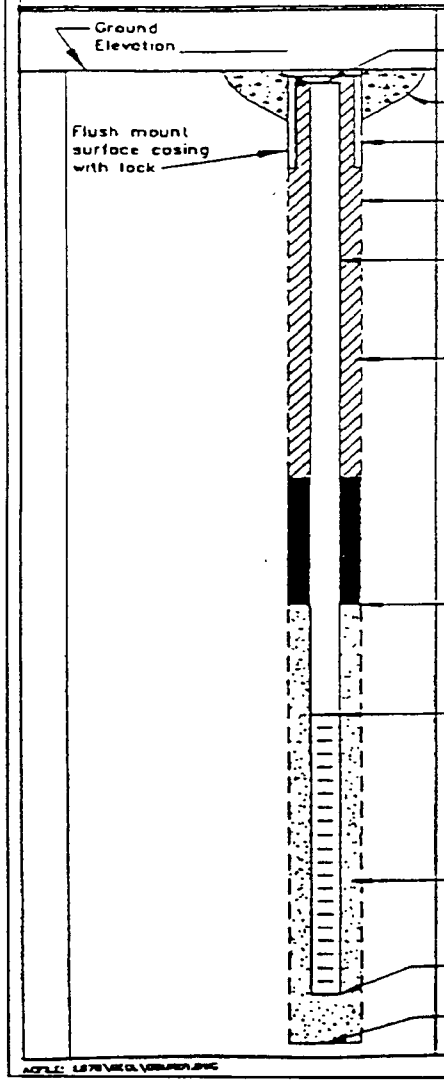
ATTACHMENT C-5A
EXAMPLE OVERBURDEN MONITORING WELL SHEET (FLUSHMOUNT)

BORING NO : _____

MONITORING WELL SHEET

PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____



ELEVATION TOP OF RISER: _____

TYPE OF SURFACE SEAL: _____

TYPE OF PROTECTIVE CASING: _____

I.D. OF PROTECTIVE CASING: _____

DIAMETER OF HOLE: _____

TYPE OF RISER PIPE: _____

RISER PIPE I.D.: _____

TYPE OF BACKFILL/SEAL: _____

_____

DEPTH/ELEVATION TOP OF SAND: _____ / _____

DEPTH/ELEVATION TOP OF SCREEN: _____ / _____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

TYPE OF SAND PACK: _____

DIAMETER OF HOLE IN BEDROCK: _____

DEPTH/ELEVATION BOTTOM OF SCREEN: _____ / _____

DEPTH/ELEVATION BOTTOM OF SAND: _____ / _____

DEPTH/ELEVATION BOTTOM OF HOLE: _____ / _____

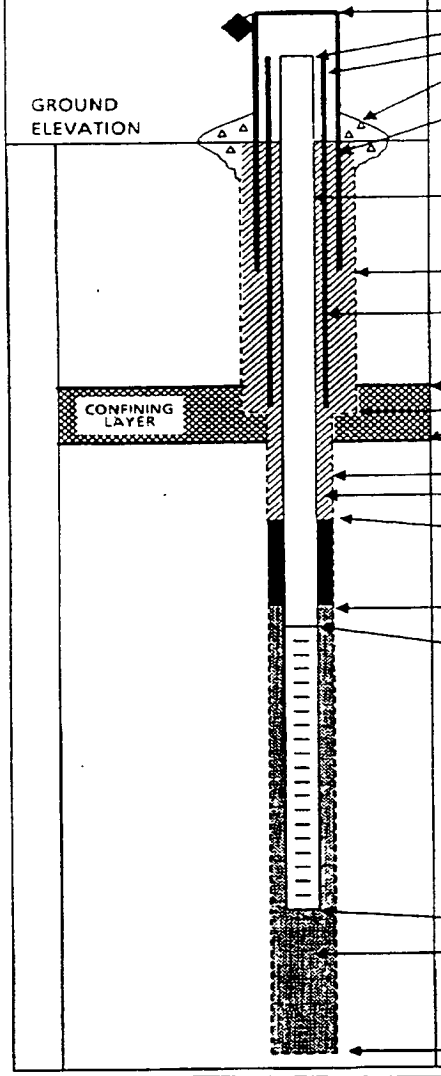
BACKFILL MATERIAL BELOW SAND: _____

ATTACHMENT C-6
EXAMPLE CONFINING LAYER MONITORING WELL SHEET

BORING NO : _____

CONFINING LAYER
MONITORING WELL SHEET

PROJECT _____ LOCATION _____ DRILLER _____
PROJECT NO. _____ BORING _____ DRILLING METHOD _____
ELEVATION _____ DATE _____ DEVELOPMENT METHOD _____
FIELD GEOLOGIST _____



ELEVATION OF TOP OF SURFACE CASING . _____
ELEVATION OF TOP OF RISER PIPE: _____
ELEVATION TOP OF PERM. CASING: _____
TYPE OF SURFACE SEAL. _____
I.D. OF SURFACE CASING. _____
TYPE OF SURFACE CASING. _____
RISER PIPE I.D. _____
TYPE OF RISER PIPE _____
BOREHOLE DIAMETER: _____
PERM. CASING I.D _____
TYPE OF CASING & BACKFILL: _____
ELEVATION / DEPTH TOP CONFINING LAYER: _____
ELEVATION / DEPTH BOTTOM OF CASING: _____
ELEVATION / DEPTH BOT CONFINING LAYER: _____
BOREHOLE DIA. BELOW CASING: _____
TYPE OF BACKFILL: _____
ELEVATION / DEPTH TOP OF SEAL: _____
TYPE OF SEAL: _____
DEPTH TOP OF SAND PACK: _____
ELEVATION/DEPTH TOP OF SCREEN: _____
TYPE OF SCREEN: _____
TYPE OF SAND PACK: _____
ELEVATION / DEPTH BOTTOM OF SCREEN: _____
ELEVATION / DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____
ELEVATION / DEPTH OF HOLE: _____

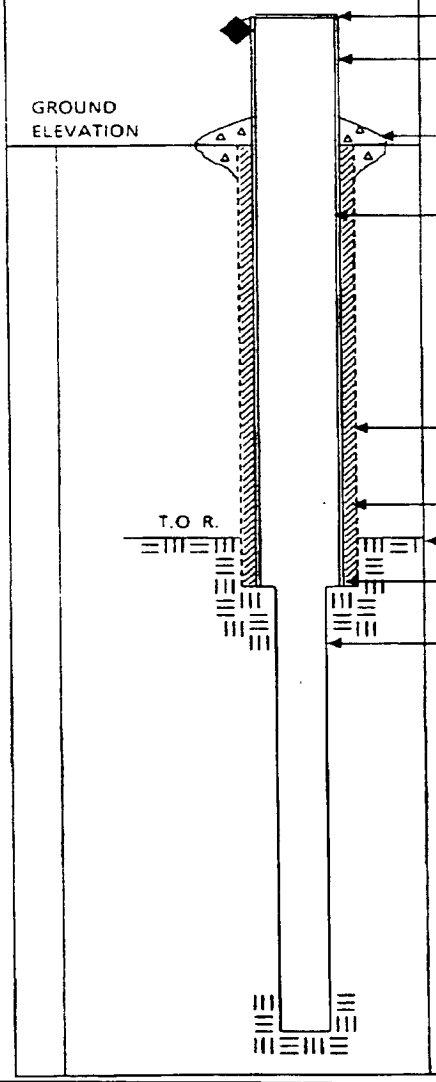
ATTACHMENT C-7
EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL

BORING NO : _____

BEDROCK
MONITORING WELL SHEET
OPEN HOLE WELL

PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF CASING: _____

STICK UP OF CASING ABOVE GROUND SURFACE _____

TYPE OF SURFACE SEAL: _____

I.D. OF CASING: _____

TYPE OF CASING: _____

TEMP. / PERM.: _____

DIAMETER OF HOLE: _____

TYPE OF CASING SEAL: _____

DEPTH TO TOP OF ROCK. _____

DEPTH TO BOTTOM CASING: _____

DIAMETER OF HOLE IN BEDROCK: _____

DESCRIBE IF CORE / REAMED WITH BIT.

_____

_____

_____

DESCRIBE JOINTS IN BEDROCK AND DEPTH:

_____

_____

_____

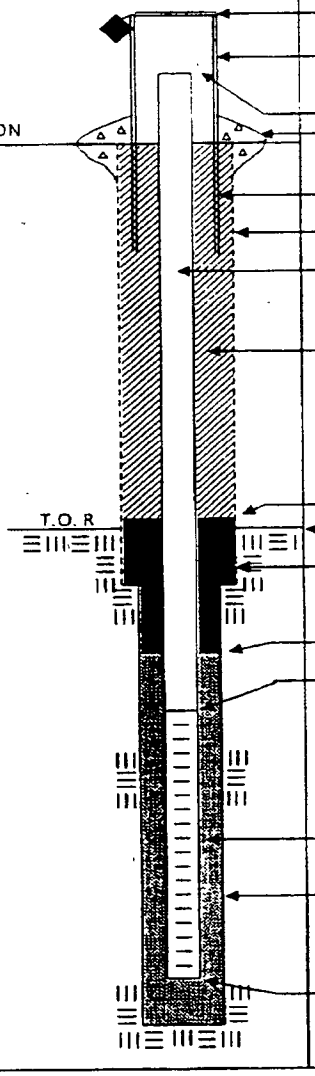
ELEVATION / DEPTH OF HOLE: _____ / _____

ATTACHMENT C-8
EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK

BORING NO : _____

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT _____ LOCATION _____ DRILLER _____
PROJECT NO. _____ BORING _____ DRILLING METHOD _____
ELEVATION _____ DATE _____ DEVELOPMENT METHOD _____
FIELD GEOLOGIST _____



ELEVATION OF TOP OF SURFACE CASING: _____

STICK UP OF CASING ABOVE GROUND SURFACE: _____

ELEVATION TOP OF RISER. _____

TYPE OF SURFACE SEAL: _____

I.D. OF SURFACE CASING: _____

DIAMETER OF HOLE: _____

RISER PIPE I.D.: _____

TYPE OF RISER PIPE: _____

TYPE OF BACKFILL: _____

ELEVATION / DEPTH TOP OF SEAL: ____/____

ELEVATION / DEPTH TOP OF BEDROCK: ____/____

TYPE OF SEAL: _____

ELEVATION / DEPTH TOP OF SAND: ____/____

ELEVATION / DEPTH TOP OF SCREEN: ____/____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

I.D. SCREEN: _____

TYPE OF SAND PACK: _____

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM: _____

ELEVATION / DEPTH BOTTOM SCREEN: ____/____

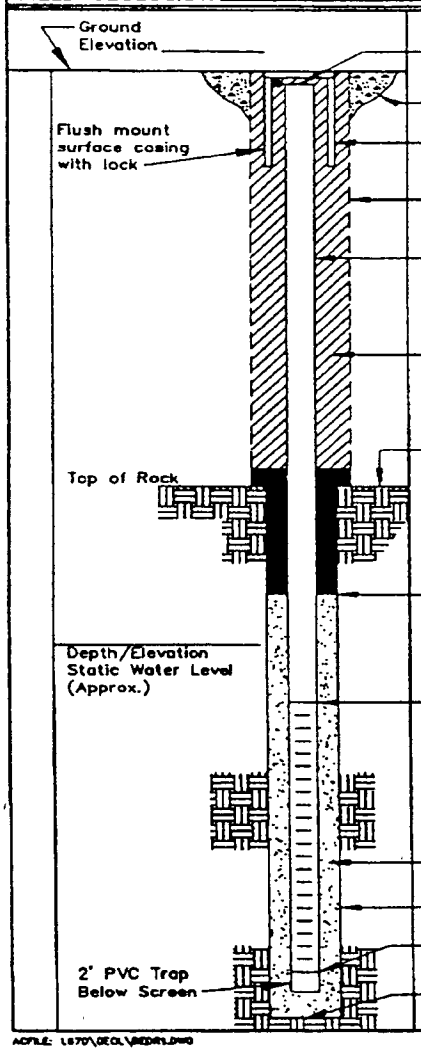
ELEVATION / DEPTH BOTTOM OF HOLE. ____/____

ATTACHMENT C-9
EXAMPLE BEDROCK MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK (FLUSHMOUNT)

BORING NO.: _____

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT: _____	LOCATION: _____	DRILLER: _____
PROJECT NO.: _____	BORING: _____	DRILLING METHOD: _____
ELEVATION: _____	DATE: _____	DEVELOPMENT METHOD: _____
FIELD GEOLOGIST: _____		



ELEVATION TOP OF RISER. _____

TYPE OF SURFACE SEAL: _____

TYPE OF PROTECTIVE CASING: _____

I.D. OF PROTECTIVE CASING. _____

DIAMETER OF HOLE: _____

TYPE OF RISER PIPE: _____

RISER PIPE I.D.: _____

TYPE OF BACKFILL/SEAL: _____

_____

DEPTH/ELEVATION TOP OF BEDROCK: _____/_____

DEPTH/ELEVATION TOP OF SAND: _____/_____

DEPTH/ELEVATION TOP OF SCREEN: _____/_____

TYPE OF SCREEN: _____

SLOT SIZE x LENGTH: _____

TYPE OF SAND PACK: _____

DIAMETER OF HOLE IN BEDROCK: _____

DEPTH/ELEVATION BOTTOM OF SCREEN: _____/_____

DEPTH/ELEVATION BOTTOM OF SAND: _____/_____

DEPTH/ELEVATION BOTTOM OF HOLE: _____/_____

BACKFILL MATERIAL BELOW SAND: _____

ACFILE: L070\GEOL\BEDRYL.DWG

ATTACHMENT C-10
EXAMPLE TEST PIT LOG

Tetra Tech NUS, Inc.

