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CONTAMINATION ASSESSMENT PLAN AT CAROLINE AND WILLIAM STREET REVISION 1
WITH TRANSMITTAL LETTER NAS KEY WEST FL
6/29/2001
TETRA TECH NUS

TETRA TECH NUS, INC.

AIK-01-0234

June 29, 2001

Project Number HK 3958 *via U.S. Mail*

Byas Glover (Code 18410)
Department of the Navy
SOUTHDIV NAVFACENGCOM
P.O. Box 190010
North Charleston, South Carolina 29419-9010

Reference: CLEAN Contract No. N62467-94-D-0888
Contract Task Order No. 0153

Subject: Contamination Assessment Plan at Caroline and William Street, Rev. 1,
Naval Air Station Key West, Florida

Dear Mr. Glover:

Enclosed is the CD that contains the PDF file for the final version of the Contamination Assessment Plan at Caroline and William Street, Rev. 1, Naval Air Station Key West, Florida. This CD contains an electronic duplicate for the report that was sent to you on 1 May 2001 with the exception of title page, signature page, and the Response to Comment page (Appendix A). This document is being delivered to you in order to meet TtNUS's contractual obligation under CTO 0153. I am not expecting to receive any comments on this plan. An additional copy of the enclosed plan is provided to NAS Key West for their transmittal to City of Key West officials for their use.

Please call me at (803) 649-7963, extension 345, if you have any questions regarding the enclosed plan.

Sincerely,

C. M. Bryan
Project Manager

CMB:spc

Enclosure

c: Ms. Debbie Wroblewski (Cover Letter Only)
File: 3958-7.1.2
Mr. R. Courtright, NAS Key West (2 copies)
Mr. M. Perry/File

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Rev. 1
6/29/01

Contamination Assessment Plan
at
Caroline and William Streets

Naval Air Station
Key West, Florida

Southern Division
Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 153

June 2001

Rev. 1

Rev. 1
6/29/01

CONTAMINATION ASSESSMENT PLAN

AT

CAROLINE AND WILLIAM STREETS

NAVAL AIR STATION
KEY WEST, FLORIDA

COMPREHENSIVE PERFORMANCE
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS
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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 153

June 2001

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TETRA TECH NUS
PITTSBURGH, PENNSYLVANIA

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ACRONYMS

bls	below land surface
BTEX	Benzene toluene, ethylbenzene, and xylenes
CLEAN	Comprehensive Long-Term Environmental Action, Navy
CompQAP	Comprehensive Quality Assurance Plan
CTO	Contract Task Order
DAR	Daily Activities Record
DPT	direct-push technology
EDB	1,2-Dibromoethane
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FOL	Field Operations Leader
EPA	United States Environmental Protection Agency
ID	inside diameter
KAG	Kerosene Analytical Group
MTBE	Methyl-tert-butyl-ether
NAS	Naval Air Station
NAVFACENGCOM	Naval Facilities Engineering Command
NTU	Nephelometric Turbidity Unit
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbon
PVC	polyvinyl chloride
QC	quality control
RCRA	Resource Conservation and Recovery Act
SAR	Site Assessment Report
SouthDiv	Southern Division
SOP	Standard Operating Procedure
TOC	Total organic carbon
TOM	Task Order Manager
TOX	Total organic halogens
TRPH	total recoverable petroleum hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
USCS	Unified Soil Classification System
USGS	United States Geological Survey

ACRONYMS (CONTINUED)

VOA	volatile organic aromatic
VOC	volatile organic compound
VOH	Volatile organic halocarbon
UST	underground storage tank

1.0 INTRODUCTION

Tetra Tech NUS, Inc. (TtNUS) has prepared this Work Plan for the completion of a site assessment and submittal of a Site Assessment Report (SAR) for the Caroline and William Streets Site at the Naval Air Station (NAS) Key West, Florida. This Work Plan was prepared for the U.S. Navy (Navy) Southern Division (SouthDiv) Naval Facilities Engineering Command (NAVFACENGCOM) under Contract Task Order (CTO) 153, for the Comprehensive Long-Term Environmental Action, Navy (CLEAN III) Contract Number N62467-94-D-0888.

The Work Plan provides the rationale for performing field activities associated with collecting data to evaluate potential petroleum hydrocarbon releases in the subsurface at the intersection of Caroline and William Streets. Data collected during the investigation will be used to prepare an SAR.

1.1 GENERAL SITE LOCATION

The site is located in Key West within Section 29 of Township 67 South, Range 25 East, as shown on United States Geological Survey (USGS) Key West, Florida, 7.5 Minute Series Quadrangle (Figure 1-1). The City of Key West is approximately 150 miles southwest of Miami on the last major island of the Florida Keys, in southern Monroe County, Florida. The Overseas Highway, U.S. Highway 1, connects the Florida Keys to the mainland. The U.S. Navy manages 6,323 acres of land (divided into 20 separate tracts) in the lower Florida Keys, concentrated around Key West and Boca Chica Key. The site is specifically located at the intersection of Caroline and William Streets in downtown Key West (Figure 1-2).

1.2 OBJECTIVE

The objective of the proposed field investigation at Caroline and William Streets is to determine the presence or absence of petroleum hydrocarbons in subsurface soils and groundwater. Data collected during the investigation will be used to prepare an SAR and to evaluate the need for a remedial action at the facility.

2.0 SITE HISTORY

The site is located at the intersection of Caroline and William Streets in downtown Key West. On October 31, 1997, oil was observed to be seeping to the surface at this intersection. It was suspected that the oil was due to the pipeline abandonment project being performed by the Navy. The street surface was cleaned up and an excavation was conducted to remove the source of the oil. A vacuum truck was used to recover approximately 3,000 gallons of petroleum products and 3,000 gallons of petroleum contact water. All emergency activities were concluded on November 1, 1997.

During the integrity testing of a Navy abandoned underground pipeline in December 1997, approximately 3,300 gallons of petroleum product is suspected to have been released. In response to the spill, NAS conducted an initial recovery effort. Approximately 3,300 gallons of product was recovered and 100 tons of contaminated soil was excavated and disposed of. The contaminated soils were excavated down to groundwater (approximately 2-3 feet below land surface [bls]). The excavation was backfilled with clean soil on the south and west sides. Clean soil was not replaced in isolated areas on the north and east sides of the excavations. These areas exhibited elevated headspace and Florida Petroleum Range Organics analytical results. Following the incident, Bechtel (1998) prepared a Source Removal Report.

On December 18, 1997, during removal of broken storm lines in the intersection of Caroline and William Streets, approximately 260 gallons of petroleum contact water and free product were recovered. In addition, approximately 25 tons of contaminated soils were excavated.

Between January 27 and January 30, 1998, the intersection was again excavated to remove any remaining contaminated soils. The scope of the excavation was to be within the confines of the intersection and was not extended beyond the storm drain pipelines. All free product and groundwater encountered were also recovered with a vacuum truck. The depth of the excavation was to the top of the groundwater, approximately 2 to 3 feet below grade. Approximately 550 gallons of petroleum contact water, 100 gallons of petroleum products, and 75 tons of contaminated soil were removed.

3.0 SCOPE OF PROPOSED ASSESSMENT

The proposed scope of work for assessment activities at the intersection of Caroline and William Streets will take place in two phases or mobilizations. The first phase field event will consist of soil assessment and preliminary groundwater investigation. Direct-push technology (DPT) will be utilized to identify petroleum-impacted soil and groundwater. An onsite laboratory will be used to analyze all samples collected. The results will be used to delineate the extent of vadose zone soil contamination and determine the optimum number and location of permanent monitoring wells.

Following the Phase I DPT investigation, the Florida Department of Environmental Protection (FDEP) and SouthDiv will be advised of site conditions and recommendations will be made for the Phase II assessment. After a consensus is reached between FDEP and SouthDiv, permanent monitoring wells will be installed and sampled to refine and delineate the extent of groundwater contamination at the site. The groundwater samples from the permanent monitoring wells will be analyzed by a fixed-based laboratory to determine levels of dissolved petroleum hydrocarbons in the shallow aquifer.

3.1 DPT INVESTIGATION

The soil assessment and preliminary groundwater investigation will be conducted using DPT equipment. Approximately 20 DPT borings will be installed during the DPT investigation. The borings will be concentrated around the two “hot spot” areas north and west of the previous excavation areas. Groundwater samples will be collected from each boring and analyzed by an onsite mobile laboratory to evaluate the magnitude and extent of contamination at each of the two areas. Based on results of the initial groundwater sampling, a determination will be made as to how far the extent of horizontal delineation should be pursued at each of the concerned areas. A few DPT borings will be randomly located within the clean fill of the former excavation to determine the presence or absence of petroleum hydrocarbon in that area. One intermediate DPT boring will be installed to determine the vertical extent of groundwater contamination. The vertical boring will be placed in the vicinity of the shallow boring with the highest hydrocarbon concentration. Vadose zone soils will be screened for hydrocarbon vapors, following the procedures for headspace analysis required by Chapter 62-770.200 of the Florida Administrative Code (F.A.C.). Locations of the proposed DPT borings and the former excavation area are shown on the Site Plan in Figure 3.1.

In accordance with Rule 62-770.600(3)(e), soil will be collected from a minimum of three (3) soil borings for fixed-base laboratory analysis to confirm the organic vapor analyzer (OVA) results. The boring locations and sample intervals will be selected to coincide with samples that exhibit high, medium, and low field screening results during the soil vapor survey. The samples will be analyzed for constituents of the

Kerosene Analytical Group (KAG) as defined in Chapter 62-770, F.A.C. These samples will also be analyzed for total organic halides, total organic carbon (TOC) and Resource Conservation and Recovery Act (RCRA) metals for disposal requirements.

The methodology for soil sampling will follow the revised procedures promulgated by the U.S. Environmental Protection Agency (EPA) in Update III of SW-846 for sites contaminated with volatile organic compounds (VOCs). EnCore™ samplers will be used for soil collection and to transfer soil samples to the laboratory. This method assures the lowest loss of volatiles during collection and shipment of the soils. In order for the laboratory to analyze for low-level and high-level VOCs, five EnCore™ samplers will be filled for each soil boring location. All soil samples will be collected and shipped to the laboratory on the same day to assure that the 48-hour holding time is not exceeded.

The onsite geologist will maintain a completed log for each boring. At a minimum, the boring log will contain the following information:

- Sample numbers and types
- Sample depths
- Sample recovery/Sample interval
- Soil density or cohesiveness
- Soil color
- Unified Soil Classification System (USCS) material description
- Presence of free product (if applicable)
- Filtered/unfiltered Flame Ionization Detector readings

The site's lithology will be assessed from soil samples collected during installation of the DPT borings.

3.2 GROUNDWATER INVESTIGATION

During Phase II, it is anticipated that two (2) upgradient, three (3) downgradient, and one (1) source area wells will be installed to delineate the plume. A vertical extent well will also be installed near the source area of the plume. The shallow water table monitoring wells and one deep monitoring well are required to assess the horizontal and vertical extent of dissolved hydrocarbons at the site. The proposed monitoring well locations will be determined, based on groundwater and soil quality data collected from the DPT investigation conducted during Phase I. Proposed locations for monitoring wells will be discussed with the Navy and FDEP prior to the field investigation. Minor modifications to the proposed locations may be necessary due to under ground and above ground utilities.

3.2.1 Monitoring Well Installation

Permanent monitoring wells will be installed, using hollow stem auger drilling techniques. These wells will be used to monitor water quality and evaluate the horizontal and vertical extent of contamination. Prior to well installation, underground utilities in the area will be located by the 'Sunshine One-Call' utility locator. The City of Key West will provide additional assistance and blueprints to determine any unknown utilities. As an added precaution, the first 4 feet of each well boring will be hand augered to further ensure that no utilities are present within that interval. During installation of the wells, traffic control services will be set up to provide safe working conditions and ample access to work areas around the rig.

The monitoring wells will be installed per the SouthDiv procedures for groundwater monitoring well installation, as recommended in Section 5.0 of the TtNUS' Standard Operating Procedures (SOP). The wells will be constructed of 2-inch-inside-diameter (ID), Schedule 40, flush-joint polyvinyl chloride (PVC) risers and flush-joint factory slotted well screens. Each section of casing and screen shall be approved by the National Sanitation Foundation. The screen slot size will be 0.01 inch. The shallow monitoring wells will be constructed with 10 feet of screen, with the top of the screen interval positioned approximately 2 feet above the water table. The vertical extent monitoring well will be constructed with 5 feet of screen, with the top of the screen interval positioned approximately 10 to 15 feet below the bottom of the shallow wells. After the borings are drilled to the desired depth, (6-inch-minimum-diameter boring for 2-inch-ID wells), the wells will be installed through the augers.

The lithology has been sufficiently characterized from previous investigations NAS Key West. Therefore, a sieve analysis of the soils is not needed in determining the type of sand pack and screen slot size for well completion. Clean silica sand of U.S Standard Sieve Size No. 20/30 will be installed into the boring annulus around each well screen as the augers are withdrawn from the boring. Due to the expected shallow depths of the monitoring wells (less than 15 feet), it is proposed that the sand pack be poured around the annulus from the top of the hole. The sand pack will be set from the bottom of the hole to approximately 1 foot above the top of the well screen. A minimum 1-foot-thick fine sand seal will be installed above the sand pack. Borings that are not converted to monitoring wells will be backfilled with a Type I Portland cement/bentonite grout. The depths of all backfill materials will be constantly monitored during the well installation process by means of a weighted stainless steel or fiberglass tape. The position of the top of the screen interval, sand pack, and bentonite seal may be adjusted as site conditions warrant (elevated water table, etc.)

Flush-mounted steel well covers and manholes will be installed around the 2-inch-ID wells. Each manhole will consist of a flush-mounted 22-gauge steel, water-resistant, welded box with a 3/8-inch steel lid. A 2-foot by 2-foot by 6-inch-thick concrete apron will be constructed around the manhole. The manhole will be

completed 2 inches above existing grade and the apron tapered to be flush at the edges with the existing grade, so that water will run off the apron. A detail of a typical flush-mounted well can be found in SOP SA-6.3, included in Appendix C.

All locks supplied for the wells will be keyed alike. After installation, the ground surface and the top of the PVC riser pipe for each well will be surveyed to within 0.01-foot vertical accuracy (using datum points) and will be referenced to site features (building corners, etc.) by a state-licensed surveyor. A monitoring well construction diagram will be completed for each installed well. A sample of the monitoring well construction form is provided in Appendix C.

The monitoring wells will be developed no sooner than 24 hours after installation, in order to allow removal of fine material from around the monitored interval of the well. Wells will be developed by bailing and surging, or by pumping, as determined by the field geologist. The pH, temperature, specific conductance, and turbidity measurements will be collected from the purge water. Wells will be developed up to a maximum of one hour, or until these measurements become stable and the purge water is visibly clear. Water quality stabilization will be determined according to the following criteria: temperature (+/- 0.50^{c}), pH (+/- 0.1unit), specific conductivity (+/- 10%), and turbidity (within a 10-Nephelometric-Turbidity-Unit [NTU] range for two consecutive readings). Wells will be developed until they are approved by the field geologist.

3.2.2 Groundwater Sampling

Following installation of the monitoring wells, groundwater samples will be collected for laboratory analysis for KAG constituents. Groundwater samples will also be collected from three wells for field screening of dissolved oxygen, carbon dioxide, and ferrous iron, as well as laboratory analysis for anions and methane. Two groundwater sampling events will occur approximately 90 days apart. Groundwater samples will be obtained from assessment monitoring wells at Caroline and William Streets, in accordance with TtNUS' Comprehensive Quality Assurance Plan (CompQap) (FDEP Comp QA Plan No. 980038) (TtNUS, June 2000). Prior to obtaining samples, water levels and total well depths will be measured and the wells will be purged, using a peristaltic pump and a low-flow quiescent purging technique. Three to five well volumes will be purged. If wells are purged dry with fewer than three well volumes removed, the water level in the well will be allowed to recover at least 80 percent, and then a sample will be collected. Field measurements of pH, temperature, specific conductance, and turbidity will be taken after each volume of water is purged. Stabilization of the above parameters is defined in the previous paragraphs. If these parameters do not stabilize after three volumes, up to five volumes will be removed. Before purging, a clear bailer or an oil/water interface probe will be used to check for free product. No samples will be collected from a well that exhibits measurable free product. The thickness of the free product will be

measured and recorded. Samples will be obtained with a peristaltic pump, using a low-flow quiescent sampling technique. The samples will be transferred directly into the appropriate (pre-preserved) sample bottles for analysis. Samples to be analyzed for volatile constituents will be taken first and immediately sealed in vials, so that no headspace exists. Constituents to be analyzed are summarized in Table 3-1 for both soil and groundwater.

3.2.3 Water-Level Measurements

Synoptic water-level measurements will be taken from all monitoring wells at the site. Static water level will be measured from the north rim of the top of the PVC riser pipe, using an electronic water-level indicator. The newly installed wells will be notched and marked, so that the same point will be referenced for all measurements. The depth to water will be measured to the nearest 0.01 foot below the top of the PVC riser pipe. Water-level measurements will be recorded to the nearest 0.01 foot in the appropriate field log book.

3.3 TIDAL INFLUENCE STUDY

TtNUS will conduct a tidal influence study to measure fluctuation in periodic rise and fall of the surrounding waters to determine the impact on the surficial aquifer in the site vicinity. One shallow well will be used to determine whether tidal fluctuations are apparent in the area. Static water levels in this well will be measured at 15-minute intervals over a 48-hour period, using an electronic data logger. The study will be conducted as close as possible to a full moon so as to assess the maximum possible tidal effect, if any, on the surficial aquifer. Existing groundwater data (from previous aquifer tests performed at the Base to calculate hydraulic conductivity values of the aquifer) will be used to determine aquifer characteristics.

3.4 EQUIPMENT DECONTAMINATION

The equipment involved in field sampling activities will be decontaminated prior to and during drilling and sampling activities in accordance with TtNUS' SOP and CompQAP. This equipment includes drill rigs, downhole tools, augers, well casings and screens, and soil and water sampling equipment.

3.4.1 Major Equipment

All downhole drilling equipment used in the construction and sampling of permanent monitoring wells, including downhole drill and sampling tools, will be steam-cleaned prior to beginning work, between boreholes, any time the drill rig leaves the drill site prior to completing a boring, and at the conclusion of the drill program.

These decontamination operations will include washing equipment with a high-pressure steam wash from a potable water supply and the heavy-duty detergent Alconox™. The equipment will then be rinsed with tap water. All decontamination activities will take place at a predetermined location. Additional requirements for drilling equipment decontamination can be found in SOP SA-7.1, included in Appendix C.

3.4.2 Sampling Equipment

All equipment such as trowels, bailers, and split spoon samplers used for collecting samples will be decontaminated prior to beginning field sampling and between sample locations. The following decontamination steps will be taken:

- Tap water and Alconox™ or Liquinox™ detergent rinse
- Tap water rinse
- Rinse thoroughly with de-ionized, analyte-free water
- Rinse with isopropanol
- Rinse thoroughly with de-ionized, analyte-free water
- Air dry
- Wrap equipment in aluminum foil until use.

Field meters such as pH, conductivity, and temperature instrument probes will be rinsed first with tap water, then with de-ionized, analyte-free water, and finally with the sample liquid.

3.5 WASTE HANDLING

Drill cuttings from drilling activities and purge water will be collected and containerized in Florida Department of Transportation-approved (Specification 17C) 55-gallon drums. Each drum will be sealed, labeled, and left at a drum staging area. NAS Key West will then transport the drums to the Base for storage until the results of the chemical analyses are complete. A lined decontamination pad will be constructed and used to collect water from the steam cleaning of drilling equipment. All decontamination materials generated during the site investigation will be containerized for proper disposal.

3.6 SAMPLE HANDLING

Sample handling includes field-related considerations concerning the selection of sample containers, preservatives, allowable holding times, and analysis requested. In addition, sample identification, packaging, and shipping will be addressed. All sample handling procedures will be in accordance with TtNUS' FDEP-approved CompQAP No. 980038, dated June 13, 2000.

3.7 SAMPLE PACKAGING AND SHIPPING

Samples will be packaged and shipped in accordance with the TtNUS CompQAP. The Field Operations Leader (FOL) will be responsible for completion of the following forms when samples are collected for shipping:

- Sample labels
- Chain-of-custody labels
- Appropriate labels applied to shipping coolers
- Chain-of-custody forms
- Federal Express air bills

TtNUS' CompQAP addresses the topics of containers and sample preservations. A summary of bottleware requirements, preservation requirements, and sample holding times is provided in Table 3-2.

3.8 SAMPLE IDENTIFICATION

Each sample collected will be assigned a unique sample tracking number. This number will consist of a three-segment, alpha-numeric code that identifies the building number (the site), sample medium, location, the sampling event identifier or sample depth (in the case of soil samples), and the quality control (QC) designation, if applicable. Any other pertinent information regarding sample identification will be recorded in the field logbook.

The alpha-numeric coding to be used in the sample system is explained in the following definitions:

NN(N or A)	-	(Building Designation)
AA	-	(Medium)
AANN	-	(Location)
NNN(N)	-	(QC Designation, if applicable)

Character Type:

A = Alpha
N = Numeric

Medium:

GW = Groundwater sample from a monitoring well
SS = Subsurface soil sample taken via soil boring
TW = Temporary well groundwater sample

Sample Location:

Subsurface soil (SS) sample locations will correspond to the boring number (i.e., SB02)

Groundwater (GW) sample locations will correspond to the well number (i.e., 58-1)

Temporary well (TW) groundwater sample locations will correspond to the temporary well number (i.e., 58-TW1)

Sample Identifier:

For soil samples = Sample depth interval, in feet
For groundwater = Sampling round

QC Sample Designation:

D = Duplicate
F = Field Blank
B = Equipment Rinsate Blank
T = Trip Blank

For example, a groundwater sample collected from monitoring well MW-01 at a Building 1360 underground storage tank (UST) would be designated as 1360-GW-MW01-001.

A duplicate sample from that same well would be 1360-GW-MW01-001D.

A subsurface soil sample taken from Monitoring Well Boring 01 at Building 1360 UST, at a depth of 4 to 6 feet bls would be 1360-SS-MW01-0406.

Information regarding sample labels to be attached before shipment to a laboratory is contained in SOP SA-6.3, included in Appendix C. Examples of sample labels, chain of custody seals, and chain-of-custody forms are included in Appendix C.

3.9 SAMPLE CUSTODY

The chain of custody begins with the release of the sample bottles from the laboratory and must be documented and maintained from that point forward. To maintain custody of the sample bottles or samples, they must be in someone's physical possession, in a locked room or vehicle, or sealed with an intact custody seal. When possession of the bottles or samples is transferred from one person to another, it must be documented in the field logbook and on the chain-of-custody form.

3.10 QUALITY CONTROL (QC) SAMPLES

In addition to periodic calibration of field equipment and appropriate documentation, QC samples will be collected or generated during environmental sampling activities. QC samples may include field blanks (which consist of field duplicates and trip blanks) and rinsate blanks. Each type of field QC sample is defined as follows:

Field Duplicate - Field duplicates are two water samples collected independently at a sample location during a single act of sampling under representative field conditions. Field duplicate sample frequencies are provided in Table 3-3**.** If necessary, the duplicates shall be analyzed for the same parameters as the environmental sample in the laboratory (see Table 3-1).

Trip Blank - Trip blanks will be prepared at the laboratory facility and will accompany the volatile organic aromatics (VOA) vials to the sampling site and back to the laboratory. Trip blanks are not required by FDEP unless 10 or more VOA samples are collected during a given sampling event. Trip blank sample frequencies are provided in Table 3-3.

Rinsate Blank - Rinsate blanks are obtained under representative field conditions by running analyte-free water through sample collection equipment (bailer, split spoon, etc.) after decontamination and placing it in the appropriate containers for analysis. Rinsate blanks will be used to assess the effectiveness of decontamination procedures. If necessary, rinsate blanks may be collected for each type of non-dedicated sampling equipment used and will be submitted to the laboratory, as shown in Table 3-1.

3.11 FIELD MEASUREMENTS

Certain field measurements will be recorded during sampling activities, including groundwater temperature, pH, specific conductance, and turbidity. Instruments used in the field to record this data and additional instruments will be calibrated according to the procedures described below.

3.11.1 Parameters

- Air monitoring – Flame Ionization Detector
- Temperature - Temperature probe
- Specific conductance - Specific conductance meter
- pH - pH meter
- Turbidity - Turbidity meter
- Depth to water table - interface probe

3.11.2 Equipment Calibration

The electronic water-level indicator will be calibrated prior to mobilization and periodically at the discretion of the FOL. The remaining instruments will be calibrated daily and/or according to the manufacturer's operation manual.

Calibration will be documented on an Equipment Calibration Log, as shown in Appendix C. During calibration, an appropriate maintenance check will be performed on each piece of equipment. If damaged or defective parts are identified during the maintenance check and it is determined that the damage could have an impact on the instrument's performance, the instrument will be removed from service until defective parts are repaired or replaced.

3.11.3 Equipment Maintenance

Measuring equipment used in environmental monitoring or analysis and test equipment used for calibration and maintenance will be controlled by established procedures. Measuring equipment will have an initial calibration and be recalibrated at scheduled intervals against certified standards.

TtNUS maintains a large inventory of sampling and measuring equipment. If failed equipment cannot be repaired, replacement equipment can be shipped to the site by overnight express carrier to minimize downtime.

3.12 RECORD KEEPING

In addition to chain-of-custody records associated with sample handling and packaging and shipping, certain standard forms will be completed for sample description and documentation. These will include sample log sheets (for soil and groundwater samples), daily activity records, and logbooks. Examples of these forms are in Appendix C.

A bound, weather-proof field notebook will be maintained by each sampling event leader. The field team leader, or designee, will record all information related to sampling or field activities. This information may include sampling time, weather conditions, unusual events (e.g., well tampering), field measurements, descriptions of photographs, etc.