TEST PIT LOG

PROJECT: _____ TEST PIT NO.:

PROJECT NO _____ DATE: _____

LOCATION: _____

FIELD GEOLOGIST _____

DEPTH (FT.)	LITHOLOGY CHANGE (DOCUMENT)	MATERIAL DESCRIPTION (Soil Density / Consistency, Color)	USCS	REMARKS

Test Pit Cross Section and / or Plan View

REMARKS _____

PHOTO LOG _____ TEST PIT _____

PAGE ____ OF ____

ATTACHMENT C-11
EXAMPLE CERTIFICATE OF CONFORMANCE

MONITORING WELL MATERIALS
CERTIFICATE OF CONFORMANCE

Well Designation: _____
Site Name: _____
Date Installed: _____
Project Name: _____

Site Geologist: _____
Drilling Company: _____
Driller: _____
Project Number: _____

Material	Brand/Description	Source/Supplier	Sample Collected ?
Well Casing			
Well Screen			
End Cap			
Drilling Fluid			
Drilling Fluid Additives			
Backfill Material			
Annular Filter Pack			
Bentonite Seal			
Annular Grout			
Surface Cement			
Protective Casing			
Paint			
Rod Lubricant			
Compressor Oil			

To the best of my knowledge, I certify that the above described materials were used during installation of this monitoring well.

Signature of Site Geologist: _____

ATTACHMENT C-12
EXAMPLE MONITORING WELL DEVELOPMENT RECORD

Tetra Tech NUS, Inc.

MONITORING WELL DEVELOPMENT RECORD

Page ___ of ___

Site: _____ Depth to Bottom (ft.): _____ Project Name: _____
Well: _____ Static Water Level Before (ft.): _____ Project Number: _____
Date Installed: _____ Static Water Level After (ft.): _____ Site Geologist: _____
Date Developed: _____ Screen Length (ft.): _____ Drilling Co: _____
Dev. Method: _____ Specific Capacity: _____
Pump Type: _____ Casing ID (in.): _____

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units _____)	Turbidity (NTU)	Remarks (odor, color, etc.)

ATTACHMENT D
EXAMPLE EQUIPMENT CALIBRATION LOG

Tetra Tech NUS, Inc.

EQUIPMENT CALIBRATION LOG

PROJECT NAME : _____

SITE NAME: _____

PROJECT No.: _____

INSTRUMENT NAME/MODEL: _____

MANUFACTURER: _____

SERIAL NUMBER: _____

Date of Calibration	Instrument I.D. Number	Person Performing Calibration	Instrument Settings		Instrument Readings		Calibration Standard (Lot No.)	Remarks and Comments
			Pre-calibration	Post-calibration	Pre-calibration	Post-calibration		

ATTACHMENT E

Tetra Tech NUS, Inc

DAILY ACTIVITIES RECORD

PROJECT NAME: _____ PROJECT NUMBER: _____

CLIENT: _____ LOCATION: _____

DATE: _____ ARRIVAL TIME: _____

Tt NUS PERSONNEL: _____ DEPARTURE TIME: _____

CONTRACTOR: _____ DRILLER: _____

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

COMMENTS: _____

APPROVED BY.

_____ Tt NUS REPRESENTATIVE

_____ DRILLER

DATE: _____

ATTACHMENT F
FIELD TRIP SUMMARY REPORT
PAGE 1 OF 2

SUNDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

MONDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

TUESDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

WEDNESDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

ATTACHMENT F
PAGE 2 OF 2
FIELD TRIP SUMMARY REPORT

THURSDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

FRIDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

SATURDAY

Date: _____ Personnel: _____

Weather: _____ Onsite: _____

Site Activities: _____

APPENDIX D

SEPTEMBER 2003 SAMPLING ADDENDUM

APPENDIX D - SEPTEMBER 2003 SAMPLING ADDENDUM

This addendum provides a brief description of the Site 13 pre-design sampling investigation performed in June 2003. In addition this addendum describes the scope of work to collect additional sediment samples as part of pre-design sampling activities to be performed in September 2003.

D.1 SUMMARY OF JUNE 2003 PRE-DESIGN INVESTIGATION

During the June 2003 pre-design investigation, 16 sediment samples were collected in areas defined in the proposed plan as areas where sediment might need to be excavated for consolidation within the limits of the proposed landfill cover system. The June 2003 sediment samples were collected to better define the limit of sediment contamination in these areas for excavation purposes. Eleven of the sediment samples were collected from the ditch running along the west side of the DPDO yard. The remaining five sediment samples were collected from the landfill washout area along the northwestern slopes of the landfill, where an erosion gully had washed dirt and landfill material out of the landfill. The summary of these sediment results is provided in the following sections.

D.1.1 June 2003 Ditch Samples

Eleven sediment samples (SD1309 to SD1319) were collected within the drainage ditch both upstream and downstream of RI sediment sample 13SD01. These samples were collected to bound the extent of silver and PCB contamination that exceeds their respective remediation levels (silver 3.7 mg/kg and PCB 1 mg/kg) in this RI sediment sample. None of the eleven sediment samples collected in June 2003 contained silver or PCBs in excess of these remediation levels. Sample locations are provided in Figure D-1.

D.1.2 June 2003 Landfill Washout Area Samples

RI sediment sample 13SD03 was centered in the washout materials. This sample exceeded the silver and PCB criteria listed in Sections D.1.1. Five June 2003 sediment samples (SD1304 - SD1308) were collected around the landfill washout area in order to bound the extent of silver and PCB contamination. The results of the June 2003 sediment sampling indicated that four of the five samples collected contained silver in excess of 3.7 mg/kg, and three of the five samples collected contained PCBs in excess of 1 mg/kg. Sampling locations and the silver and PCB results exceeding the remediation level are summarized in Figure D-1.

D.2 SEPTEMBER 2003 PRE-DESIGN INVESTIGATION

In accordance with the Decision rule presented in Section 2.4 of this report, additional samples are required around the Site 13 landfill washout area to bound the extent of sediment contamination. As indicated above, sediment samples collected during the June 2003 pre-design investigation around the landfill washout area contained concentrations of silver and PCB that exceed their respective remediation level (3.7 mg/kg silver and 1 mg/kg PCB). Therefore, a second pre-design round of sample collection is required to delineate the extent of silver and PCB contamination.

D.2.1 Sampling Design and Analysis

The proposed sampling for the September 2003 pre-design investigation includes the collection of 12 additional sediment samples. Five additional sediment samples will be collected from a second ring of samples outside the June 2003 sediment samples (SD1304 – SD1308). The second round of samples will be approximately 20 feet down-gradient of the June 2003 samples and will be collected from a depth of 0- to 6-inches. Three additional sediment samples will be collected down-gradient of the first five proposed September 2003 sediment sample locations. These samples are located down-gradient of the two samples containing the highest concentrations of silver and PCB (SD1305 and SD1306). In addition, these locations are directly down-gradient of the washout area along the preferential flow path of stormwater runoff. These three sediment samples will be collected from a depth of 0- to 6-inches. Lastly, four sediment samples will be collected from a depth of 12- to 18-inches to assure the contamination is not at depth and to provide data to help achieve a more accurate volume estimate for the design. Three of the 4 at depth sediment samples will be collected from locations that are also being sampled at the 0- to 6-inch sample interval. The remaining at depth sediment sample will be collected within the circle of June 2003 sediment sample locations. The locations of the proposed sediment samples are provided in Figure D-2.

As with the June 2003 samples, the September 2003 sediment samples will be analyzed for Target Compound List (TCL) PCBs and Target Analyte List (TAL) metals. The entire list of TAL metals will be analyzed and reported to assure that no other metals are posing a risk to ecological receptors. Table D-1 lists the sediment samples to be collected, as part of this investigation.

D.2.2 Project Schedule

It is anticipated that these sediment samples will be collected during the last week of September 2003, and will take 1 to 2 days to complete. The lab analyses will then be completed on a 10-day turnaround.

D.2.3 Proj ct Target Parameters and Intended Data Us

The target parameters and intended data use for the September 2003 sampling event are the same as those for the June 2003 sampling event. The target parameters and intended data use is provided in Section 2.7 of this report.

D.2.4 Quality Control / Quality Assurance Objectives

The quality control / quality assurance (QAQC) objectives are outlined in Sections 3 through 15 of this report.

TABLE D-1

SUMMARY OF PROPOSED SEDIMENT SAMPLING
SITE 13
NWS EARLE
COLTS NECK, NEW JERSEY

Sample Identification	Method of Collection	Sample Collection Depth	Analyses	
			Total PCBs	TAL Metals
SITE 13 SEDIMENT SAMPLES				
SD1320-0006	Grab Sediment Sample	0 to 6 inches	X	X (1)
SD1321-0006	Grab Sediment Sample	0 to 6 inches	X	X (1)
SD1321-1218	Grab Sediment Sample	12 to 18 inches	X	X (1)
SD1322-0006	Grab Sediment Sample	0 to 6 inches	X	X (1)
SD1323-0006	Grab Sediment Sample	0 to 6 inches	X	X (1)
SD1324-0006	Grab Sediment Sample	0 to 6 inches	X	X (1)
SD1324-1218	Grab Sediment Sample	12 to 18 inches	X	X (1)
SD1325-0006	Grab Sediment Sample	0 to 6 inches	X	X (1)
SD1326-0006	Grab Sediment Sample	0 to 6 inches	X	X (1)
SD1326-1218	Grab Sediment Sample	12 to 18 inches	X	X (1)
SD1327-0006	Grab Sediment Sample	0 to 6 inches	X	X (1)
SD1328-1218	Grab Sediment Sample	12 to 18 inches	X	X (1)
QUALITY CONTROL SAMPLES				
RB080802 (2)	Discrete aqueous sample	NA	TBD	TBD
SAMPLE-MS (3)	TBD	TBD	TBD	TBD
SAMPLE-MSD (4)	TBD	TBD	TBD	TBD
FD080802-01 (5)	TBD	TBD	TBD	TBD

1 Include TAL Metals from Table 2-2.

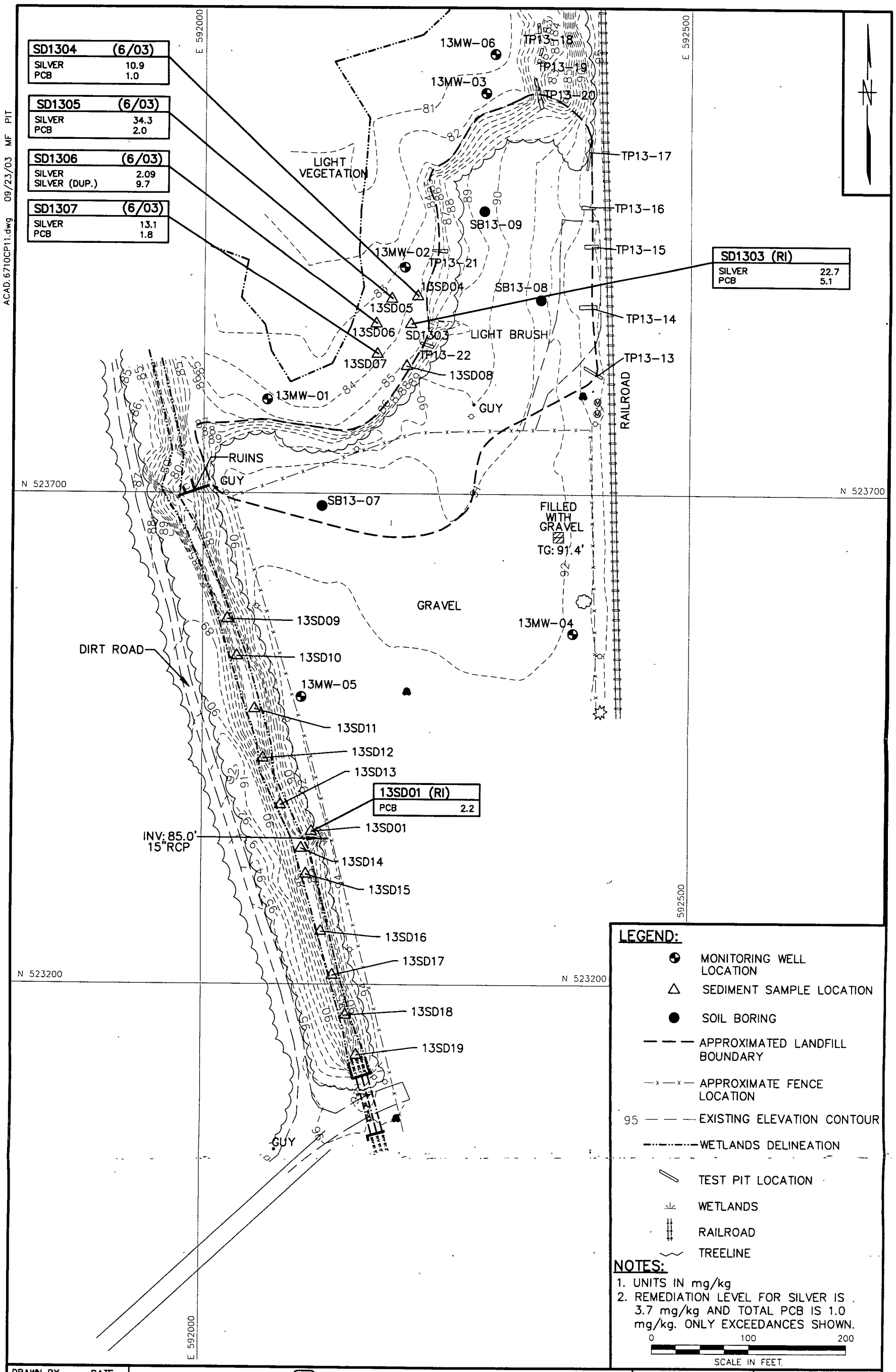
2 For rinse blanks the 6-digit number represents the date on which the sample was collected (i.e."080802" refers to August 8, 2002. In the event that disposable sampling equipment is used for the collection of Environmental samples for the entire day, no rinse blank would be required for that day.

3 The "MS" indicates that sample contains extra volume to run matrix spike analysis. MS samples are to be collected at a rate of 1 for every 20 environmental samples.

4 The "MSD" indicates that sample contains extra volume of the indicated sample to run matrix spike duplicate analysis.

5 The "080802" indicates the date on which the duplicate sample was collected. The "01" provides a sequential number for days when multiple duplicates are collected. The sample/duplicate pair will be recorded in the field logbook. Duplicate samples are to be collected at a rate of 1 for every 10 environmental samples collected for each site.

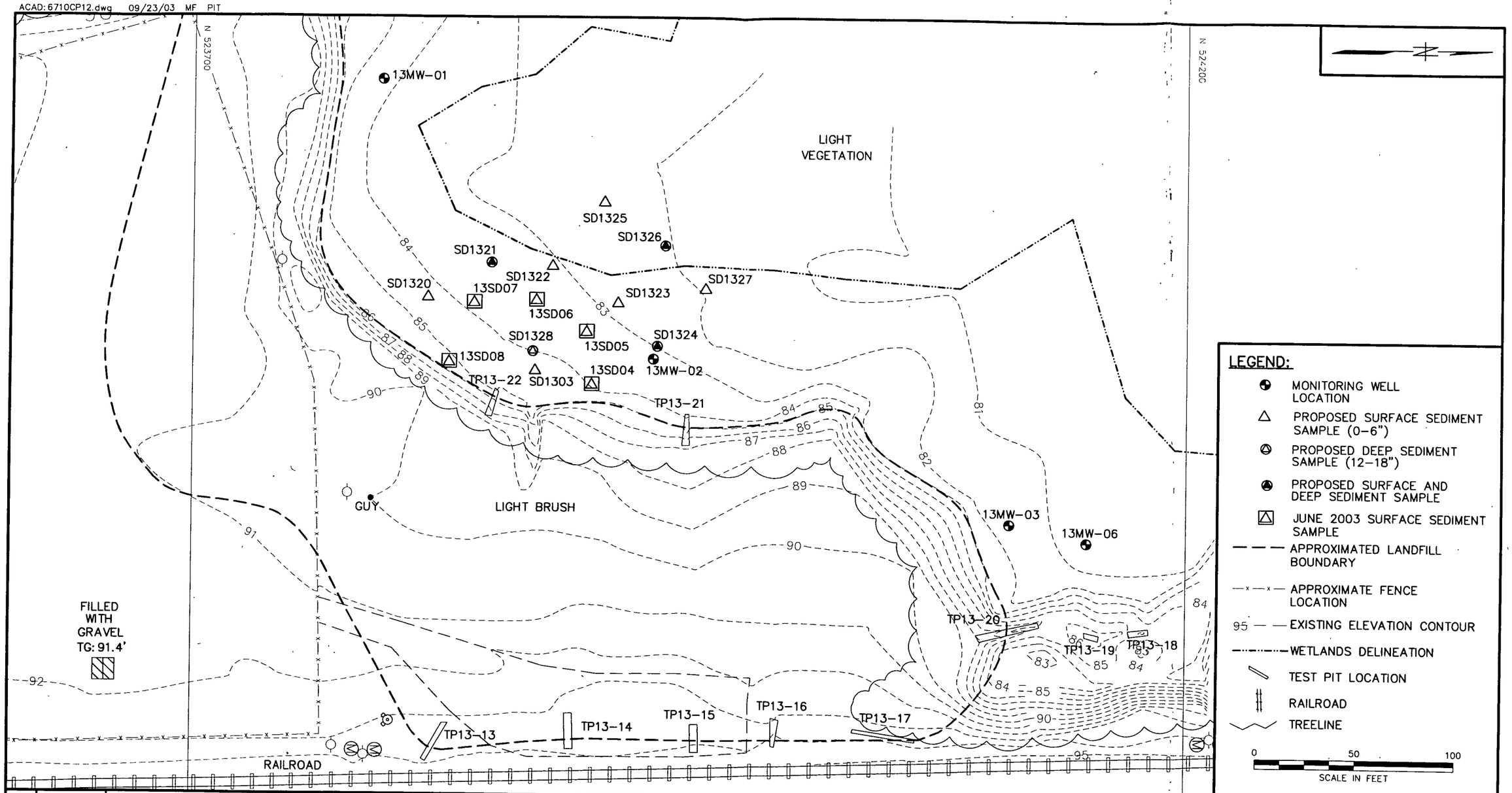
TAL Target Analyte List
TBD To Be Determined
NA Not Applicable
PCB polychlorinated biphenyls



DRAWN BY DM DATE 9/19/03	T tra T ch NUS, Inc.	CONTRACT NO. 6710	OWNER NO. ———
CHECKED BY DATE	JUNE 2003 SEDIMENT SAMPLE LOCATION EXCEEDANCES SITE 13 – DPDO YARD NAVAL WEAPONS STATION EARLE COLTS NECK, NEW JERSEY	APPROVED BY	DATE 7/23/03
COST/SCHED–AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE D–1	REV. 0

FORM CADD NO. TtNUS_BV.DWG – REV 0 – 1/20/98

ACAD: 6710CP12.dwg 09/23/03 MF PIT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 9/23/03
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

PROPOSED SEDIMENT SAMPLE LOCATIONS
SITE 13 – DPDO YARD
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

CONTRACT NO. 6710
OWNER NO. ——
APPROVED BY [signature] DATE 9/24/03
APPROVED BY DATE
DRAWING NO. FIGURE D-2
REV. 0

FORM CADD NO TtNUS_BH.DGN – REV 0 – 1/20/98

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permeability cover system, institutional controls, and long-term monitoring. Also indicated in the Proposed Plan are two areas of possible excavation located outside the landfill limit. These areas are associated with sediment contamination and are the focus of this investigation. The Record of Decision (ROD) for this site is currently being prepared. The investigation outlined in the QAPP is being performed as part of pre-design activities for Site 13. It is anticipated that the results of this investigation will be presented in remedial design documents.

1.4 REPORT CONTENTS

Section 1.0 of this QAPP is the introduction and site background. Section 2.0 details the scope of work to be conducted for this investigation and the use of the data to be collected. Section 3.0 discusses the project organization including personnel and entities involved with this project. Section 4.0 discusses sampling procedures. Sections 5.0 through 15.0 detail the QA/QC requirements for the data collection, analysis, and validation. Appendix A contains the project specific HASP. Appendix B contains field forms and Appendix C contains standard operating procedures (SOPs). Appendix D contains a brief discussion of the June 2003 pre-design sampling event. Appendix E contains a brief discussion of the September 2003 pre-design sampling event and provides a description of the proposed December 2003 pre-design sampling event.

APPENDIX E

DECEMBER 2003 SAMPLING ADDENDUM

APPENDIX E - DECEMBER 2003 SAMPLING ADDENDUM

This addendum provides a brief description of the Site 13 pre-design sampling investigation performed in September 2003. A brief description of pre-design sampling investigation performed in June 2003 is provided in Appendix D. In addition this addendum describes the scope of work to collect additional sediment samples as part of pre-design sampling activities to be performed in December 2003.

E.1 SUMMARY OF SEPTEMBER 2003 PRE-DESIGN INVESTIGATION

During the September 2003 pre-design investigation, 12 sediment samples were collected from the landfill washout area along the northwestern slopes of the landfill where an erosion gully had washed dirt and landfill material out of the landfill. The washout area was defined in the proposed plan as an area where sediment might need to be excavated for consolidation within the limits of the proposed landfill cover system. The September 2003 sediment samples were collected to bound the extent of contamination not bounded by the first round of sampling (i.e., by June 2003 samples 13SD04 through 13SD08) and to determine if contamination exists at depth. A summary of the September 2003 sediment sampling results is provided below.

Twelve additional sediment samples were obtained: five sediment samples (13SD20 through 13SD24) at a depth of 0 to 6 inches bgs from a second ring of samples outside of the June 2003 sediment samples, three sediment samples (13SD25 through 13SD27) at a depth of 0 to 6 inches bgs downgradient from the second ring of samples, and four sediment samples (13SD21, 13SD24, 132SD26, and 132SD28) at a depth of 12 to 18 inches below ground surface (bgs) from within the washout area. The sediment samples were analyzed for TAL metals and TCL PCBs and reviewed for exceedances of the remediation levels. The remediation levels were exceeded for silver or total PCB at all 9 sediment sample locations. The remediation levels were exceeded for silver and total PCB in 12 of 12 and 6 of 12 sediment samples, respectively. The exceedances of the silver and total PCB remediation levels are shown on Figure E-1.