A site logbook will be maintained by the FOL. The requirements of the logbook are referenced in Appendix C. This book will contain a summary of each day's activities and will reference the field notebooks when applicable.

Each field team leader who is supervising a drilling subcontractor activity must complete a Daily Activities Record (DAR). The DAR documents the progress of daily drilling activities. The information contained within this record is used for billing verification and progress reports. The driller's signature is required at the end of each working day to verify work accomplished, hours worked, standby time, and material used. An example of this form is provided in Appendix C.

At the completion of field activities, the FOL will submit to the Project Manager all field records, data, field notebooks, logbooks, chain-of-custody receipts, sample log sheets, drilling logs, daily logs, etc.

3.13 SITE MANAGEMENT AND BASE SUPPORT

TtNUS will conduct this project with support from the Navy. This section of the Work Plan describes the project contacts, support personnel, project milestones, and time frames of all major events.

Throughout investigation activities, work at the intersection of Caroline and William Streets will be coordinated through SouthDiv and facility personnel. The primary contacts are as follows:

1. SouthDiv Engineer in Charge/Remedial Project Manager
   Mr. Byas Glover
   (843) 820-5651

2. NAS Key West UST Program Manager
   Mr. Bob Courtright
   (305) 293-2881

This Work Plan assumes that the following support functions will be provided by NAS Key West personnel:

- Assist TtNUS in locating underground utilities prior to the commencement of drilling operations
- Provide existing engineering plans, drawings, diagram, files, etc., to facilitate evaluation of the site under investigation
- Provide all historical data, background geological and hydrogeological information, and initial site investigation documents.
- Arranging for personnel identification badges, vehicle passes, and/or entry permits
- Providing a secure staging area (approximately 1,000 square feet) for storing equipment and supplies
- Establishing a decontamination area and waste staging area located adjacent to or near the study area.

The project will be staffed with personnel from the TtNUS Aiken (South Carolina), Jacksonville (Florida) and Deerfield Beach (Florida) offices. During field activities, TtNUS will provide a senior level geologist and/or staff geologist and equipment technician(s).

Mr. Charles Bryan is the Task Order Manager (TOM) for CTO 153 and will be the primary point of contact. He is responsible for cost and schedule control, as well as technical performance, and will provide senior level review and oversight during field activities. Mr. Bryan will be the primary point of contact for the FOL.

3.13.1 Contingency Plan

In the event of problems that may be encountered during site activities, the SouthDiv point of contact will be notified immediately, followed by the TtNUS Project Manager and the NAS Key West point of contact. The Project Manager will determine a course of action that will not interfere with the schedule or budget. All contingency plans will be approved through the SouthDiv point of contact before being enacted.

TABLE 3-1

FIELD INVESTIGATION
ENVIRONMENTAL SAMPLE SUMMARY
CAROLINE AND WILLIAM STREETS ASSESSMENT
NAVAL AIR STATION
KEY WEST, FLORIDA

Analyte	Proposed Method (1)	Env. Samples	Field Blanks	Rinsate Blanks (Aqueous)	Trip Blanks	Total Samples
GROUNDWATER						
VOH, BTEX, and MTBE	SW-846 8021B	16	2	2	2	22
PAH	SW-846 8310	16	2	2	0	20
LEAD	EPA 239.2	16	2	2	0	20
TRPH	FL-PRO	16	2	2	0	20
EDB	EPA 504.1	16	2	2	0	20
Anions	EPA 300 or SW-846 9056	3	0	0	0	3
Methane	RSK SOPs 147 and 175	3	0	0	0	3
SOILS						
VOH, VOA, and MTBE	SW-846 8021B	3	0	0	0	3
PAH	SW-846 8310	3	0	0	0	3
TRPH	FL-PRO	3	0	0	0	3
Total Organic Carbon (TOC)	ASTM D2974-87	1	0	0	0	1
TOX	SW-846 5050/0956	1	0	0	0	1
RCRA Metals	SW-846 6010B	1	0	0	0	1
TOTAL		98	10	10	2	120

VOHs - Volatile organic halocarbons
BTEX - Benzene, toluene, ethylbenzene, and xylenes
MTBE - Methyl-tert-butyl-ether
PAH - Polynuclear aromatic hydrocarbons
TRPH - Total recoverable petroleum hydrocarbons
EDB - 1,2-Dibromoethane
TOX - Total organic halogens
TOC - Total organic carbon
(1) Method referenced reflects FDEP requirements.
All samples are analyzed using standard 30-day laboratory turn-around time.

TABLE 3-2

SUMMARY OF ANALYSES, BOTTLEWARE REQUIREMENTS, PRESERVATION REQUIREMENTS, AND HOLDING TIMES NAS KEY WEST, FLORIDA

Parameter	Analytical Method	Sample Container	Volume	Preservation	Maximum Holding Time(1)
AQUEOUS SAMPLES					
VOHs, VOAs, and MTBE	SW-846 Method 8021B	Glass Volatile Vial	2 x 40 ml	Add HCl to pH < 2; Chill to 4 degrees Celcius	14 days
EDB (1,2-Dibromoethane)	EPA Method 504.1	Glass Volatile Vial	40 ml	Add HCl to pH < 2; Chill to 4 degrees Celcius	28 days
PAHs	SW-846 Method 8310	Amber Glass	1 L	Add .008% Na2S2O3;Chill to 4 degrees Celcius	7 days until extraction; 40 days to analysis
Lead (Total and dissolved)	EPA Method 239.2	High Density Polyethylene	500 ml	Chill to 4 degrees Celcius	180 days
TRPH	FL-PRO	Glass	1L	Add H_2SO4 to pH <2; Chill to 4 degrees Celcius	28 days
SOLID SAMPLES					
VOHs, VOAs, and MTBE	SW-846 Method 8021B	EnCore Sampler	3 x 5g	Chill to 4 degrees Celcius; Lab to preserve within 48 hours of samples (2)	14 days
RCRA Metals	SW-846 Method 6010B/7000A series	Clear Wide Mouth Glass	4 ounces	Chill to 4 degrees Celcius	180 days; except mercury 28 days
TRPH	FL-PRO	Clear Wide Mouth Glass	4 ounces	Chill to 4 degrees Celcius	28 days
PAHs	SW-846 Method 8310	Clear Wide Mouth Glass	8 ounces	Chill to 4 degrees Celcius	14 days to extraction; 40 days to analysis
Total Halides	SW-846 Method 5050/9056	Clear Wide Mouth Glass	500 ml	Chill to 4 degrees Celcius	28 days

VOHs - Volatile Organic Halocarbons
VOAs - Volatile Organic Aromatics
MTBE - Methyl-tert-butyl-ether
PAHs - Polynuclear Aromatic Hydrocarbons
TRPH - Total Recoverable Petroleum Hydrocarbons
RCRA - Resource Conservation and Recovery Act
H_2SO4 - Sulfuric acid
HCl - Hydrochloric acid
EDB - 1,2-Dibromoethane
(1) Holding time is measured from date of sample collection to date of sample analysis.

TABLE 3-3

QUALITY CONTROL SAMPLE FREQUENCY
CAROLINE AND WILLIAM STREETS
NAVAL AIR STATION
KEY WEST, FLORIDA

No. Samples	Pre-cleaned Equipment BLK	Field-cleaned Equipment BLK	Trip BLK (VOCs)	Field Duplicate
10+	Minimum of one then 5%	Minimum of one then 5%	One per cooler	Minimum of one then 10%
5-9	one*	one*	NR	one
< 5	one*	one*	NR	NR

NR = Not required
BLK = Blank

* Note: For nine or fewer samples, one pre-cleaned equipment blank or a field-cleaned equipment blank is required. A field-cleaned equipment blank must be collected if equipment is cleaned in the field.

4.0 PROPOSED LABORATORY ANALYSIS

Soil and groundwater samples collected for laboratory analyses will be analyzed in accordance with the parameters identified in Chapter 62-770.800 of the Florida Administrative Code (F.A.C.) (see Sections 5.1 and Section 5.2 below for specific sampling requirements regarding soil and groundwater).

4.1 SOIL INVESTIGATION

Three (3) soil samples will be collected and analyzed for the KAG in accordance with Chapter 62-770, F.A.C. The soil samples will be collected from areas of high, medium, and low concentrations, as indicated by OVA screening. In addition, one sample will be analyzed for TOC, total organic halogens and RCRA metals for disposal requirements. Parameters within these groups are identified in Table 3-1.

4.2 GROUNDWATER INVESTIGATION

Groundwater samples will be collected from DPT locations during Phase I, and from permanent monitoring during Phase II. The samples from Phase II will be analyzed for VOHs, VOAs, MTBE, 1,2-Dibromoethane (EDB), PAHs, TRPH, and total lead. In addition, three groundwater samples from each site will be analyzed for natural attenuation parameters, which include anions and methane.

An environmental sample summary is provided in Table 3-1.

5.0 PROPOSED SCHEDULE

The assessment activities are proposed to begin in June 2001 and take approximately two 10-day shifts to complete. The SAR will be developed upon completion of the assessment activities and submitted within 60 days of assessment completion to the Navy for review.

6.0 REPORTS

Upon completion of all field work and laboratory analysis, a SAR summarizing the results of the investigation will be submitted to the Navy. Basic site information, including the site Facility Identification Number, facility name and address, date closed, area, type of system, and capacity will be provided. Also included in this report will be graphical presentations of the groundwater screening results and complete summaries of soil and groundwater analytical results. The locations of soil sampling points and monitoring wells will be presented on scaled figures. Boring logs, chain-of-custody forms, field forms, field screening results, and analytical reports will be included in Appendices to the report. The SAR is expected to recommend one of the following as a course of action: completion of a remedial action plan, a monitoring only plan, or no further action for the facility.

REFERENCES

Bechtel. February 1988. Source Removal Report. Pipeline abandonment, NAS Key West.

Tetra Tech NUS, Inc., 2000 Revision. Comprehensive Quality Assurance Plan, FDEP COMP QA PLAN # 980038.

APPENDIX A

RESPONSE TO COMMENTS

APPENDIX A. RESPONSE TO COMMENTS

Note: No comments were received on Rev. 0.

APPENDIX B

HEALTH AND SAFETY PLAN

Health and Safety Plan

For

Site Assessment

at

Caroline and William Streets Site

Naval Air Station Key West
Key West, Florida

Southern Division
Naval Facilities Engineering Command
Contract No. N62467-94-D-0888
Contract Task Order 0153

June 2001

Rev. 1
6/29/01

HEALTH AND SAFETY PLAN
FOR
SITE ASSESSMENT
AT
CAROLINE AND WILLIAM STREETS SITE

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY CONTRACT

SUBMITTED TO:
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
2155 EAGLE DRIVE
NORTH CHARLESTON, SOUTH CAROLINA 29406

SUBMITTED BY:
TETRA TECH NUS
661 ANDERSEN DRIVE
FOSTER PLAZA 7
PITTSBURGH, PENNSYLVANIA 15220

CONTRACT NO. N62467-94-D-0888
CONTRACT TASK ORDER 0153

JUNE 2001

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1.0 INTRODUCTION

The objective of this Health and Safety Plan (HASP) is to provide the minimum safety practices and procedures to Tetra Tech NUS, Inc. (TtNUS) personnel conducting site assessment activities for the Naval Air Station (NAS) Key West, at the Caroline and William Street Site in Key West, Florida.

This HASP specifies personnel responsibilities, restrictions, and evaluation techniques and establishes requirements to be incorporated into the planned activities for the purpose of protecting personnel from hazards present at the Site or arising out of activities at the Site.

The HASP is to be used in conjunction with the TtNUS Health and Safety Guidance Manual. The Guidance Manual provides detailed information on procedures to be performed onsite, as directed by the HASP, as well as TtNUS standard operating procedures. This HASP and the contents of the Guidance Manual were developed to comply with requirements stipulated in 29 Code of Federal Regulations (CFR) 1910.120, the Occupational Safety and Health Administration's (OSHA's) Hazardous Waste Operations and Emergency Response Standard). Both documents must be present at the Site to satisfy these requirements.

This HASP has been written to support proposed tasks and techniques associated with the scope of work presented in Section 4.0. It 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. Should the proposed work site conditions and/or suspected hazards change, or if new information becomes available, this document will be modified. All changes to the HASP will be made with the approval of the TtNUS Site Safety Officer (SSO) and the TtNUS Health and Safety Manager (HSM). Requests for modifications to the HASP will be directed to the SSO, who will determine whether or not to make the changes. If changes are made, the SSO will notify the Task Order Manager (TOM), who will notify all affected personnel of such changes.

1.1 AUTHORITY

This work is authorized under the Comprehensive Long-term Environmental Action, Navy (CLEAN) contract, administered through the U.S. Navy Southern Division Naval Facilities Engineering Command, as defined under Contract No. N62467-94-D-0888; Contract Task Order (CTO) Number 0153.

1.2 KEY PROJECT PERSONNEL AND ORGANIZATION

This section defines individual responsibilities for Site safety and health for TtNUS and subcontractor employees conducting environmental sampling and other field activities. Personnel assigned to these positions will exercise the primary responsibility for all onsite health and safety and will also be the primary points of contact for any questions regarding the safety and health procedures and the selected control measures. A brief description of key personnel and their responsibilities follows.