E.2 SEPTEMBER 2003 PRE-DESIGN INVESTIGATION

In accordance with the decision rule presented in Section 2.4 of this plan, additional samples are required around the Site 13 landfill washout area to bound the extent of sediment contamination. As indicated in Appendix D and above, sediment samples collected during the June and September 2003 pre-design investigations around the landfill washout area contained concentrations of silver and total PCB that exceed their respective remediation levels (3.7 mg/kg silver and 1 mg/kg PCB). Therefore, a third pre-design round of sample collection is required to delineate the extent of silver and total PCB contamination.

E.2.1 Sampling Design and Analysis

The proposed sampling for the December 2003 pre-design investigation includes the collection of 27 additional sediment samples. The December 2003 sediment samples are located downgradient of areas with the largest silver and total PCB concentrations and in the area of an apparent swale flowing north and paralleling the landfill. Two additional sediment samples will be collected to extend the third ring of samples collected during September 2003. Sediment samples will be collected from a fourth, fifth and sixth ring extending at 50 foot increments outside the September 2003 sediment samples (13SD31 through 13SD35, 13SD36 through 13SD41, 13SD42 through 13SD46, respectively). Lastly, three additional sediment samples will be collected from a seventh ring extending approximately 150-feet outside of the sixth ring (13SD47 through 13SD49). Sediment samples will be collected form 0- to 6-inches bgs at all locations and from 12- to 18-inches bgs for approximately 25% of the samples. The locations of the proposed sediment samples are provided in Figure E-2.

Sediment samples obtained from the third and fifth sampling rings will be submitted initially for analytical laboratory testing with a 7-day turnaround time (TAT). All remaining samples would be archived pending results for the fifth sampling ring. If contaminant concentrations from the fifth sampling ring are below the remedial goals then the fifth sampling ring effectively bounds the extent of contamination. Additional sediment samples from the fourth sampling ring may then be released for testing to refine the planar limits of contamination if desired. If contaminant concentrations from the fifth sampling ring are above the remedial goals then additional sediment samples from the sixth and/or seventh sampling rings may then be released for testing to define the planar limits of contamination. Sediment samples released for testing will be tested for Target Compound List (TCL) PCBs and Target Analyte List (TAL) metals as were the June and September 2003 sediment samples. The entire list of TAL metals will be analyzed and reported to assure that no other metals are posing a risk to ecological receptors. In addition, representative archived sediment samples from the September 2003 sampling event and 20 to 25 percent of the December 2003 sediment samples will be analyzed for total organic carbon (TOC) using the Lloyd-Kahn Method. Table E-1 lists the sediment samples to be collected as part of this investigation.

E.2.2 Project Schedule

It is anticipated that these sediment samples will be collected during December 2003 with the sampling effort taking 1 to 2 days to complete. The laboratory analyses will then be completed on a 7-day TAT.

E.2.3 Proj ct Targ t Parameters and Intended Data Use

The target parameters and intended data use for the December 2003 sampling event are the same as those for the June and September 2003 sampling events with the addition of TOC. The target parameters and intended data use is provided in Section 2.7 of this report.

E.2.4 Quality Control/Quality Assurance Objectives

The quality control/quality assurance (QAQC) objectives are outlined in Sections 3 through 15 of this report.

TABLE E-1

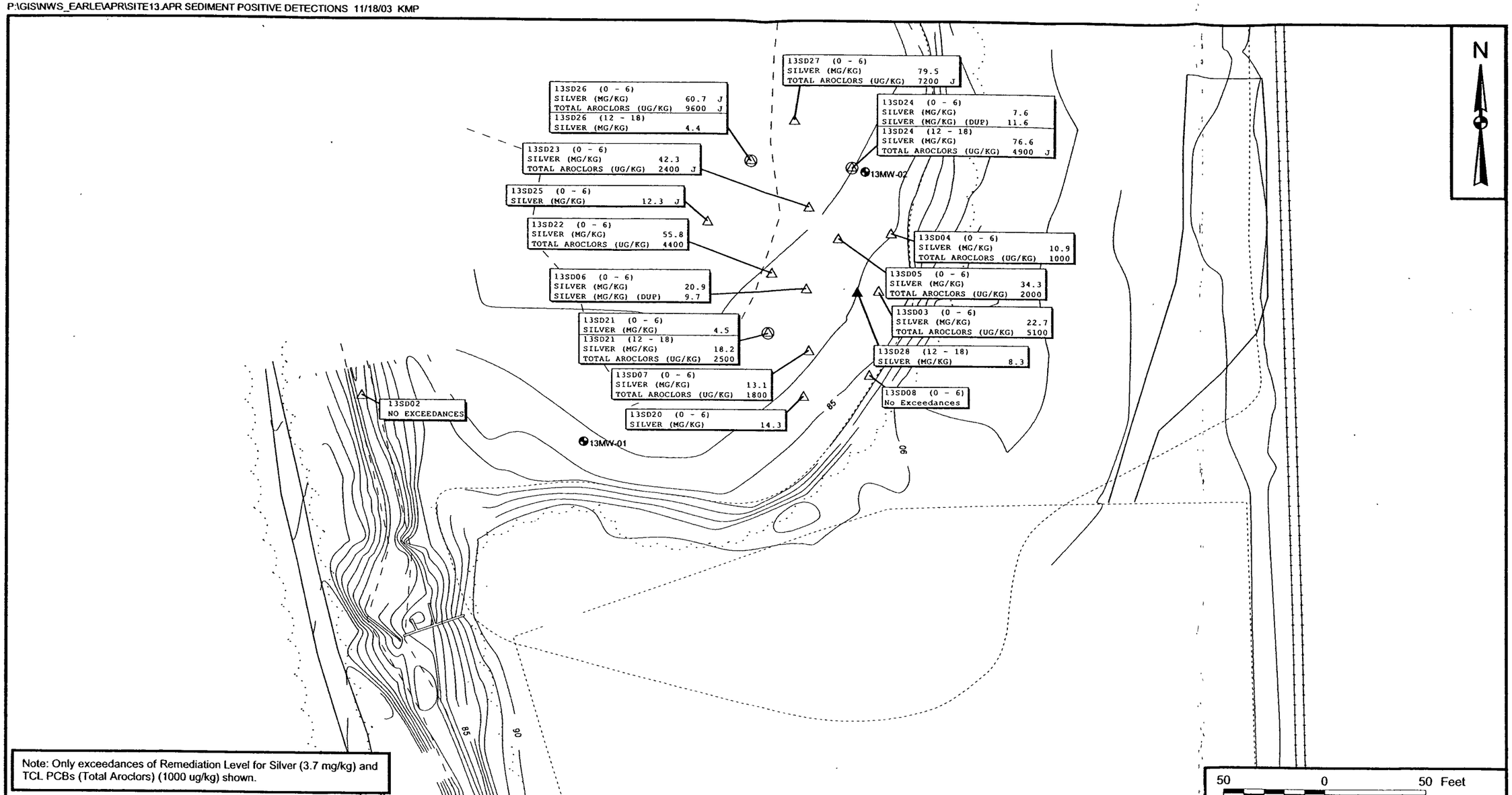
SUMMARY OF PROPOSED SEDIMENT SAMPLING
SITE 13
NWS EARLE
COLTS NECK, NEW JERSEY

Sample Identification	Method of Collection	Sample Collection Depth	Analyses				
			TCL PCBs	TAL Metals [1]	Total Organic Carbon	Analyze Immediately	Archive Pending Analysis of First Set of Samples
SITE 13 SEDIMENT SAMPLES / SEPTEMBER 2003 SAMPLES (ARCHIVED)							
13SD21-0006 [2]	Grab Sediment Sample	0 to 6 inches			X	X	
13SD23-0006 [2]	Grab Sediment Sample	0 to 6 inches			X	X	
13SD26-0006 [2]	Grab Sediment Sample	0 to 6 inches			X	X	
SITE 13 SEDIMENT SAMPLES / DECEMBER 2003 SAMPLES							
Sediment Sampling Ring 3							
13SD29-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [3]	X	
13SD30-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [3]	X	
Sediment Sampling Ring 4							
13SD31-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD32-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD33-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD34-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD34-1218	Grab Sediment Sample	12 to 18 inches	X	X			X
13SD35-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
Sediment Sampling Ring 5							
13SD36-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [3]	X	
13SD37-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [3]	X	
13SD37-1218	Grab Sediment Sample	12 to 18 inches	X	X		X	
13SD38-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [3]	X	
13SD39-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [3]	X	
13SD39-1218	Grab Sediment Sample	12 to 18 inches	X	X		X	
13SD40-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [3]	X	
13SD41-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [3]	X	
13SD41-1218	Grab Sediment Sample	12 to 18 inches	X	X		X	
Sediment Sampling Ring 6							
13SD42-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD43-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD43-1218	Grab Sediment Sample	12 to 18 inches	X	X			X
13SD44-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD45-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD46-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
Sediment Sampling Ring 7							
13SD47-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD48-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
13SD48-1218	Grab Sediment Sample	12 to 18 inches	X	X			X
13SD49-0006	Grab Sediment Sample	0 to 6 inches	X	X	TBD [4]		X
QUALITY CONTROL SAMPLES							
RB120803 [5]	Discrete aqueous sample	NA	TBD	TBD	TBD		
SAMPLE-MS [6]	TBD	TBD	TBD	TBD	TBD		
SAMPLE-MSD [7]	TBD	TBD	TBD	TBD	TBD		
FD120803-01 [8]	TBD	TBD	TBD	TBD	TBD		

1 Include TAL Metals from Table 2-2
2 Sediment sample previously analyzed for TCL PCBs and TAL metals Laboratory archived sample will be tested for indicated analyses
3 Select surface sediment samples from 13SD29, 13SD30, and 13SD36 through 13SD41 at a rate of 20% to 25% (2 samples) for TOC analysis Select samples with different textural classification to encompass range of soil types encountered A minimum of one sediment sample will be selected from each "sediment sampling ring"
4 For sediment samples released for analysis, select surface sediment samples from 13SD31 through 13SD35 and 13SD42 through 13SD49 at a rate of 20% to 25% for TOC analysis. Select samples with different textural classification to encompass range of soil types encountered. A minimum of one sediment sample will be selected from each "sediment sampling ring".
5 For rinse blanks the 6-digit number represents the date on which the sample was collected (i.e "120803" refers to December 8, 2003 In the event that disposable sampling equipment is used for the collection of environmental samples for the entire day, no rinse blank would be required for that day.
6 The "MS" indicates that sample contains extra volume to run matrix spike analysis MS samples will be collected at a rate of 1 for every 20 environmental samples
7 The "MSD" indicates that sample contains extra volume of the indicated sample to perform matrix spike duplicate analysis.
8 The "120803" indicates the date on which the duplicate sample was collected The "01" provides a sequential number for days when multiple duplicates are collected The sample/duplicate pair will be recorded in the field logbook Duplicate samples will be collected at a rate of 1 for every 10 environmental

TCL Target Compound
TAL Target Analyte List
TOC Total Organic Carbon
TBD To Be Determined.
NA Not Applicable
PCB Polychlorinated biphenyls

P:\GIS\NWS_EARLE\APR\SITE13.APR SEDIMENT POSITIVE DETECTIONS 11/18/03 KMP



Note: Only exceedances of Remediation Level for Silver (3.7 mg/kg) and TCL PCBs (Total Aroclors) (1000 ug/kg) shown.