The TtNUS TOM is responsible for the overall direction and implementation of health and safety for this work.

The TtNUS Field Operations Leader (FOL) is responsible for implementation of this HASP. The FOL manages field activities, executes the work plan, and enforces safety procedures as they apply to the work plan. Specifically, the FOL will:

- Verify training and medical status of onsite personnel in relation to Site activities
- Assist and represent TtNUS with emergency services (if needed)
- Provide elements of Site-specific training for all onsite personnel.

The TtNUS SSO (or his/her representative) supports the FOL concerning all aspects of health and safety including, but not limited to:

- Coordinating all health and safety activities
- Selecting, applying, inspecting, and maintaining personal protective equipment
- Establishing work zones and control points
- Implementing air monitoring procedures
- Implementing hazard communication, respiratory protection, and other associated safety and health programs
- Coordinating emergency services
- Providing elements of Site-specific training
- Compliance with these requirements is monitored by the Project Health and Safety Officer (PHSO) and coordinated through the HSM.

1.3 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name: Naval Air Station (NAS) Key West **Address:** Key West, Florida

Remediation Project Manager: Mr. Byas Glover **Phone Number:** (843) 820-5651

Site Point of Contact: Mr. Robert Courtright **Phone Number:** (305) 293-2881

Purpose of Site Visit: TtNUS will conduct a site assessment at the Caroline and William Street Site in downtown Key West.

Proposed Dates of Work: May 2001

Project Team:

Tetra Tech NUS Personnel:	Discipline/Tasks Assigned:
Charles Bryan	Task Order Manager (TOM)
Gary Braganza	Field Operations Leader (FOL)
Matthew M. Soltis, CIH, CSP	Health and Safety Manager (HSM)
James K. Laffey	Project Health and Safety Officer (PHSO)
Emily Harrison	Geologist
TBD*	Sampler
TBD	Site Safety Officer (SSO)

Subcontractor Personnel:	Discipline/Tasks Assigned:
Bob's Barricades	Traffic Control
TBD	Drilling Subcontractor

Hazard Assessments (for purposes of 29 CFR 1910.132) and HASP preparation conducted by:

James K. Laffey

*To be determined

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section has been developed as part of a planning effort to direct and guide field personnel in the event of an emergency. Because a majority of potential emergency situations will require assistance from outside emergency responders, TtNUS personnel will not provide emergency response support for emergency events beyond the capabilities of onsite personnel. In the event of emergencies that cannot be handled by personnel, an evacuation will be initiated. In an evacuation, Site personnel will move to a safe place of refuge and the appropriate emergency response agencies will be notified. The emergency response agencies listed in this plan are capable of providing the most effective responses and, as such, will be designated as the primary responders. These agencies are located within a reasonable distance from the area of operations, which ensures adequate emergency response time. This emergency action plan conforms to the requirements of OSHA Standard 29 CFR 1910.38(a), as allowed in OSHA 29 CFR 1910.120(l)(1)(ii).
TtNUS personnel will, through the necessary actions, provide incidental response measures for incidents such as:

- Incipient fire and spill prevention and response
- Removal of personnel from emergency situations
- Provision of initial medical support for injuries/illnesses requiring only first-aid-level support
- Provision of Site control and security measures, as needed.

2.2 EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, there is very minor potential for injuries or illnesses resulting from exposure to chemical, physical, or other hazards and, subsequently, little likelihood of emergency situations. To further minimize or eliminate potential emergency situations, emergency planning activities associated with this project shall be implemented. The FOL is responsible for:

- Coordinating response actions with City of Key West Emergency Services personnel to ensure that TtNUS emergency action activities are compatible with existing emergency response procedures
- 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.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Foreseeable emergency situations that may be encountered during Site activities will generally be recognizable by visual observation. Visual observation will be the principal method of identifying any hazards that may be associated with the proposed scope of work. These potential hazards, the activities with which they have been associated, and the recommended control methods are discussed in detail in Sections 5.0 and 6.0 of this document.

2.3.2 Prevention

TtNUS personnel will minimize the potential for emergencies by ensuring compliance with the HASP, the Health and Safety Guidance Manual, applicable OSHA regulations, and by following directions given by those persons responsible for the health, safety, and welfare of personnel.

2.4 SAFE DISTANCES AND PLACES OF REFUGE

In the event that the Site must be evacuated, all personnel will immediately stop activities and report to a pre-determined safe place of refuge. The safe place of refuge may also serve as the telephone communication point, as communication with emergency response agencies may be necessary. Telephone communication points and safe places of refuge will be determined prior to the commencement of Site activities and will be conveyed to personnel as part of pre-site training. Upon reporting to the refuge location, personnel will remain there until directed otherwise by the TtNUS FOL or the On-Scene Incident Commander. The FOL will take a head count at this location to confirm the presence of all Site personnel. Emergency response agencies will be notified of any unaccounted for personnel.

2.5 EVACUATION ROUTES AND PROCEDURES

Once an evacuation is initiated, personnel will terminate Site activities and proceed immediately to the designated place of refuge, unless doing so would further jeopardize the welfare of workers. In such an event, personnel will proceed to a designated alternate location and remain there until further notification from the FOL. The use of these locations as assembly points provides communication and a direction point for emergency services, should they be needed.

2.6 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

TtNUS personnel will be working in close proximity to each other at NAS Key West. 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, 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, or vehicle horns. Use the following signals when communication via vehicle horn is necessary:

HELP	three short blasts	▪ ▪ ▪
EVACUATION	three long blasts	▬ ▬ ▬

- Report to the designated refuge point
- Initiate appropriate response procedures to control the situation once all non-essential personnel are evacuated
- Describe to the FOL (FOL will serve as the Incident Coordinator) pertinent incident details.

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

Dial 911 and 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 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.

2.7 EMERGENCY CONTACTS

Prior to performing work at the Site, all personnel will be thoroughly briefed on the emergency procedures to be followed in the event of an accident. As indicated earlier, Table 2-1 provides a list of emergency contacts and their corresponding telephone numbers. This table will be made readily available to all Site personnel.

TABLE 2-1
EMERGENCY REFERENCE
NAS KEY WEST, FLORIDA

AGENCY	TELEPHONE
Key West Emergency Services	**9-1-1**
Key West Police Chief, Buz Dillion	(305) 294-2511
Key West Fire Chief, Tim Fahey	(305) 292-8145
Key West City Engineer, Roland S. Flowers, P.E.	(305) 292-8258
Key West City Manager, Julio Avael	(305) 292-8100
Key West Rumor Control Hotline	(305) 292-8301
Key West City Electric System Transmission and Distribution	(305) 295-1000 (305) 295-1202
Key West Utilities Department (Wastewater, Storm water, Solid waste, and Code Enforcement), Director, E. David Fernandez	(305) 293-6414 (305) 313-0436 (24-hr pager)
Monroe County Emergency Information Line	(800) 955-5504
Hospital: Lower Florida Keys Health System	(305) 294-5531
Florida Poison Information Center - Miami	(800) 282-3171
Florida Game and Fresh Water Fish Commission – South Region	(561) 625-5122
Chemtrec National Response Center	(800) 424-9300 (800) 424-8802
SouthDiv Remedial Project Manager, Byas Glover	(843) 820-5651
NAS UST Program Manager, Robert Courtright	(305) 293-2881
Environmental Branch Installation Restoration Coordinator, Helen Stanley	(305) 293-2030
TtNUS, Tallahassee Office	(850) 385-9899
Task Order Manager, Charles Bryan	(803) 649-7963
Field Operations Leader, Gary Braganza	(954) 570-5885
Health and Safety Manager, Matthew M. Soltis, CIH, CSP	(412) 921-8912
Project Health and Safety Officer, James K. Laffey	(412) 921-8678

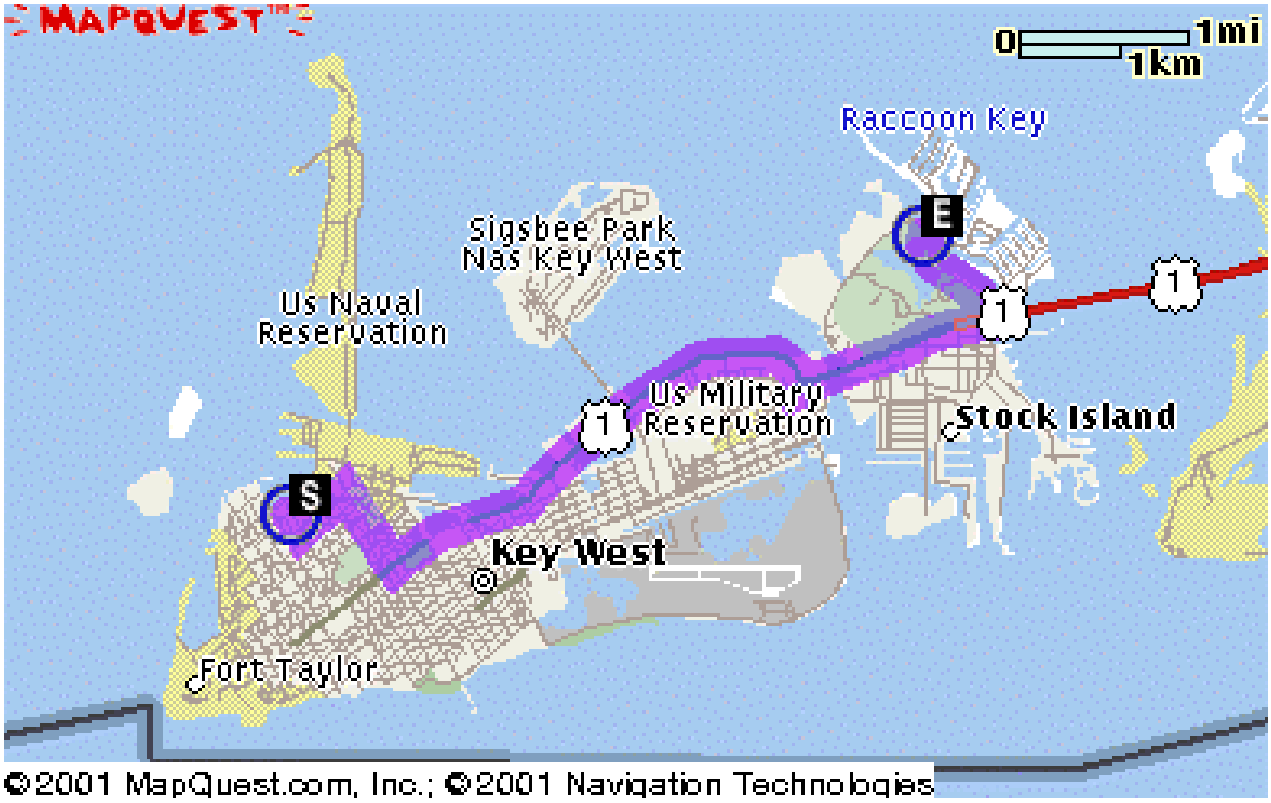
2.8 EMERGENCY ROUTE TO HOSPITAL

The Lower Florida Keys Health System, 5900 College Road, Stock Island, is approximately 5 miles from the Site. The hospital has facilities to accept chemically contaminated patients.

Directions to the hospital are as follows: From Caroline and William Streets. **[S]**, travel south on William Street to Eaton Street and turn left. Proceed to White Street and turn right. Take White Street to U.S. 1 (Truman Ave.) and turn right. Continue on U.S. 1 (becomes North Roosevelt Blvd.) and turn left onto U.S. 1 (Overseas Highway). Proceed to Stock Island and turn left onto College Road. Follow the signs to the hospital **[E]**.

FIGURE 2-1

ROUTE TO
LOWER FLORIDA KEYS HEALTH SYSTEM HOSPITAL



2.9 DECONTAMINATION PROCEDURES/EMERGENCY MEDICAL TREATMENT

During any 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.

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 from the designated emergency response agencies. **If the emergency involves personnel exposures to chemicals, follow the steps provided in Figure 2-2.**

2.10 iNJURY/ILLNESS REPORTING

If any TtNUS personnel are injured or develop an illness as a result of working onsite, the TtNUS "Injury/Illness Procedure" (Attachment I) must be followed. Following this procedure is necessary for documenting all information obtained at the time of the incident. Any 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, information will be provided on the chemical, physical, and toxicological properties of the subject chemical(s) to medical service personnel.

FIGURE 2-2

EMERGENCY RESPONSE PROTOCOL

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

In the event of a personnel exposure to a hazardous substance or agent:

- 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 exposed person is a TtNUS employee, call and advise the medical facility 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 appropriate specific testing. The care of the victim will be monitored by WorkCare physicians. 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 Ext. 109 or follow the voice prompt for afterhours or weekend notification, and be prepared to provide:
  - Any known information about the nature of the exposure
  - 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 exposed TtNUS employee(s)
  - Name and phone number of an informed Site officer who will be responsible for further investigations
- Fax appropriate information (e.g., the Material Safety Data Sheet [MSDS]) to WorkCare at (714) 456-2154.
- Contact the TtNUS Corporate Health and Safety Department (Matt Soltis) at 1-800-245-2730.

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

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

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

FIGURE 2-2 (continued)

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 there 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

NAS Key West is located in southern Monroe County, Florida, approximately 150 miles southwest of Miami on the two westernmost islands of the Florida Keys (Boca Chica and Key West). It is connected to the mainland by the Overseas Highway (U.S. Highway 1).

Several naval installations located in various parts of the lower Florida Keys comprise what is known as the Naval Complex at Key West. Most of these are located on Key West and Boca Chica Key. The entire complex encompasses approximately 5,000 acres. NAS Key West is the host activity of the Naval Complex. NAS is located on Boca Chica Key and encompasses 3,250 acres.

3.1 SITE BACKGROUND

In this investigation, the Site is located at the intersection of Caroline and William Streets in downtown Key West. During the integrity testing of a Navy abandoned underground pipeline in December 1997, approximately 3,300 gallons of petroleum product is suspected to have been released. In response to the spill, NAS conducted an initial recovery effort. Approximately 3,300 gallons of product was recovered and 100 tons of contaminated soil was excavated and disposed. The contaminated soils were excavated down to groundwater.

4.0 SCOPE OF WORK

This section of the HASP addresses all proposed Site activities that will be conducted while performing a Site Assessment at the Caroline and William Street Site in downtown Key West. The objective of this investigation is to determine the extent of petroleum contamination at the Navy spill site and determine whether or not further action is required to remediate the Site. If tasks other than those identified below are to be performed at this Site, the HASP will be modified accordingly:

- Mobilization/demobilization
- Soil and groundwater sampling
- Monitoring well installation using direct push technology (DPT) or hollow stem auger (HSA) technology
- Decontamination of sampling equipment
- Investigation-derived waste (IDW) management
- Geographical surveying.

The activities will be performed to identify the nature and extent of actual or potential Site contamination. Any tasks to be conducted outside the elements listed here will be considered a change in scope, requiring modification of this document. All requested modifications to this document will be submitted to the HSM by the TOM or a designated representative.

5.0 TASKS/HAZARDS/ASSOCIATED CONTROL MEASURES SUMMARIZATION

Table 5-1 in this section serves as the primary portion of the Site-specific HASP that identifies the tasks 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 Personal Protective Equipment (PPE), and decontamination measures for each Site task are discussed in detail. This table and the associated control measures will be changed, if the scope of work, contaminants of concern, or other conditions change.

Through using Table 5-1, Site personnel can determine which hazards are associated with each task at each location, 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.

As discussed earlier, a Health and Safety Guidance Manual must accompany this table and HASP. The Manual is designed to further explain 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 standard operating procedures are also provided in the Guidance Manual.

Safe Work Permits issued for all activities (See Section 9.4) will use elements defined in Table 5-1 as the primary reference. The FOL and/or the SSO completing the Safe Work Permit will add additional Site-specific information. In situations where 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. Partially completed Safe Work Permits are included in Attachment III of this HASP.

5.1 GENERAL SAFE WORK PRACTICES

In addition to the task-specific work practices identified in Table 5-1, the following safe work practices are to be followed when conducting work onsite. These safe work practices address a pattern of general

precautions and measures for reducing risks associated with Site operations. This list is not all inclusive and may be amended as needed.

- NO 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. Avoid puddles, pools, mud, or other such areas. Avoid, whenever possible, kneeling on the ground or leaning or sitting on equipment. Keep monitoring equipment away from potentially contaminated surfaces.

- Obey all instructions in the Site-specific HASP.

- Take note of the location of the nearest telephone and all emergency telephone numbers. See Section 2.0, Table 2-1.

- Attend briefings on anticipated hazards, equipment requirements, safe work permits, emergency procedures, and communication methods before going onsite.

- Plan and mark entrance, exit, and emergency escape routes. See Section 2.0.

- Rehearse unfamiliar operations prior to implementation.

- Buddies should maintain visual contact with each other and with other onsite team members by remaining in close proximity 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.

- Immediately report all injuries, illnesses, and unsafe conditions, practices, defective equipment, and potential exposure incidents to the SSO.

- Matches, lighters, tobacco products, and food and drink are restricted from entering the Exclusion Zone or Contamination Reduction Zone.

- Observe coworkers for signs of toxic exposure and heat or cold stress.

- Inform co-workers of potential symptoms of illness, such as headaches, dizziness, nausea, or blurred vision.

5.2 DRILLING OPERATIONS - SAFE WORK PRACTICES

The following safe work practices are to be followed when working in or around drilling operations.

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 IV.

- All drilling rigs will be inspected by a competent person (the SSO or designee) prior to 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 II. 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 drill flights will be provided to avoid the collapse of stacked equipment.

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

5.2.2 During Drilling Operations

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

- Support functions (sampling and screening stations) will be maintained at a minimum distance from the drilling rig of the height of the mast plus 5 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.

- 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 After Drilling Operations

- All equipment used within the Exclusion Zone will undergo a complete decontamination and evaluation by the SSO to determine 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 shut down and bonded to the fuel provider.

- When not in use, all direct push rigs will be shut down, emergency brakes set, and wheels chocked.

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

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR CAROLINE AND WILLIAM STREET SITE, KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring – Types and Action Levels	Personal Protective Equipment *Items in italics are deemed optional as conditions or the FOL or SSO dictate.*	Decontamination Procedures
Soil borings and installation of monitoring wells (using DPT and HSAs)	***Chemical hazards:*** 1) Air/particulate/waterborne contaminants include semivolatile organic compounds (SVOCs), Bunker C Fuel Oil, or Fuel Oil # 6. Refer to Table 6-1 for specific information regarding these Site contaminants. 2) Transfer of contamination into clean areas or onto persons. ***Physical hazards*:** 3) Rotating equipment - Pinch/compression points 4) Noise 5) Energized systems 6) Vehicular and foot traffic 7) Lifting ***Natural hazards*** 8) Insect/animal bites and stings 9) Inclement weather	1) Use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (air, water, soils, etc.). Generation of dusts should be minimized to avoid contaminants bound to particulates. If airborne dusts are observed, area wetting methods will be used to reduce the generation of dusts created during drilling activities. If area wetting methods are not feasible, termination of activities will be used to minimize exposure to observed airborne dusts. 2) Decontaminate all equipment and supplies between boreholes and prior to leaving the Site. 3) All equipment to be used will be: - Inspected in accordance with Federal safety and transportation guidelines, OSHA (1926.600,.601,.602), and manufacturers design and documented as such using the Equipment Inspection Checklist (See Attachment II of this HASP). - Operated by qualified operators and knowledgeable ground crew. - Used within establish safe zones and routes of approach. In addition to equipment considerations, the following safe operating procedures will be incorporated: - All personnel not directly supporting this operation will remain at least the height of the mast plus 5 feet or 25 feet from the point of operation, whichever is greater. - Hydraulic masts or other projecting devices shall remain at least 20 feet from overhead power sources and a minimum of 3 feet from underground utilities, unless the exact location of the underground utility is known. - 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 (i.e., flight connectors etc.). - Work areas will be kept clear of clutter. - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All personnel working in high equipment traffic areas are required to wear reflective vests for high visibility, and to establish unimpeded work areas around the operation. - 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 insure its operational status. - Areas will be inspected prior to the movement of 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 floor openings, unsupported sidewalls, and excavations. - Follow the Safe Work Practices identified in Section 5.2 of this HASP. 4) Hearing protection will be used during all subsurface activities. 5) All utility clearances will be obtained prior to subsurface activities. Prior to any subsurface investigations, the locations of all underground utilities will be identified and marked. See Attachment IV, Utility Locating and Excavation Clearance, of this HASP. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e., boom or mast + 5 feet). - Coordinate with City of Key West to ensure that all local regulations are being followed. - Foot and vehicular traffic routes shall be well defined. - Heavy equipment patterns shall be isolated, using fences or other suitable barricades, from pedestrian pathways. - Bumpers or other suitable traffic stops shall be placed in areas where it is desired that traffic approaching an open excavation stop. - All self-propelled equipment shall be equipped with movement warning systems. - The FOL and/or the SSO, as a precautionary measure to remove or clearly mark physical hazards, shall preview traffic routes (foot and vehicular) before the commitment of personnel and resources. 7) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques as described in Table 5-1 for Mobilization/Demobilization. 8) Avoid nesting areas, use commercially available repellents. Report potential hazards to the SSO. Follow guidance presented in Section 6.3 of the HASP. Various local animals (such as snakes, alligators, etc.) could be a hazard, depending on the nearness of sample locations to nesting areas, the time of year, and other factors. Site activities will be suspended or terminated if dangerous conditions are determined to exist. If necessary, the City of Key West, the Florida Fish and Wildlife Conservation Commission, or other appropriate agencies will be contacted to remove or relocate animals or nests. 9) Suspend or terminate operations until directed otherwise by SSO.	**It is anticipated that potential contaminant concentrations will be low to nil due to the characteristics of the product. Any vapors will be dispersed via natural wind currents and dilution prior to reaching worker breathing zones.** A Flame Ionization Detector or a Photoionization Detector w/10.6 eV UV lamp source, will be used to detect VOCs as follows: Source (borehole and drill rig operator) monitoring will be conducted at regular intervals determined by the SSO. The SSO will also monitor the breathing zone of all potentially affected employees, with the following guidance: Any sustained (>10 minutes in duration with no greater than 4 occurrences in a single work day) reading greater than 50 ppm in the BZ requires evacuation to a safe area. Once the readings in the BZ have returned below 50 ppm, work in the area may resume. If readings do not subside, notify the PHSO for additional air monitoring requirements. This action level has been selected based on previously identified disposal practices at these sites and the limited information regarding potential Site contaminants. Potential contaminants may adhere to or be part of airborne dusts or particulates generated during Site activities. Generation of dusts should be minimized to avoid inhalation of contaminated dusts or particulates. Potential exposure to contaminants attached to dust particles will be controlled by using water to suppress dusts and by avoiding dust plumes.	All drilling operations will be performed in Level D protection, including the following articles: Sampler/Oversight Personnel - Standard field dress (long pants, sleeved shirts) - Steel-toe safety shoes/work boots - Hard hat - Safety Glasses - Appropriate weather gear - Orange traffic safety vest - Layered nitrile surgeon-style gloves for sampling - *Tyvek or washable cotton coveralls* - *Impermeable boot covers* - *Reflective vest for traffic areas* **Driller and Driller Helper** - Standard field attire including sleeved shirt and long pants - Steel-toe safety shoes/work boots - Safety glasses - Nitrile inner and outer gloves - Hearing protection - Hard hat - *Impermeable outer garments such as PVC Rain-suit or Saranex®, PE coated Tyvek® due to contact with contaminated tooling. An impermeable apron is an acceptable alternative and may be employed when conditions of heat stress are prevalent.* - *Impermeable boot covers* - *Reflective vest for traffic areas* As Site conditions may change, the following equipment will be maintained during all onsite activities - Fire extinguishers - First-aid kit **Note:** The Safe Work Permit(s) for this task (see Attachment III) 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 and non-reusable outer protective equipment (boots, gloves, PVC splash suits, as applicable). This decontamination function may be subdivided into two locations. Gross contamination of outer boots and outer gloves will be removed at a satellite location near the operation. Final wash and rinse will take place at the centralized decontamination pad. The sequential procedure is as follows: Stage 1: Equipment drop, remove outer protective wrapping; Decontamination personnel will wipe down the outer shell and pass hand equipment through, as necessary. Stage 2: Soap/water wash and rinse of outer boots and gloves Stage 3: Soap/water wash and rinse of the outer splash suit, as applicable. If personnel are wearing cotton coveralls or work clothes, these may be vacuumed at this point. Stage 4: Disposable PPE will be removed and bagged. Stage 5: Wash face and hands or use hygienic wipes to remove associated contaminants. **Equipment Decontamination** - All heavy equipment decontamination will take place at a centralized decontamination pad, utilizing a steam cleaner or pressure washer. 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 so as to not 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 Work Plan. All equipment used in the Exclusion Zone will require a complete decontamination between locations and prior to removal from the Site. The FOL or SSO will be responsible for evaluating equipment arriving onsite, leaving the Site, and between locations. No equipment will be authorized access, exit, or movement to another location without this evaluation.