LEGEND

- Groundwater Monitoring Well
- Surface Sediment Sample (0-6")
- Deep Sediment Sample (12-18")
- Surface and Deep Sediment Sample
- Topographic Contour (Contour Interval = 1 ft.)
- Road
- Railroad
- Fence
- Pipe
- Tree Line
- Wall
- Wetland Limit
- Landfill Limit

DRAWN BY K. PEILA	DATE 11/14/03	Tetra Tech NUS, Inc.	CONTRACT NUMBER 6710 / OWNER NUMBER 851
CHECKED BY R. MERTZ	DATE 11/14/03	SEDIMENT SAMPLE REMEDIATION LEVEL EXCEEDANCES SITE 13 - DPDO YARD NAVAL WEAPONS STATION EARLE COLTS NECK, NEW JERSEY	APPROVED BY — DATE —
COST/SCHEDULE-AREA			APPROVED BY — DATE —
SCALE AS NOTED			DRAWING NO. FIGURE E-1 / REV 0

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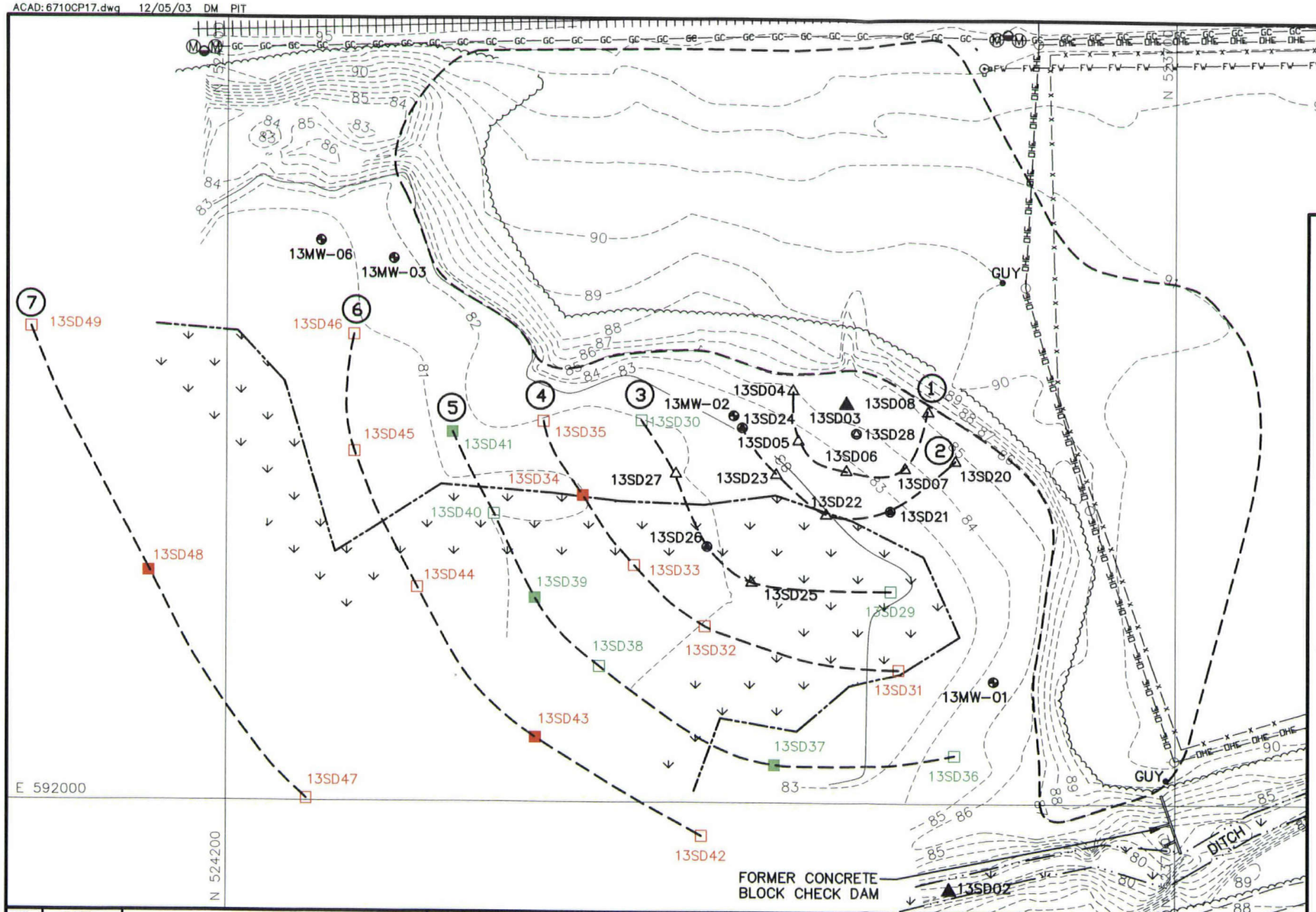


LEGEND:

□ 13SD32	PROPOSED SURFACE SEDIMENT SAMPLE (0–6")
■ 13SD37	PROPOSED SURFACE AND DEEP SEDIMENT SAMPLE (0–6" & 12–18")
13MW-05	GROUNDWATER MONITORING WELL
▲ 13SD01	SEDIMENT SAMPLE (REMEDIAL INVESTIGATION)
△ 13SD25	SURFACE SEDIMENT SAMPLE (0–6")
13SD28	DEEP SEDIMENT SAMPLE (12–18")
13SD26	SURFACE AND DEEP SEDIMENT SAMPLES
(1)	SEDIMENT SAMPLING RING I.D.
90	EXISTING CONTOUR
—x—x—x—	FENCE
	LIMIT OF DELINEATED WETLAND
	ORDINARY HIGH WATER MARK
	RAILROAD TRACKS
	LANDFILL BOUNDARY
	WETLANDS

NOTES:

1. SAMPLES IN GREEN TO BE TESTED IMMEDIATELY
2. SAMPLES IN RED, THE TESTING IS TO BE DETERMINED.

0 60 120
SCALE IN FEET

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY DM DATE 12/3/03
CHECKED BY RCM DATE 12/3/03
COST/SCHED-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

PROPOSED SEDIMENT SAMPLE LOCATIONS
SITE 13 – DPDO YARD
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

CONTRACT NO. 851
OWNER NO. 6710
APPROVED BY
DATE 12/8/03
APPROVED BY
DATE
DRAWING NO. FIGURE E-2
REV. 0

FORM CADD ID TTNUS_BHDSN - REV 0 - 1 30/96

APPENDIX F

FEBRUARY 2005 SAMPLING ADDENDUM

APPENDIX F – FEBRUARY 2005 SAMPLING ADDENDUM

This addendum provides a brief description of the Site 13 pre-remediation sampling investigation. The purpose of this pre-remediation sampling investigation is to determine the required excavation depths within the two excavation areas located outside the limits of the proposed Site 13 cap limits. In addition to the scope of work to collect the additional sediment samples, this addendum provides a brief description of the pre-design sampling activities used to determine the horizontal extent of the excavation area presented in this addendum.

F.1 SUMMARY OF HISTORIC PRE-DESIGN SAMPLING ACTIVITIES

The purpose of the pre-design sampling activities was to delineate the horizontal extent of excavation needed to remove the impacted sediments found in areas outside the proposed Site 13 landfill cap system. Three sediment sampling events were performed to determine the horizontal extent of these locations. The results of these sediment sampling events, a summary of Remedial Investigation results, and the delineated horizontal extent of excavation (Figure F-1) are all summarized in a Technical Memo titled "Technical Memorandum, Sediment Sampling Summary – 2003 Sampling Events, Site 13 Defense Property Disposal Office (DPDO) Yard, Colts Neck, New Jersey, Naval Weapons Station Earle" dated December 2004.

F.2 SCOPE OF WORK

F.2.1 Sampling Objectives

The objective of this sediment sampling addendum is to present a procedure to obtain sufficient data to confirm the depth of excavation required within the sediment excavation areas associated with the proposed Site 13 Remedial Action Design. With sufficient data, the collection of verification samples following excavation will not be required. This plan will also present the criteria and procedures to evaluate the data obtained during this proposed sediment sampling event.

F.2.2 Sample Areas

The remedial design for Site 13 identifies two areas from which contaminated sediments will be excavated. These excavated sediments will be consolidated with the landfill materials within the proposed Site 13 cap system limits. The excavation areas are described below and are presented in Figure F-1.

Excavation Area 1: Excavation area 1 is approximately 0.92 in size and is located adjacent to the Site 13 landfill, northwest of an area where erosion events have washed landfill material and associated soils from the landfill toward the delineated wetlands.

Excavation Area 2: Excavation area 2 is approximately 220 square feet in size and is located at the out fall of a 15-inch diameter reinforced concrete culvert located south west of the landfill. This area is located adjacent to a stream that conveys flow toward the Site 13 Landfill. This stream eventually receives overland flow from the area in which the Site 13 landfill is located.

The proposed sediment samples will be collected within these two excavation areas at multiple depths.

F.2.3 Sampling Methodology

The purpose of this sediment sampling event is to determine the required depth of excavation within the two excavation areas such that further confirmation sampling is not required following excavation. The proposed sampling methodology is therefore based on post-excavation sampling strategies which have been used on other CERCLA sites. With most confirmation sampling, the residual ground surface following excavation is sampled to determine if acceptable concentrations remain. The Site 13 proposed sampling will characterize the soil within defined areas at specific depth intervals down to the water table.

The Soil Screening Guidance (SSG) User's Guide (USEPA, 1996) is the basis for the sampling approach; however, it has been modified to be more applicable to confirmation sampling. The original SSG sampling approach is set up for characterization of a site to determine if additional investigation is required. The SSG approach characterizes 0.5 acre exposure areas. From each 0.5 exposure area, 6 composite samples are collected. Each composite consists of four randomly located grab samples (one from each quadrant of the exposure area. The problem with the original SSG approach with relation to confirmation sampling is that if one of the composite samples exceeds the cleanup level it can not be determined where to dig in the exposure area.

The proposed sampling approach involves dividing each 0.5 area into 6 smaller areas and collecting a composite sample from each of the six smaller areas (these smaller areas will be called a sample area). In that way, each composite sample is only related to one sample area (SA). If the sample results for a composite sample are above the cleanup levels, that smaller area can be targeted for additional excavation. Each SA is then approximately 1/12th of an acre in size. It is proposed that two randomly located grab samples be collected from each depth interval within each SA. Those two grab samples would then be composited, analyzed and compared to the screening criteria.

Figures F-2 and F-3 present the 12 sample areas for proposed Excavation Area 1 (11 sample areas) and Excavation Area 2 (one sample area).

Proposed Sample Locations:

In order to provide an unbiased grab sample locations, each grab sample location within each sample area is randomly located using a random number generator. For each sample grab location, the random number generator selects two numbers. Each number is selected between 1 and 100 and represents the approximate percentage of the distance across the sample areas in a northing and easting direction. Table F-1 presents the random numbers generated for the purpose of locating each grab sample location. Each grab sample location is also presented on Figures F-2 and F-3.

Sample Collection Procedure:

At each grab sample location, sediment samples will be collected at one foot depths intervals starting from one foot below ground surface. Grab samples will be collected from at each interval until reaching the groundwater table. Groundwater is expected to be at an average of 3 feet below ground surface in each excavation area. Because the surface of the two proposed excavation areas have already been sampled and characterized, samples will not be collected from the 0 to 1 foot depth interval. It is anticipated that the first foot of soil will be excavated based on previous sampling.

To collect the sediment samples, the field crew will identify and flag the location of each grab sample location in each of the 12 sample areas using a hand held GPS and the grab sample coordinates provided in Figure F-2. Following sample collection, the grab sample locations will be surveyed by a New Jersey Licensed Surveyor. Once the locations are flagged, hand augers will be used to reach the desired sample depth. Sediment samples will be collected on a sample area by sample area basis and on a depth by depth basis. For example, once reaching the desired sample interval in the first grab sample location, sediment will be collected and placed in a stainless steel bowl. Leaving the first hand auger assembly in place a second hand auger will be used to collect a sediment sample form the second grab sample location within the same sample area. Once reaching the same interval as the first grab sample location sediment will be collected and placed in the same stainless steel bowl as the first grab sample location sediment. These two sediment grabs samples will then be mixed into one sample that will be bottled for shipment to the laboratory for analysis. After collecting the sediment sample from the first interval, the hand augers will be advanced to the next sample interval. This process will continue until the groundwater table within that sample area is reached. In the event that grab samples are oriented in such a manner that the groundwater table in one of the two grab sample locations is reached before the other, continue collecting sediment samples from each location until the groundwater table is reached at both grab sample locations.