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR CAROLINE AND WILLIAM STREET SITE, KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment *Items in italics are deemed optional as conditions or the FOL or SSO dictate.*	Decontamination Procedures
Multimedia sampling including soils, groundwater, and IDW. Also included in this task is monitoring well development and purging.	***Chemical hazards:*** 1) Air/particulate/waterborne contaminants include SVOCs, Bunker C Fuel Oil, or Fuel Oil # 6. Refer to Table 6-1 for specific information regarding these Site contaminants. 2) Transfer of contamination into clean areas ***Physical hazards:*** 3) Noise 4) Lifting (muscle strains and pulls) 5) Pinches and compressions 6) Vehicular and foot traffic 7) Slip, trips, and falls 8) Cuts and lacerations ***Natural hazards:*** 9) Insect/animal bites and stings 10) Inclement weather.	1) For Volatile Organic Compounds (VOCs), use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (air, water, soils, etc.). Many of the potential Site contaminants are solids or are bound to particulates. As a result, generation of dusts should be minimized. If airborne dusts are observed, area wetting methods will be used to reduce the generation of dusts. 2) Decontaminate all equipment and supplies between sampling locations and prior to leaving the Site. 3) When sampling at the drill rig, use hearing protection. The use of hearing protection to protect against excessive noise should be incorporated under the following conditions: - Hearing protection during sample acquisition outside the boring sample will be determine on a case-by-case scenario. As a general rule of thumb, if you have to raise your voice to talk to someone who is within 2 feet of your location, noise levels may be becoming excessive. - The physical hazards boundaries of the height of the mast plus 5 feet or 2 feet, whichever is greater, have been established to remove persons a sufficient distance that hearing protection will not be required (distance = reduction in noise levels). 4) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 5) Use pinch bars or other equipment to remove hands from the point of operation. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e., boom or mast + 5 feet). - Coordinate with the City of Key West to ensure that all local regulations are being followed. - Foot and vehicular traffic routes shall be well defined. - Heavy equipment patterns shall be isolated, using fences or other suitable barricades, from pedestrian pathways. - Bumpers or other suitable traffic stops shall be placed in areas where it is desired that traffic approaching an open excavation stop. - All self-propelled equipment will be equipped with movement warning systems. - The FOL and/or the SSO, as a precautionary measure to remove or clearly mark physical hazards, shall preview traffic routes (foot and vehicular) before the commitment of personnel and resources. 7) Preview work locations for unstable/uneven terrain. Barricade all excavations and other associated drop-off points at least 3 feet from the edge. 8) To cut open sample tubes, use a knife system with an acetate liner holder. This system allows sample acquisition without placing the sampler at risk. In addition, the following safe work practices will also assist in the minimization of this hazard: - Always cut away from the body and others. - Never place items to be cut in your hand or on your knee. - Change the knife blades frequently. 9) Avoid nesting areas and use commercially available repellents. Report potential hazards to the SSO. Follow guidance presented in Section 6.3 of the HASP. Various local animals (such as snakes, alligators, etc.) could be a hazard depending on the nearness of sampling locations nesting areas, the time of year, and other factors. If necessary, City of Key West personnel, the Florida Fish and Wildlife Conservation Commission, or other appropriate agencies will be contacted to remove or relocate animals or nests. 10) Suspend or terminate operations until directed otherwise by SSO.	**It is anticipated that potential contaminant concentrations will be low to nil due to the characteristics of the product. Any vapors will be dispersed via natural wind currents and dilution prior to reaching worker breathing zones.** Photoionization Detector w/ 10.6 eV UV lamp source, or a Flame Ionization Detector, will be used to detect VOCs as follows: Source (borehole and drill rig operator) monitoring will be conducted at regular intervals determined by the SSO. The SSO will also monitor the breathing zone of all potentially affected employees, with the following guidance: - Any sustained (>10 minutes in duration with no greater than 4 occurrences in a single work day) readings greater than 10 ppm in the BZ requires evacuation to a safe area. Once the readings in the BZ have returned below 10 ppm, work in the area may resume. If readings do not subside, notify the PHSO for additional air monitoring requirements. This action level has been selected, based on previously identified disposal practices at these Sites and the limited information regarding potential Site contaminants. Potential contaminants may adhere to or be part of airborne dusts or particulates generated during Site activities. Generation of dusts should be minimized to avoid inhalation of contaminated dusts or particulates. Potential exposure to contaminants attached to dust particles will be controlled by using water to suppress dusts and by avoiding dust plumes.	Level D protection will be utilized for the initiation of all sampling activities. Level D - (Minimum Requirements) - Standard field attire (sleeved shirt; long pants) - Tyvek coveralls and disposable boot covers, if surface contamination is present or if the potential for soiling work attire exists. - Surgical-style nitrile inner gloves for soil and groundwater sampling - Steel-toe safety shoes/work boots - Safety glasses - Orange traffic safety vest - *Hardhat (when overhead hazards exist or identified as a operation requirement)* - *Reflective vest for high traffic areas* - *Hearing protection for high noise areas, or as required based on the noise level at each operation.* **Note:** The Safe Work Permit(s) for this task (see Attachment III) 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, 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, PVC splash suits, etc.). This function will take place at a satellite location. Disposable PPE will be bagged between sampling events. This procedure will consist of - Sample acquisition - Clean (Deionized water spray) the outside of the sample containers/label/bags This decontamination procedure for Level D protection at a satellite location will consist of - Remove protective gloves - Wipe face and hands with hygienic wipes - Wash face and hands at earliest possible convenience, prior to breaks, lunch, and other hand-to-mouth activities.

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR CAROLINE AND WILLIAM STREET SITE, KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment *Items in italics are deemed optional as conditions or the FOL or SSO dictate.*	Decontamination Procedures
Mobilization/ demobilization	***Chemical hazards:*** 1) The onsite Hazard Communication Program (Section 5.0 TtNUS Health and Safety Guidance Manual) will be followed. All chemicals brought onto the Site by TtNUS and subcontractor personnel will be inventoried and have an MSDS onsite and on file. This effort shall include: - Accurate Chemical Inventory List (entries will match chemicals brought onsite, as the names appear on the MSDS and the label) This list, which also includes quantities and storage locations, will be provided to local emergency response officials upon request. - MSDSs will be maintained in a central location, accessible to all personnel. - All containers will have labels specifying the following information: - Chemical identity (as it appears on the label, MSDS, and chemical inventory list) - Appropriate warning (i.e., eye and skin irritation, flammable, etc.) - Manufacturer's name, address, and phone number It will be the FOL' s and/or the SSO's responsibility to insure that this is completed. ***Physical hazards:*** 2) Lifting (strains/muscle pulls) 3) Pinches and compressions 4) Slips, trips, and falls 5) Heavy equipment hazards (swinging booms, hydraulic lines, etc.) 6) Vehicular and foot traffic 7) Ambient temperature extremes (heat/cold stress) ***Natural Hazards*:** 8) Inclement weather	1) All personnel will be required to review the appropriate MSDSs prior to the use of a specified chemical substance. This direction should also be communicated on the Safe Work Permit completed for this task. 2) Use machinery or multiple personnel for heavy lifts: - Use proper lifting techniques - Lift with your legs, not your back, and bend your knees; move as close as possible to the load and ensure that good hand holds are available - Minimize the horizontal distance to the center of the lift to your center of gravity - Minimize turning and twisting when lifting, as the lower back is especially vulnerable at this time - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive - Plan your lifts – place heavy items on shelves between the waist and chest and lighter items on higher shelves. - Periods of high-frequency lifts or extended-duration lifts should provide sufficient breaks to guard against fatigue and injury. In determining whether you can lift an item, several factors must be considered, as follows: - Maximum weight lifted by a single person should not exceed 70 pounds. Items over 70 pounds, or the amount you feel you can confidently lift up to 70 pounds, should define a point where assistance in the lift is sought. Other considerations defining lifting hazards: - Area available to maneuver the lift - Area of the lift – workplace clutter, slippery surfaces - Overall physical condition. 3) Keep any machine guarding in place. Do not modify tooling without manufacturer's expressed permission. - Avoid moving parts. - Use tools or equipment where necessary to avoid contacting pinch points. - Adjust machine guarding as necessary to minimize distance between guards and point of operation. - When staging equipment, insure that all stacked loads and/or shelving are adequately secure to avoid creating a hazard from falling objects. - All equipment will undergo a thorough equipment inspection. Mechanized and powered equipment inspections will be documented on the Equipment Inspection Checklist provided in Attachment II. All hand tools will be inspected (handle condition, cutting attachment, as applicable) to insure acceptable condition. 4) Preview work locations for unstable/uneven terrain. - Cover, guard, and barricade all open pits, ditches, and floor openings, as necessary. - As part of Site control efforts, fences shall be constructed to control and isolate traffic in the work area. Fences shall also be constructed to isolate resource or staging areas. - The FOL and the SSO should identify these potential hazards during Site surveys and Site preparation. 5) All equipment will be: - Inspected in accordance with OSHA and manufacturer's design. - Operated by knowledgeable operators and ground crew. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e., boom or mast + 5 feet). - Coordinate with the City of Key West to ensure that all local regulations are being followed. - Foot and vehicular traffic routes shall be well defined. - Heavy equipment patterns/work areas shall be isolated, using the most suitable barricades to keep pedestrians away from the work site. - Bumpers or other suitable traffic stops shall be placed in areas where it is desired that traffic approaching an open excavation stop. - All self-propelled equipment shall be equipped with movement warning systems. - The FOL and/or the SSO (as a precautionary measure to remove or clearly mark physical hazards) shall preview traffic routes (foot and vehicular) before the commitment of personnel and resources. 7) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding heat and cold stress is provided in Section 4.0 of the TtNUS Health and Safety Guidance Manual. 8) Suspend or terminate operations until directed otherwise by SSO.	Not required	Level D - (Minimum Requirements) - Standard field attire (sleeved shirt; long pants) - Steel-toe safety shoes/work boots - Orange traffic safety vest - *Safety glasses* - *Hardhat (when overhead hazards exists or identified as a operation requirement)* - *Reflective vest for high traffic areas* - *Hearing protection for high noise areas, or as required based on the noise level at each operation.* **Note:** The Safe Work Permit(s) for this task (see Attachment III) 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.	Not required

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR
CAROLINE AND WILLIAM STREET SITE, KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Hazard Monitoring	Personal Protective Equipment *Items in italics are deemed optional as conditions or the FOL or SSO dictate.*	Decontamination Procedures
Decontamination of sampling and heavy equipment	***Chemical hazards:*** 1) Air/particulate/waterborne contaminants include SVOCs, Bunker C Fuel Oil, or Fuel Oil #6. Refer to Table 6-1 for specific information regarding this Site contaminant. 2) Decontamination fluids - Liquinox (detergent), isopropanol. ***Physical hazards:*** 3) Lifting (muscle strains and pulls) 4) Pinches and compressions 5) Slips, trips, and falls 6) Vehicular and foot traffic 7) Flying object debris 8) 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 solvents used onsite. Follow the onsite Hazard Communication Plan, as defined in Section 5.0 of the Health and Safety Guidance Manual. Use appropriate PPE, as identified on MSDS. 3) Use multiple persons where necessary for lifting and handling drilling and sampling equipment for decontamination purposes. 4) Provide stacking racks for air drying of decontaminated equipment to prevent unstable drying stacks of equipment from collapsing. 5) The polyethylene lining used in the temporary decontamination pad creates a slip hazard. A light coating of sand may be used to control slip and fall hazards associated with walking on plastic lining. The decon pad should be constructed of sufficient slope to collect water at one end, so personnel will not have to work in standing wash water. - Collect hoses when not in use to control potential tripping hazards. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e., boom or mast + 5 feet). Coordinate with the City of Key West to ensure that all local regulations are being followed. - Foot and vehicular traffic routes shall be well defined. - Heavy equipment patterns shall be isolated, using fences or other suitable barricades, from pedestrian pathways. - Bumpers or other suitable traffic stops shall be placed in areas where it is desired that traffic approaching an open excavation stop. - All self-propelled equipment shall be equipped with movement warning systems. - The FOL and/or the SSO (as a precautionary measure to remove or clearly mark physical hazards) shall preview traffic routes (foot and vehicular) before the commitment of personnel and resources. 7) Equipment and auger decontamination should only occur on Base. The pressure washer unit in excess of 3,000 psi should be equipped with a fan tip of 250 or greater to control potential high-pressure lacerations or puncture wounds. 8) Suspend or terminate operations until directed otherwise by SSO.	Use visual observation and real-time monitoring instrumentation to ensure that all equipment has been properly cleaned of contamination and dried. All sampling equipment that has been decontaminated should be scanned with the PID to ensure removal of the chemical solvent through rinsing.	*For heavy equipment* This applies to high-pressure soap/water, steam cleaning wash, and rinse procedures. Level D minimum requirements - - Standard field attire (sleeved shirt; long pants) - Steel-toe safety shoes/boots - Chemical-resistant boot covers - Nitrile outer and inner gloves - PVC rainsuits or PE- or PVC-coated Tyvek for protection from splash* - Safety glasses underneath a splash shield - *Hearing Protection will be worn when operating pressure washers* *For sampling equipment*, the following PPE is required: Level D minimum requirements - - Standard field attire (sleeved shirt; long pants) - Steel-toe safety shoes - Nitrile outer gloves - Safety glasses underneath a splash shield. In the event of overspray of chemical decontamination fluids, use impermeable aprons as needed. **Note:** The Safe Work Permit(s) for this task (see Attachment III) 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, special considerations, or conditions associated with any identified task. *An impermeable apron may be used in place of splash suits, if they provide sufficient protection from splashing. This alternative may be incorporated to control heat stress during conditions of ambient temperature extremes.	**Personnel decontamination - T**his decontamination procedure for Level D protection will consist of: - Soap/water wash and rinse of outer boots, gloves, and suit, as applicable - Soap/water wash and rinse of outer gloves - Soap/water wash and rinse of the outer splash suit, as applicable - Wash hands and face, leave contamination reduction zone This decontamination will take place onsite and at the centralized decontamination location on Base. **Equipment decontamination** - All heavy equipment decontamination must take place at a centralized decontamination pad on Base. Decontamination, utilizing steam or pressure washers, will be necessary for the augers. Motorized heavy equipment will be positioned on the City streets, thus reducing the potential to carry contaminated soil offsite. However, the wheels and tires should be checked and, if necessary, cleaned prior to transporting to the central decontamination area. Every effort should be taken to ensure that roadways are cleared of any debris resulting from the onsite activity. All equipment used in the Exclusion Zone will require decontamination between locations and prior to removal from the Site. 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.). The FOL or the SSO is required to evaluate all equipment arriving and leaving the Site.

TABLE 5-1
TASKS/HAZARDS/CONTROL MEASURES COMPENDIUM FOR CAROLINE AND WILLIAM STREET SITE, KEY WEST, FLORIDA

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
Geographical surveying	***Chemical hazards:*** **Exposure to potential Site contaminants during surveying activities is highly unlikely, given the nature of surveying work and the limited contact with potentially contaminated media (soils, groundwater, etc.).** ***Physical hazards:*** 1) Slip, trips, and falls 2) Cuts and lacerations ***Natural hazards:*** 3) Natural hazards (Insect/animal bites and stings, poisonous plants) 4) Inclement weather	1) Preview work locations and site lines for uneven and unstable terrain. Clear necessary vegetation and establish temporary means for traversing hazardous terrain (i.e., rope ladders, etc.) 2) If hand tools (brush hooks, machetes, etc.) are necessary to clear and carry lines and bench marks to the area of operation, the following precautions are recommended: - Ensure that handles are of good construction (no cracks, splinters, loose heads/cutting apparatus). - Ensure that all cutting tools are maintained. Blades shall be sharp and without knicks and goudges. - All hand tools (brush hooks, machetes, etc.) with cutting blades shall be provided with sheathes to protect individuals when not in use. - All personnel will maintain a 10-foot perimeter or more around persons clearing brush. 3) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews under conditions of ambient temperature extremes. - Avoid nesting – preview work area and avoid nests, if at all possible. - Wear light-color clothes. This will allow easier detection of ticks and insects crawling on your body. It will also assist in heat stress control. - Use commercially available repellents - Report potential hazards to the SSO. See Section 4.0 of the TtNUS Health and Safety Guidance Manual for additional information concerning natural hazards. 4) Suspend or terminate operations until directed otherwise by SSO.	No air monitoring is required. The potential for exposure to Site contaminants during this activity is considered minimal. .	Surveying 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 - Orange traffic safety vests - *Safety glasses, hard hats (if working near machinery)* - *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 III) 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, 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.
IDW management and moving IDW drums to storage areas	***Chemical hazards:*** 1) Air/particulate/waterborne contaminants include SVOCs, Bunker C Fuel Oil, or Fuel Oil #6. Refer to Table 6-1 for specific information regarding this Site contaminant. 2) Transfer of contamination into clean areas ***Physical hazards:*** 3) Lifting (muscle strains and pulls) 4) Pinches and compressions 5) Vehicular and foot traffic	1) & 2) It is not anticipated that chemical hazards will be significant during this operation, as the IDW will be in sealed containers. It is anticipated that the IDW will represent a limited chemical hazard, if the container is breached. Control measures in this case will represent PPE and good work hygiene practices to control potential exposures during the implementation of the Spill Containment Program (See Section 10.0). 3) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques: - Lift with your legs, not your back, and bend your knees; move as close as possible to the load and ensure that good hand holds are available. - Minimize the horizontal distance to the center of the lift to your center of gravity. - Minimize turning and twisting when lifting, as the lower back is especially vulnerable at this time. - Break lifts into steps if the vertical distance (from the start point to the placement of the lift) is excessive. - Plan your lifts – place heavy items on shelves between the waist and chest and lighter items on higher shelves. - Periods of high-frequency lifts or extended-duration lifts should provide sufficient breaks to guard against fatigue and injury. In determining whether you can lift an item, several factors must be considered as follows: - Maximum weight lifted by a single person should not exceed 70 pounds. Items over 70 pounds, or the amount you feel you can confidently lift up to 70 pounds, should define a point where assistance in the lift is sought. - Area available to maneuver the lift - Area of the lift – workplace clutter, slippery surfaces - Overall physical condition - Material handling devices shall be used where necessary. This includes drum dollies, drum grapplers, etc., to handle drums of IDW. 4) Use tools or equipment where necessary to avoid contacting pinch points. - All hand tools will be inspected (handle condition, cutting attachment, as applicable) to insure acceptable condition. - Satellite storage area – The IDW storage area should be structured as follows: -- 4 drums to a pallet with retaining ring and label on the outside. -- Maintain a minimum of 4 feet between each row of pallets. If the Site is not secured, the satellite storage area shall be fenced and signs placed giving the following information: - Primary point of contact - Phone number - Emergency contact 5) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e., IDW drum loading area + 5 feet). Coordinate with the City of Key West to ensure that all local regulations are being followed. - Foot and vehicular traffic routes shall be well defined. - Heavy equipment patterns shall be isolated, using fences or other suitable barricades, from pedestrian pathways. - Bumpers or other suitable traffic stops shall be placed in areas where it is desired that traffic approaching an open excavation stop. - The FOL and/or the SSO (as a precautionary measure to remove or clearly mark physical hazards) shall preview traffic routes (foot and vehicular) before the commitment of personnel and resources	Excessive chemical contaminant concentrations impacting field crews during this task is not anticipated.	Level D protection will be utilized for the initiation of all IDW activities. Level D protection constitutes the following minimum protection - Standard field dress long pants, long-sleeved shirts - Steel-toe safety shoes - Orange traffic safety vests These following items will be incorporated during IDW operations which require the containers to be open: - Inner nitrile surgeons gloves, layered if necessary - *Hard hat, safety glasses, impermeable boot covers, and earplugs or muffs.* - *Tyvek coveralls will be worn if there is a possibility of soiling work attire* - *PVC or PE-coated Tyvek and boot covers will be incorporated if there is a potential for saturation of work attire.*	**Personnel decontamination** will consist of a soap/water wash and rinse for outer protective equipment (e.g., boots, gloves, PVC splash suits, etc.), as applicable. This function will take place at a satellite location. Disposable PPE will be bagged and placed in appropriate containers for disposal. Containers of IDW must be appropriately labeled, identifying their contents. The decontamination procedures for this task will consist of: - Equipment drop - Soap/water wash and rinse of outer boots - Remove (and dispose of non-reusable) PPE - Wash hands and face, leave contamination reduction zone

6.0 HAZARD ASSESSMENT AND CONTROLS

This section provides reference information regarding the chemical and physical hazards that may be associated with activities to be conducted as part of the scope of work. Table 6-1 provides specific information related to the various chemical hazards that may be present at the planned project areas within NAS Key West. 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

Information provided regarding previous Site activities and potential sources of contamination indicates the following primary contaminants of concern:

- Semivolatile organic compounds (SVOCs), including diesel fuel and specifically Bunker C Fuel Oil, also known as # 6 Burning Oil

Exposure to chemical hazards while performing the elements identified within the scope of work is considered to be minimal, even though the activity is intrusive. This assessment is based on the number of locations to be investigated, the method of extraction, and the contaminant concentrations identified during prior sampling programs. The following information provides a clearer insight to the physical aspects of the chemical.

6.1.1 Bunker C Fuel Oil

"Bunker C fuel oil" is a term that has been used for many years to designate the most thick and sticky of the residual fuels. When steamships were coal-fired, "bunkers" were home for the bins used to hold the coal. As marine diesel engines became prevalent, the term was carried over to include the liquid fuel tanks. At one time, the lighter fuel oils, Bunker A and Bunker B, were also available.

Appearance

Bunker C fuel oil is a sticky, black liquid similar in appearance and smell to asphalt-sealing compounds. At 50° Fahrenheit (F) (10° Centigrade [C]), it has a consistency of liquid honey or corn syrup. At 32° F (0° C), it barely flows.

Origin

"Residual" fuel was originally defined as whatever liquid was left behind in the petroleum distillation unit after the removal of more valuable products like kerosene, diesel, and naphtha. However, this type of fuel

is no longer commonly available. Bunker C oil is currently produced by blending oil remaining after the refining process with a lighter oil.

Use

In addition to being used in the majority of large marine diesel engines, bunker oils are used in power generating stations, industrial boilers and furnaces, and pumping plants. Bunker oil is an inexpensive and readily available source of energy in many parts of the world.

Spill Behavior

Because it is less dense than water, fresh Bunker C fuel oil would float in water, either at or below the surface. As the oil ages or "weathers", it becomes heavier, but would still float under most conditions. If the oil comes into contact with sediment, sand, or other shoreline materials, it may adhere to them and form lumps or tar balls.

Toxicity

Bunker C fuel oil poses little threat to deep-water marine life because it does not disperse into the water column. The main threat to surface and shoreline organisms comes from the possibility of coating or smothering. Because it is a residual oil that contains few volatile organic compounds (VOCs), Bunker C fuel oil is generally not toxic to plants or animals.

6.2 PHYSICAL HAZARDS

The following is a list of physical hazards that may be encountered at the Site or may be present during the performance of Site activities associated with the scope of work.

- Slip, trip, and fall hazards
- Strain/muscle pulls from manual lifting
- Noise in excess of 85 decibels (dBA)
- Exposure to pinch or compression points
- Entanglement or contact with moving or rotating equipment/machinery
- Contact with energized sources (aboveground and underground)
- Heat stress
- Cutting accidents

6.2.1 Heavy Equipment Hazards (Pinch/compression points, rotating equipment, etc.)

Hazards associated with drilling operations are often the most dangerous to be encountered during site activities. The SSO will discuss safe drilling procedures as part of Site-specific training and/or during daily safety meetings using Safe Work Permits (Figure 9-1) presented in this HASP. The following rules will apply to all drilling operations:

- Site personnel will be aware of the location and operation of this equipment
- Each drill rig must be equipped with emergency stop devices, which will be tested daily to ensure that they are operational.
- Long-handled shovels or equivalents shall be used to clear cuttings from the borehole and rotating equipment.

Additional requirements during drilling activities are discussed in Table 5-1. 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.

6.2.2 Cutting Accidents

A number of accidents have occurred recently when field personnel were cut while extracting samples from the acetate liner used in the various types of sampling devices. These injuries are directly related to the manner in which this task is carried out and often result in numerous cuts to hands and legs. The most common error occurs when the liner is sliced while resting it on the sampler's opposite hand or leg.

To minimize this hazard, it is recommended that the Geoprobe© knife system with acetate liner holder be used. This system allows sample acquisition without placing the sampler at risk. In addition, the following safe work practices will also assist in the minimization of this hazard.

- Always cut away from the body and others.
- Never place items to be cut in your hand or on your knee.
- Change knife blades frequently. Many accidents result from struggling with dull cutting edges.

6.3 NATURAL HAZARDS

Insect/animal bites and stings, poisonous plants, and inclement weather are natural hazards that may be present, given the location of activities to be conducted. In general, avoidance of areas of known

infestation or growth will be the preferred exposure control for insects/animals and poisonous plants. Specific discussions on principal hazards of concern follow.

6.3.1 Insect/Animal Bites and Stings

Fire Ants

Various insects and animals may be present at Site locations and should be considered. For example, fire ants present a unique situation when working outdoors in Florida. Their aggressive behavior and ability to sting repeatedly can pose a unique health threat. The sting injects venom (formic acid) that causes an extreme burning sensation. Pustules form which can become infected if scratched. Allergic reactions of people sensitive to the venom include dizziness, swelling, shock and, in extreme cases, unconsciousness and death. People exhibiting such symptoms should see a physician. Fire ants can be identified by their habitat. They build mounds in open sunny areas; these mounds are sometimes supported by a wall or shrub and have no external openings. The size of the mound can range from a few inches across to some that are in excess of 2 feet or more in height and diameter. When a mound is disturbed, the ants defend it by swarming out and over the mound, even running up grass blades and sticks.

Also, areas to be investigated could be prime nesting and/or hiding locations for snakes and other insects. Personnel should avoid reaching into areas that are not visibly clear of snakes or insects. Snake chaps will be worn in areas of known or anticipated snake infestation. 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 any medical condition or allergy, information regarding the condition must be listed on the Medical Data Sheet and the FOL and SSO must also be notified.

Alligators

Alligators live in all Florida counties, but are most common in the major river drainage basins and large lakes in the central and southern portions of the state. They also can be found in marshes, swamps, ponds, drainage canals, phosphate-mine settling ponds, and ditches. Alligators are tolerant of poor water quality and occasionally inhabit brackish marshes along the coast. A few even venture into salt water.

Mature alligators seek open water areas during the April-to-May courtship and breeding season. After mating, the females move into marsh areas to nest in June and early July and remain until the following spring. Males generally prefer open and deeper water year-round. Alligators less than 4 feet long typically

inhabit the marshy areas of lakes and rivers. Dense vegetation in these habitats provides protective cover and many of the preferred foods of young alligators.

- Most human attacks associated with alligators occur when they have been fed by humans or when defending their nests.