Sample Nomenclature

Table F-2 presents the anticipated samples to be collected during this sediment sampling event. The sampling nomenclature assumes that two samples will be created from each sample area and depth interval and shipped to the laboratory for analysis. However, the actual number of samples collected from each sample area may vary depending on the depth to groundwater. Each sample identifies the site from which the sample was collected, the sample area from which the sample was collected, and the depth from which the sample was collected. As an example, sample identification number 13SA09-SD0102 indicates that the sample was collected from Site 13 (13) Sample Area 9 (SA09), was a sediment sample (SD), and was collected from a depth of 1 to 2 feet (0102). In the event that sediment samples are collected from more than two sample intervals (i.e. intervals identified on Table F-2) the last portion of the sample identification will increase by one number. In the event that only one sample interval needs to be collected from a sample area, the second sample identified in Table F-3 will not be collected.

Sample Analyses

The proposed sample analyses are based on the past contaminant detections and anticipated future land use at each area. All samples submitted for laboratory analysis will be analyzed for the following compounds.

Target Compound List PCBs	Target Analyte List Metals	
Aroclor – 1016	Aluminum	Magnesium
Aroclor – 1221	Antimony	Manganese
Aroclor – 1232	Arsenic	Mercury
Aroclor – 1242	Barium	Nickel
Aroclor – 1248	Beryllium	Potassium
Aroclor – 1254	Cadmium	Selenium
Aroclor – 1260	Calcium	Silver
	Chromium (total)	Sodium
	Cobalt	Thallium
	Copper	Vanadium
	Iron	Zinc
	Lead	

In addition to the sediment samples collected, rinse blanks and field duplicate samples will also be analyzed for these parameters for quality control purposes as outlined in the QAPP.

Each analytical sample will be analyzed with a 3 day turn-around time, however, the results will not be considered final until the data has been fully validated.

F.2.4 Screening Levels and Data Evaluation

The results of each composite verification sample will represent the mean concentration of the compounds analyzed for each sample area. The results of each composite sample will be compared to the screening levels presented in Table F-3. Since the excavation will be at least one foot thick and will be backfilled to original grade, soil screening levels are proposed. It is felt that sediment screening levels would not be appropriate since sediment receptors are usually found within a foot of the surface. In the event that sample results exceed the screening levels, the depth of excavation for that sample area will be increased to include the depth interval with samples exceeding screening levels. For example, if two at depth samples are collected from Sample Area 2, and the sample results for the sample collected from 1 to 2 feet exceed the screening levels but the sample results for the sample collected from 2 to 3 feet do not exceed the screening levels, then the excavation depth for Sample Area 2 will be set at 2 feet below ground surface. In the event both sample results were to exceed the screening levels, the excavation depth for Sample Area 2 would extend to the groundwater table. Likewise, if the sample results from the top sample interval (1 to 2 feet) do not exceed screening levels but the sample results from the bottom sample interval (2 to 3 feet) does exceed screening levels, the excavation within Sample Area 2 would extend to the groundwater table.

The final excavation depths will be determined based on the sample results and discussions with the Navy and regulatory agencies. In the event of marginal exceedances of the screening criteria, it is anticipated that the Navy and regulatory agencies would discuss the exceedances within the context of risk management.

F.3 FIELD ACTIVITIES AND PROCEDURES

Summary tables and corresponding figures have been developed to identify the locations, identification numbers, analytical requirements, analytical methods, volumes, and holding times for each of the proposed samples. The sample identification numbers, methods of collection, depths, and required analyses for the samples propose at Site 13 are provided in Table F-2. A summary of the analytical methods and bottleware preservation, and holding time requirements is provided in Table 4-1 of the main text of the QAPP.

The filed activities will include the following tasks:

Mobilization/demobilization
Sediment Sampling Using Hand Augers

Sample Handling
Sample Custody

F.3.1 Mobilization

TtNUS will prepare specifications and obtain a subcontractor for the analytical analyses. All field team members will review this addendum and the Health and Safety Plan prior to initiation of the at depth sediment sampling event. Lastly a field team orientation meeting will be held to familiarize personnel with the scope of the field activities.

F.3.2 Sediment Sampling Using Hand Augers

The required sediment samples will be collected using hand augers. Sediment samples will be collected in accordance with TtNUS standard operation procedure (SOP) SA-1.2, provided in Appendix C. Hand auguring will be performed in accordance with methods identified in TtNUS SOP GH-1.3, provided in Attachment 1 to this addendum. Hand auger equipment and sampling bowls will be decontaminated between each Sample Area in accordance with the procedures presented in TtNUS SOP SA-7.1, provided in Attachment 1 of this addendum.

Personal Protective Equipment (PPE) and other miscellaneous trash visibly free of soil will be bagged and removed from the site by TtNUS for disposal as general refuse. Excess sediment and decontamination fluids will be disposed on site at the point of generation. Excess sediment will be returned to the sampling site within the vicinity of the sample collection location. Decontamination fluids will be discharged to the ground surface near the sample locations. No other investigation derived waste (IDW) will be generated during the course of the work.

F.3.3 Sample Handling

Sample handling includes the field-related consideration of the selection of sample containers, preservatives, and allowable holding times. Sample identification, packaging, and shipping are outlined in TtNUS SOP SA-6.1 provided in Appendix C. Summaries of sample containers, volume requirements, preservatives, allowable holding times, and analysis requested are provided in Table 4-1 of the main text of the QAPP.

Field Documentation

Sample documentation consists of the completion of chain-of-custody reports and matrix-specific log sheets. Chain-of-custody reports are detailed in Section 5.0 of the Project Specific QAPP. In addition, the Master Site Logbook, filled out in accordance with SOP SA-6.3, provided in Appendix C, serves as

the overall record of field activities. Information included daily in the Master Site Logbook includes weather conditions, identity and arrival and departure times of personnel, management issues, etc. Anticipated filed forms for this sediment sampling event are provided in Appendix B.

Sample Preservation

The existence of some chemical constituents in some environmental matrices is unstable. Therefore, these types of samples must be "stabilized" using preservatives and/or special handling procedures. These preservation techniques prevent degradation of the sample to ensure that the sample is representative of actual site conditions. Preservation requirements for samples to be collected at Site 13 are presented in Table 4-1 of the main text of the QAPP..

Documentation, Sample Packaging, and Shipping

Samples will be packaged and shipped in accordance with TtNUS SOP SA-6.1 provided in Appendix C.

F.3.3 Sample Custody

Custody of samples must be maintained and documented at all times. The chain-of-custody process begins with the collection of the samples in the field and ends with disposal by the laboratory. The Project Specific QAPP and TtNUS SOP SA-6.1 (Appendix C) provides further details on chain-of-custody procedures.

TABLE F-1

RANDOM GENERATION OF GRAB SAMPLE LOCATIONS
SITE 13
NSW EARLE
COLTS NECK, NEW JERSEY

Sample Area	Grab Location	Random Location	
		X[1]	Y[2]
SA01	Grab 1	42	29
	Grab 2	86	63
SA02	Grab 1	8	22
	Grab 2	90	95
SA03	Grab 1	4	51
	Grab 2	83	9
SA04	Grab 1	12	79
	Grab 2	76	14
SA05	Grab 1	55	91
	Grab 2	96	45
SA06	Grab 1	17	21
	Grab 2	43	11
SA07	Grab 1	10	33
	Grab 2	46	91
SA08	Grab 1	35	47
	Grab 2	68	59
SA09	Grab 1	83	66
	Grab 2	12	37
SA10	Grab 1	11	78
	Grab 2	54	32
SA11	Grab 1	81	6
	Grab 2	5	59
SA12	Grab 1	4	6
	Grab 2	91	46

1 Indicates the percent eastern distance across the sample area measured from the western side of the Sample Area.
2 Indicates the percent northern distance across the sample area measured from the southern side of the Sample Area.

TABLE F-2

SAMPLE SUMMARY TABLE
SITE 13
NWS EARLE
COLTS NECK, NEW JERSEY

Sample Area	Sample Identification	Sample Depth Interval	Method of Collection	Analyses	
				TCL PCBs	TAL Metals
SA01	13SA01-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA01-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA02	13SA02-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA02-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA03	13SA03-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA03-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA04	13SA04-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA04-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA05	13SA05-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA05-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA06	13SA06-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA06-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA07	13SA07-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA07-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA08	13SA08-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA08-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA09	13SA09-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA09-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA10	13SA10-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA10-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA11	13SA11-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA11-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X
SA12	13SA12-SD0102	1 to 2 feet bgs	Composite of two grab sediment sample locations	X	X
	13SA12-SD0203	2 to 3 feet bgs	Composite of two grab sediment sample locations	X	X

Parameter list and screeing valuse presented in Table F-3.

TAL Target Analyte List
TCL Target Compound List
bgs Below ground surface

TABLE F-3

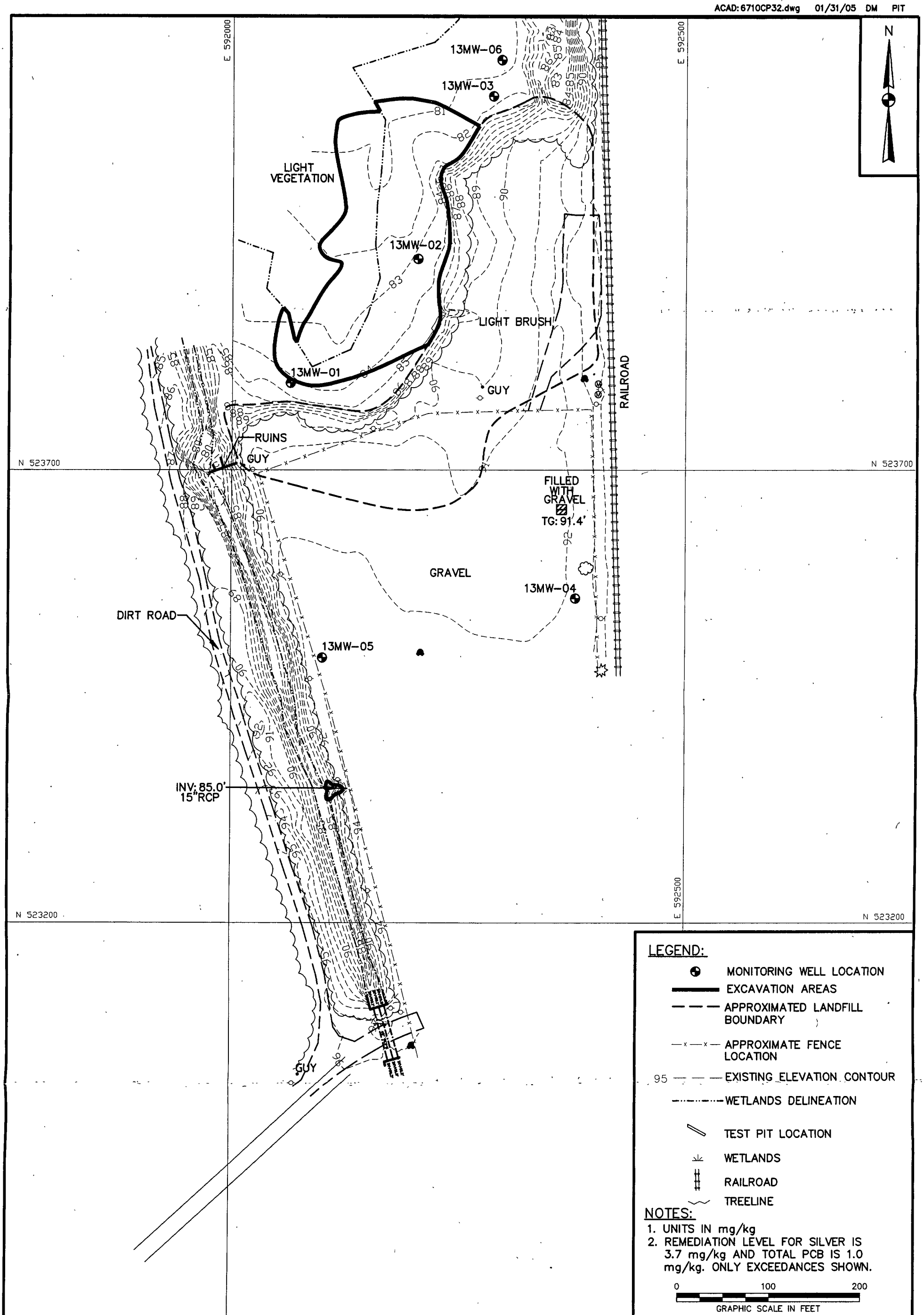
SUMMARY OF SCREENING LEVELS
SITE 13
NWS EARLE
COLTS NECK, NEW JERSEY

Parameters	Soil Background [1]	Soil Screening Criteria [1]
TCL PCBs (ug/kg)		
Aroclor – 1016	--	--
Aroclor – 1221	--	--
Aroclor – 1232	--	--
Aroclor – 1242	--	--
Aroclor – 1248	--	--
Aroclor – 1254	--	--
Aroclor – 1260	--	--
Total PCBs	--	371
TAL Metals (mg/kg)		
Aluminum	6,153	--
Antimony	--	78
Arsenic	13.4	10
Barium	22.5	330
Beryllium	0.39	2
Cadmium	0.67	32
Calcium	--	--
Chromium (total)	69.1	0.4
Cobalt	3.15	13
Copper	10.1	50
Iron	52,403	--
Lead	37.3	115
Magnesium	--	--
Manganese	128	100
Mercury	0.18	0.1
Nickel	5.13	30
Potassium	--	--
Selenium	--	1
Silver	--	2
Sodium	--	--
Thallium	1.64	1
Vanadium	70.1	2
Zinc	22.8	50

1 Data taken from Table 6 of the Seiment Sampling Technical Memorandum.

TAL Target Analyte List
TCL Target Compound List
-- No Criteria

ACAD: 6710CP32.dwg 01/31/05 DM PIT

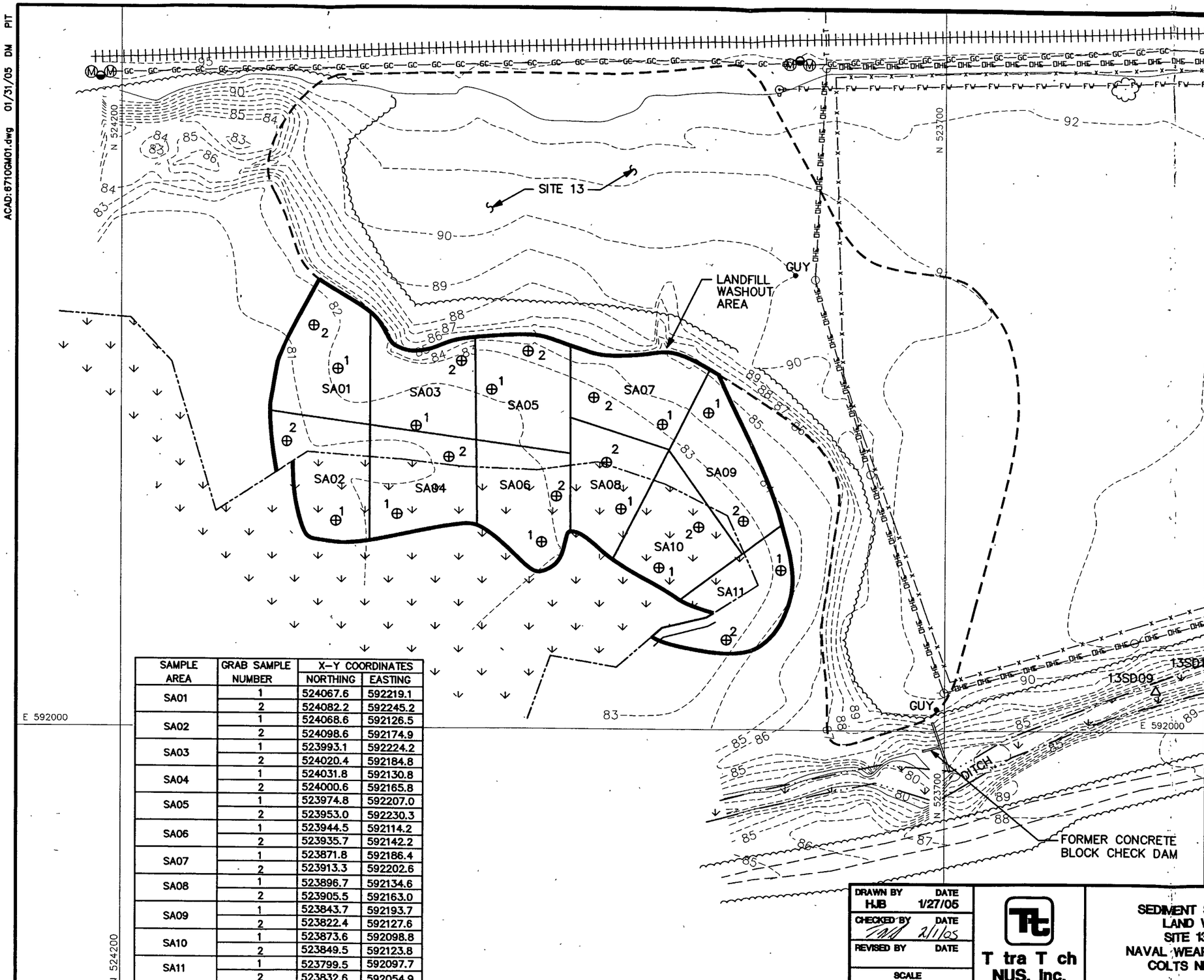


DRAWN BY DM	DATE 1/31/05	Tetra Tech NUS, Inc.	PROPOSED EXCAVATION AREAS SITE 13 - DPDO YARD NAVAL WEAPONS STATION EARLE COLT'S NECK, NEW JERSEY
CHECKED BY	DATE 2/1/05		CONTRACT NO. 6710
REVISED BY	DATE		OWNER NO. 0000
SCALE AS NOTED			APPROVED BY / DATE 2/1/05
			DRAWING NO. FIGURE F-1 / REV. 0

592000

FORM CADD NO. TTNUS-BV.DWG - REV 1 -9/11/98

ACAD:6710GM01.dwg 01/31/05 DM PIT



SAMPLE AREA	GRAB SAMPLE NUMBER	X-Y COORDINATES NORTHING	X-Y COORDINATES EASTING
SA01	1	524067.6	592219.1
	2	524082.2	592245.2
SA02	1	524068.6	592126.5
	2	524098.6	592174.9
SA03	1	523993.1	592224.2
	2	524020.4	592184.8
SA04	1	524031.8	592130.8
	2	524000.6	592165.8
SA05	1	523974.8	592207.0
	2	523953.0	592230.3
SA06	1	523944.5	592114.2
	2	523935.7	592142.2
SA07	1	523871.8	592186.4
	2	523913.3	592202.6
SA08	1	523896.7	592134.6
	2	523905.5	592163.0
SA09	1	523843.7	592193.7
	2	523822.4	592127.6
SA10	1	523873.6	592098.8
	2	523849.5	592123.8
SA11	1	523799.5	592097.7
	2	523832.6	592054.9

LEGEND:

- 13MW-01 — GROUNDWATER MONITORING WELL
- GRAB SEDIMENT SAMPLES
- 90 — EXISTING CONTOUR
- FENCE
- LIMIT OF DELINEATED WETLAND
- ORDINARY HIGH WATER MARK
- RAILROAD TRACKS
- LANDFILL BOUNDARY
- WETLANDS
- PROPOSED EXCAVATION AREA

NOTE:

GRAB SEDIMENT SAMPLES WILL BE COLLECTED FROM EACH IDENTIFIED LOCATION AT 1 FOOT DEPTH INTERVALS STARTING AT 1 TO 2 FEET BELOW GROUND SURFACE AND CONTINUING UNTIL GROUNDWATER IS ENCOUNTERED.

0 60 120
GRAPHIC SCALE IN FEET

DRAWN BY HJB	DATE 1/27/05
CHECKED BY TAM	DATE 2/1/05
REVISED BY	DATE
SCALE AS NOTED	

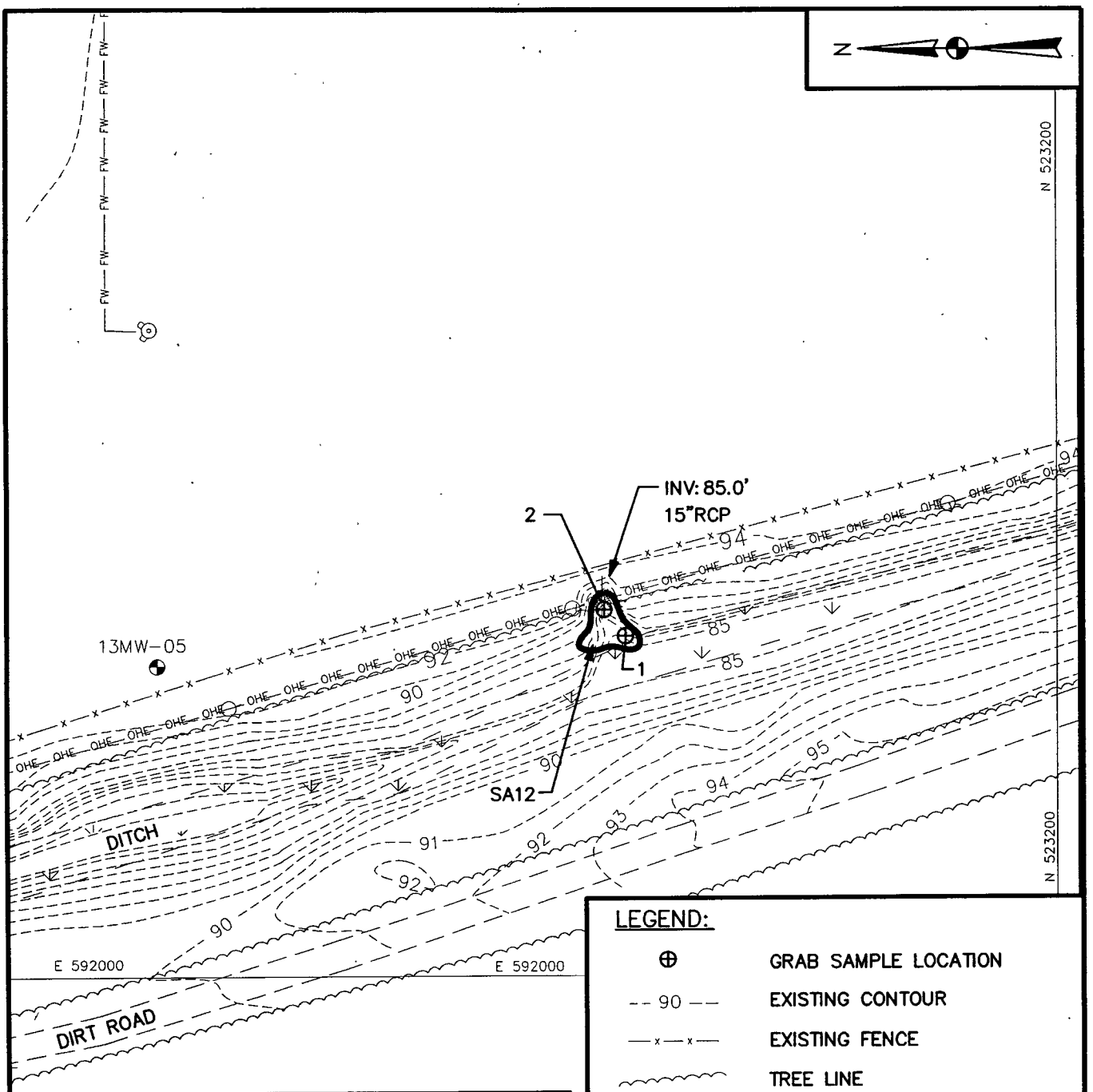
T tra T ch NUS, Inc.

SEDIMENT SAMPLE LOCATIONS
LAND WASHOUT AREA
SITE 13 - DPDO YARD
NAVAL WEAPONS STATION EARLE
COLTS NECK, NEW JERSEY

CONTRACT NO. 6710
OWNER NO. 0000
APPROVED BY DWC DATE 2/1/05
DRAWING NO. FIGURE F-2
REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

ACAD: 6710CP31.dwg 01/31/05 DM PIT



SAMPLE AREA	GRAB SAMPLE NUMBER	X-Y COORDINATES	
		NORTHING	EASTING
SA12	1	523340.5	592110.5
	2	523347.4	592119.0

LEGEND:

- ⊕ GRAB SAMPLE LOCATION
- -- 90 -- EXISTING CONTOUR
- —x—x— EXISTING FENCE
- TREE LINE
- LIMIT OF DELINEATED WETLAND
- —OHE—OHE— EXISTING OVERHEAD ELECTRIC
- WETLANDS
- PROPOSED EXCAVATION AREA

0 50 100
GRAPHIC SCALE IN FEET

DRAWN BY HJB	DATE 1/27/05	Tetra Tech NUS, Inc.	SEDIMENT SAMPLE LOCATIONS STREAM AREA SITE 13 - DPDO YARD NAVAL WEAPONS STATION EARLE COLTS NECK, NEW JERSEY	CONTRACT NO. 6710
CHECKED BY	DATE 2/1/05			OWNER NO. 0000
REVISED BY	DATE			APPROVED BY / DATE 2/1/05
SCALE AS NOTED				DRAWING NO. FIGURE F-3 / REV. 0

FORM CADD NO. TTNUS-AV.DWG – REV 1 –9/10/98

Attachment 1

Soil and Rock Drilling Methods
(TtNUS SOP GH-1.3)

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number GH-1.3	Page 1 of 26
		Effective Date 06/99	Revision 1
		Applicability Tetra Tech NUS, Inc.	
		Prepared Earth Sciences Department	
Subject SOIL AND ROCK DRILLING METHODS		Approved D. Senovich	

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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 Coupling					Approximate Core Diameter	
Casing; Casing coupling; Casing bits; Core barrel bits	Rod; rod couplings	Casing O.D., Inches	O.D., Inches	I.D., Inches	Casing bit O.D., Inches	Core barrel bit O.D., Inches*	Drill rod O.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).

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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.

Attachment 2

Decontamination of Field Equipment
(TtNUS SOP SA-7.1)

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number SA-7.1	Page 1 of 8
		Effective Date 09/03	Revision 3
		Applicability Tetra Tech NUS, Inc.	
		Prepared Earth Sciences Department	
Subject DECONTAMINATION OF FIELD EQUIPMENT		Approved D. Senovich	

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1.0 PURPOSE

Decontamination is the process of removing and/or neutralizing site contaminants that have contacted and/or accumulated on equipment. The objective/purpose of this SOP is intended to protect site personnel, general public, and the sample integrity through the prevention of cross contamination onto unaffected persons or areas. It is further intended through this procedure to provide guidelines regarding the appropriate procedures to be followed when decontaminating drilling equipment, monitoring well materials, chemical sampling equipment and field analytical equipment.

2.0 SCOPE

This procedure applies to all equipment including drilling equipment, heavy equipment, monitoring well materials, as well as chemical sampling and field analytical equipment decontamination that may be used to provide access/acquire environmental samples. Where technologically and economically feasible, single use sealed disposable equipment will be employed to minimize the potential for cross contamination. This procedure also provides general reference information on the control of contaminated materials.

3.0 GLOSSARY

Acid - For decontamination of equipment when sampling for trace levels of inorganics, a 10% solution of nitric acid in deionized water should be used. Due to the leaching ability of nitric acid, it should not be used on stainless steel.

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

Decontamination Solution - Is a solution selected/identified within 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) - Deionized water is 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 CAP and NCCLS specifications for reagent grade, Type I water.

Potable Water - Tap water used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Pressure Washing - Employs high pressure pumps and nozzle configuration to create a high pressure spray of potable water. High pressure spray is employed to remove solids.

Solvent - The solvent of choice is pesticide-grade Isopropanol. Use of other solvents (methanol, acetone, pesticide-grade hexane, or petroleum ether) may be required for particular projects or for a particular purpose (e.g. for the removal of concentrated waste) and must be justified in the project planning documents. As an 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 - This method employs a high pressure spray of heated potable water. This method through the application of heat provides for the removal of various organic/inorganic compounds.

4.0 RESPONSIBILITIES

Project Manager - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

Field Operations Leader (FOL) - Responsible for the onsite verification that all field activities are performed in compliance with approved Standards Operating Procedures or as otherwise dictated by the approved project plan(s).

Site Health and Safety Officer (SHSO) - The SHSO exercises shared responsibility with the FOL concerning decontamination effectiveness. All equipment arriving on-site (as part of the equipment inspection), leaving the site, moving between locations are 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. Failure to meet these objectives are 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.

5.0 PROCEDURES

The process of decontamination is accomplished through the removal of contaminants, neutralization of contaminants, or the isolation of contaminants. In order to accomplish this activity a level of preparation is required. This includes site preparation, equipment selection, and evaluation of the process. Site contaminant types, concentrations, media types, are primary drivers in the selection of the types of decontamination as well as where it will be conducted. For purposes of this SOP discussion will be provided concerning general environmental investigation procedures.

The decontamination processes are typically employed at:

- Temporary Decontamination Pads/Facilities
- Sample Locations
- Centralized Decontamination Pad/Facilities
- Combination of some or all of the above

The following discussion represents recommended site preparation in support of the decontamination process.

5.1 Decontamination Design/Constructions Considerations

5.1.1 Temporary Decontamination Pads

Temporary decontamination pads are constructed at satellite locations in support of temporary work sites. 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 soils generated during decontamination procedures. Therefore, construction of these pads should take into account the following considerations

- Site Location – The site selected should be within a reasonable distance from the work site but should avoid:

  - Pedestrian/Vehicle thoroughfares
  - Areas where control/custody cannot be maintained
  - Areas where a potential releases may be compounded through access to storm water transport systems, streams or other potentially sensitive areas.
  - Areas potentially contaminated.

- Pad – The pad should be constructed to provide 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.

  - Slope – An adequate slope will be constructed to permit the collection of the water and potentially contaminated soils 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.

  - Sidewalls – The sidewalls should be a minimum of 6-inches in height to provide adequate containment for wash waters and soils. If splash represents a potential problem, splash guards should be constructed to control overspray. Sidewalls maybe constructed of wood, inflatables, sand bags, etc. to permit containment.

  - Liner – Depending on the types of equipment and the decontamination method 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. Achieving the desired thickness maybe achieved through layering lighter constructed materials. 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 maybe applied to provide traction as necessary.

  - Wash/drying Racks – Auger flights, drill/drive rods require racks positioned off of the ground to permit these articles to be washed, drained, and dried while secured from falling during this process. A minimum ground clearance of 2-feet is recommended.

  - Maintenance – The work area should be periodically cleared of standing water, soils, and debris. This action will aid in eliminating slip, trip, and fall hazards. In addition, these articles will reduce potential backsplash and cross contamination. Hoses should be gathered when not in use to eliminate potential tripping hazards.

5.1.2 Decontamination Activities at Drill Rigs/DPT Units

During subsurface sampling activities including drilling and direct push activities decontamination of drive rods, Macro Core Samplers, split spoons, etc. are 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 media. Drying racks will be employed as directed for temporary pads to permit parts to dry and be evaluated prior to use/re-use.

5.1.3 Decontamination Activities at Remote Sample Locations

When sampling at remote locations sampling devices such as trowels, 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.

5.2 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.

5.2.1 Monitoring Well Sampling Equipment

5.2.1.1 Groundwater sampling pumps – This includes pumps inserted into the monitoring well such as Bladder pumps, Whale pumps, Redi-Flo, reusable bailers, etc.

1) Evacuate to the extent possible, any purge water within the pump.

2) Scrub using soap and water and/or steam clean the outside of the pump and tubing, where applicable.

3) Insert the pump and tubing into a clean container of soapy water. Pump a sufficient amount of soapy water through the pump to flush any residual purge water. Once flushed, circulate soapy water through the pump to ensure the internal components are thoroughly flushed.

4) Remove the pump and tubing from the container, rinse external components using tap water. Insert the pump and tubing into a clean container of tap water. Pump a sufficient amount of tap water through the pump to evacuate all of the soapy water (until clear).

5) Rinse equipment with pesticide grade isopropanol

6) Repeat item #4 using deionized water through the hose to flush out the tap water and solvent residue as applicable.

7) Drain residual deionized water to the extent possible, allow components to air dry.

8) Wrap pump in aluminum foil or a clear clean plastic bag for storage.

5.2.1.2 Electronic Water Level Indicators/Sounders/Tapes

During water level measurements, rinsing with the extracted tape and probe with deionized water and wiping the surface of the extracted tape is acceptable. However, periodic full decontamination should be conducted as indicated below.

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* The solvent should be employed when samples contain oil, grease, PAHs, PCBs, and other hard to remove materials. If these are not of primary concern, the solvent step may be omitted. In addition, do not rinse PE, PVC, and associated tubing with solvents.

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.

5.2.1.3 Miscellaneous Equipment

Miscellaneous equipment including analytical equipment (water quality testing equipment) should be cleaned per manufacturer's instructions. This generally includes wiping down the sensor housing and rinsing with tap and deionized water.

Coolers/Shipping Containers employed to ship samples are received from the lab in a variety of conditions from marginal to extremely poor. Coolers should be evaluated prior to use for

- Structural integrity – Coolers missing handles or having breaks within the outer housing should be removed and not used. Notify the laboratory that the risk of shipping samples will not be attempted 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 associated with noticeable odors it should be decontaminated prior to use.

  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 notify the laboratory to provide a replacement unit.

5.2.2 Down-Hole 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. This procedure is to be employed prior to initiating the drilling/sampling activity, then between locations.

1) Remove all soils to the extent possible using shovels, scrapers, etc. to remove loose soils.
2) Through a combination of scrubbing using soap and water and/or steam cleaning remove visible dirt/soils.
3) Rinse with tap water.
4) Rinse equipment with pesticide grade isopropanol.
5) To the extent possible allow components to air dry.
6) Wrap or cover equipment in clear plastic until it is time to be used.

5.2.3 Soil/Sediment Sampling Equipment

This consists of 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 soils to the extent possible.

2) Through a combination of scrubbing using soap and water and/or steam cleaning remove visible dirt/soils.

3) Rinse with tap water.

4) Rinse equipment with pesticide grade isopropanol

5) Rinse with deionized water

6) To the extent possible allow components to air dry.

7) If the device is to be used immediately, screen with a PID/FID to insure all solvents (if they were used) and trace contaminants have been adequately removed.

8) Once these devices have been dried wrap in aluminum foil for storage until it is time to be used.

5.3 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.) broken sample containers.

With the exception of the broken glass, single use articles should be cleaned (washed and rinsed) of visible materials and disposed of as normal refuse. The exception to this rule is that extremely soiled materials that cannot be cleaned should be containerized for disposal in accordance with applicable federal state and local regulations.

5.3.1 Decontamination Solutions

All waste decontamination solutions and rinses must be assumed to contain the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. The waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

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. These containers must be appropriately labeled.

5.4 Decontamination Evaluation

Determining the effectiveness of the decontamination process will be accomplished in the following manner.

- Visual Evaluation – A visual evaluation will be conducted to insure the removal of particulate matter. This will be done to insure that the washing/rinsing process is working as intended.

- Instrument Screening – A PID and/or an FID should be used to evaluate the presence of the contaminants or solvents used in the cleaning process. The air intake of the instrument should be passed over the article to be evaluated. A positive detection requires a repeat the decontamination process. It should be noted that the instrument scan is only viable if the contaminants are detectable within the instruments capabilities.

- 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:

- Per decontamination method
- Per disposable article/Batch number of disposable articles

It is recommended that an initial rinsate sample be collected early in the project to ensure that the decontamination process is functioning properly and in an effort to avoid using a contaminated batch of single use articles. It is recommended that a follow up sample be collected during the execution of the project to insure those conditions do not change. Lastly, rinsate samples collection may be driven by types of and/or contaminant levels. Hard 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.