- Under no circumstances should Site personnel approach an alligator closely. They are quite agile, even on land. As with any wild animal, alligators merit a measure of respect.

- Alligators are classified as a threatened species and thus enjoy the protection of state and federal law. Only representatives of the Florida Game and Fresh Water Fish Commission are empowered to handle nuisance alligators.

- It is illegal to feed, tease, harass, molest, capture, or kill alligators.

- If a serious problem does exist, contact the Florida Game and Fresh Water Fish Commission.

Ticks

There are various areas throughout the United States. where Lyme Disease is endemic. Fortunately, Florida is not one of these areas. Nonetheless, personnel should be aware of the hazards of tick bites and Lyme Disease. 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) and performing frequent body checks will prevent long-term tick attachment. Site first-aid kits should be equipped with medical forceps and rubbing alcohol to assist in tick removal. For information regarding tick removal procedures and symptoms of exposure, consult Section 4.0 of the Health and Safety Guidance Manual.

6.3.2 Inclement Weather

Project tasks under this scope of work will be performed outdoors and near water. As a result, inclement weather may be encountered. In the event that adverse weather conditions arise (electrical storms, hurricanes, etc.), the FOL and/or the SSO will be responsible for temporarily suspending or terminating activities until hazardous conditions no longer exist.

Tropical Storms and Hurricanes

As the Florida Keys are located in a tropical storm and hurricane-prone area, the following information is supplied to explain the potential severity of these natural hazards. The decision to curtail operations and evacuate an area should be made by the FOL, Poject Manager, 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 or 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 when it makes landfall.

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). Table 6-2 compares the types of storms and hurricanes and corresponding wind speeds.

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

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

In addition to strong winds, there is the threat of debris (i.e., building materials, 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 occur with tropical storms. However, the primary threat is not the intensity of rain, but the duration of rainfall. Because 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 and is exacerbated by locally heavier rains from thunderstorms.

Storm Surge

A storm surge is an abnormal rise in sea level that accompanies 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. Table 6-3 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. Local officials should prepare for possible evacuation.
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. Local officials should prepare for possible evacuation.
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 National Oceanic and Atmospheric Administration (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.

6.3.3 Heat Stress

Given the geographic location of the Site and the project schedule, overexposure to high ambient temperatures (heat stress) may exist during performance of this work. Extremely cold temperatures are not expected to be encountered, due to the project location. Work performed when ambient temperatures exceed 70 ^{o}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. Additional information reguarding Work-Rest Regimens and personnel monitoring may be found in Section 4.0 of the Health & Safety Guidance Manual. Many of the physical hazards are also discussed in detail in Section 4.0 of the Health and Safety Guidance Manual. Additional information regarding physical hazards associated with the Site is provided in Table 5-1 of this HASP.

7.0 AIR MONITORING

Flame ionization detectors (FIDs) will be used at the Site to detect and evaluate the presence of contaminants and other potentially hazardous conditions. As a result, specific air monitoring measures and requirements are established in Table 5-1 as they pertain to the specific hazards and tasks of an identified operation. Additionally, the TtNUS Health and Safety Guidance Manual, Section 1.0, contains detailed information regarding air monitoring instrumentation, as well as general calibration procedures for various instruments.

7.1 INSTRUMENTS AND USE

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

A photoionization detector with a lamp energy of 10.6 electron volt or higher, or an FID will be used to measure the concentration of airborne organic combustible gases and vapors in air.

Prior to commencement of any field activities, the background levels of the Site must be determined and noted. Daily background readings will be taken away from any areas of potential contamination. These readings, any influencing conditions (i.e., weather, temperature, humidity), locations, and other information will be specified in the field operations logbook or other site documentation (e.g., sample log sheet).

7.1.1 Hazard Monitoring Frequency

Table 5-1 presents the frequencies at which hazard monitoring will be performed, as well as the action levels that will initiate use of elevated levels of protection. The SSO may decide to increase these frequencies, based on instrument responses and Site observations. The frequency at 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 all instruments each day prior to their use. Field calibration will be performed on instruments according to manufacturers'

recommendations (for example, the FID must be field calibrated daily and an additional field calibration must be performed at the end of each day to determine any 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 manufacturers' recommendations, and with the applicable manufacturer standard operating procedure (copies of which can be found in the TtNUS Health & Safety Guidance Manual, which 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 be recorded instead in a field operations logbook, provided that all of the information specified in Figure 7-1 is recorded. This required information includes the following:

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

7.2.1 Cylinder Safety

If the FID is used, it requires refilling onsite from a hydrogen cylinder. Because hydrogen is a flammable gas, certain precautions must be observed when refilling the FID. See Attachment V of this HASP.

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 TtNUS personnel participating in onsite activities. All TtNUS personnel must complete 40 hours of introductory hazardous waste site training prior to performing work at NAS Key West. TtNUS personnel who have had introductory training more than 12 months prior to 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 at the Site. Copies of certificates or other official documentation will be used to fulfill this requirement.

8.1.1 Requirements for Subcontractors

Identified 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) prior to performing field work at NAS Key West. 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. This letter will be accompanied by training certificates or some other form of official documentation for all subcontractor personnel participating in Site activities.

FIGURE 8-1
EXAMPLE TRAINING LETTER

The following statements must be typed on company letterhead and 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. Charles Bryan
Task Order Manager
Tetra Tech NUS, Inc.
900 Trail Ridge Road
Aiken, South Carolina 29803

Subject: HAZWOPER Training for Naval Air Station Key West, Florida

Dear Mr. Bryan:

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 all 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 126.

I also understand that Title 29 CFR 1910.120, entitled "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 any 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 all TtNUS personnel who will perform work on this project. 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 personal protective equipment
- Safe use of engineering controls and equipment
- Work practices to minimize risks from hazards
- Medical surveillance requirements
- Contents of the Health and Safety Plan
- Signs and symptoms of overexposure to site contaminants
- Contents of the Health and Safety Plan
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of the contents of relevant MSDSs
- Emergency response procedures (evacuation and assembly points)
- Associated hazards and restricted areas within the NAS Key West.

Site-specific training documentation will be established through the use of Figure 8-2.

8.3 MEDICAL SURVEILLANCE

All TtNUS personnel participating in project field activities will have had a physical examination that meets the requirements of TtNUS's medical surveillance program. Documentation for medical clearances will be maintained in the TtNUS Pittsburgh, PA, office and made available as needed.

8.3.1 Medical Surveillance Requirements for Subcontractors

Identified subcontractor personnel 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, provided that 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 the "Subcontractor Medical Approval Form" with a letter, on company letterhead, containing all of the information in the example letter presented in Figure 8-4 of this HASP.

FIGURE 8-2
SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing remedial investigation activities at NAS Key West, Florida, and that I have received site-specific training which 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 personal protective equipment
- Safe use of engineering controls and equipment
- Work practices to minimize risks from hazards
- Medical surveillance requirements
- Contents of the Health and Safety Plan
- Signs and symptoms of overexposure to site contaminants
- Contents of the Health and Safety Plan
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of the contents of relevant MSDSs
- Emergency response procedures (evacuation and assembly points)
- Associated hazards and restricted areas within the NAS Key West.

I state that I have been given the opportunity to ask questions and that all of my questions have been answered to my satisfaction. I further state, by presence of my signature below, that 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

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 found to be medically -

   ( ) qualified to perform work at the NAS Key West work site
   ( ) not qualified to perform work at the NAS Key West work site

   and,

2. Undergone a physical examination as per OSHA 29 CFR 1910.134(b)(10) and 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 personal protective equipment used or to be used.
( ) Information from previous medical examinations of the employee which 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
PAGE TWO

1. Results of the medical examination and tests (excluding finding 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 upon the employee's assigned work:

   _____
   _____
   _____

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

Based on the information provided to me, and in view of the activities and hazard potentials involved at the NAS Key West 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
EXAMPLE
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. Charles Bryan
Task Order Manager
Tetra Tech NUS, Inc.
900 Trail Ridge Road
Aiken, South Carolina 29803

Subject: HAZWOPER Training for NAS Key West, Florida

Dear Mr. Bryan:

As an officer of XYZ Corporation, I hereby state that the persons listed below participate 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, entitled "Hazardous Waste Operations and Emergency Response. 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 license 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 for NAS Key West at the Caroline & William Street Site.

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

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

Sincerely,

(Name and Title of Company Officer)

8.3.2 Requirements for All Field Personnel

Each field team member (including subcontractors) and visitors entering the Exclusion Zone(s) will be required to complete and submit a copy of Medical Data Sheet found in the TtNUS Health and Safety Guidance Manual. This will be provided to the SSO, prior to participating in Site activities. The purpose of this document is to provide Site personnel and emergency responders with additional information that may be necessary in order to administer medical attention.

8.4 SUBCONTRACTOR EXCEPTIONS

In situations in which the Exclusion Zone is not entered or when there is no potential for exposure to Site contaminants, subcontractor personnel may be exempt from some of the training and medical surveillance requirements. All subcontractors and visiting personnel are required to receive Site-specific training (as discussed in Section 8.2) regarding information provided in this HASP. Examples of subcontractors who may be exempt from training and medical surveillance requirements could include surveyors who perform surveying activities at the Site perimeters or in areas were there is no potential for exposure to Site contaminants and, in this case, the subcontractor providing concrete coring services.

The use of the subcontractor exception is strictly limited to the authority of the CLEAN HSM.

9.0 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 fractured three-zone approach will be used during work at this Site. This three-zone approach will utilize an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone. It is also anticipated that this 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.

9.1 EXCLUSION ZONE

The Exclusion Zone will consist of those areas of active operations plus an established safety zone, depending on the task. The following represent Exclusion Zone boundaries for the following identified tasks:

- Monitoring Well Installation – The boundary perimeter will be established by determining the height of the mast, plus five feet. Therefore, a 35-foot mast plus 5 feet equals a 40-foot boundary surrounding the point of operation.

- Groundwater sampling – 10 feet surrounding the well head.

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

Where appropriate and necessary to direct facility personnel, the Exclusion Zone will be delineated by barrier tape, cones and/or drive poles, and postings.

9.1.1 Exclusion Zone Clearance

A pre-startup Site visit will be conducted by members of the identified field team to identify proposed subsurface investigation locations, conduct utility clearances, and provide upfront notices concerning scheduled activities within the facility.

In all cases, no subsurface activities will proceed without utility clearances. In the event that a utility is struck during a subsurface investigative activity, the emergency numbers provided in Table 2-1 will be called.

When Base personnel are working near this operation, they will be moved or their work temporarily discontinued to remove them from potential hazards associated with this operation.

9.2 CONTAMINATION REDUCTION ZONE

The contamination Reduction Zone (CRZ) will be a buffer area between the Exclusion Zone and any area of the Site in which contamination is not suspected. This area will also serve as a focal point for supporting Exclusion Zone activities. The area will be delineated with barrier tape, cones, and postings to inform and direct facility personnel. Decontamination will be conducted at a central location. All potentially contaminated equipment will be bagged and taken to that location for decontamination. Given this consideration, equipment required to complete this operation may include hand augers and stainless steel bowls and spatulas for each location.

9.3 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. In all cases, 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.

9.4 SAFE WORK PERMITS

All Exclusion Zone activities conducted in support of this project will be done using this HASP as a reference guide and Safe Work Permits to incorporate Site-specific information to guide and direct field crews on a task-by-task basis. An example of the Safe Work Permit to be used during Site activities is illustrated in Figure 9-1. All permits will be issued by the SSO in the morning prior to the beginning of onsite activities. Partially completed Safe Work Permits are included in Attachment III of this HASP.

Safe Work Permits are to be completed in accordance with the specifications contained in Table 5-1 and the other sections of the HASP, as appropriate.

FIGURE 9-1
SAFE WORK PERMIT

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

SECTION I: General Job Scope

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

V. Protective equipment required
Level D ☐ Level B ☐
Level C ☐ Level A ☐
Detailed on Reverse

Respiratory equipment required

Full face APR	☐	Escape Pack	☐
Half face APR	☐	SCBA	☐
SAR	☐	Bottle Trailer	☐
Skid Rig	☐	None	☐

Modifications/Exceptions: _____

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

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes ☐ No		Hearing Protection (Plugs/Muffs)	☐ Yes ☐ No	
Safety Glasses	☐ Yes ☐ No		Safety belt/harness	☐ Yes ☐ No	
Chemical/splash goggles	☐ Yes ☐ No		Radio	☐ Yes ☐ No	
Splash Shield	☐ Yes ☐ No		Barricades	☐ Yes ☐ No	
Splash suits/coveralls	☐ Yes ☐ No		Gloves (Type - Work)	☐ Yes ☐ No	
Steel toe Work shoes or boots	☐ Yes ☐ No		Work/rest regimen	☐ Yes ☐ No	

Modifications/Exceptions _____

VIII. 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	☐	☐

IX. Site Preparation

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

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

XI. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____

All personnel identified on the permit as participating in the task will be made aware of its contents by the supervisor accepting the permit. The supervisor will document on the permit any unusual situations that may occur throughout the task.

All permits will be returned to the FOL or the SSO at the end of each day.

9.5 SITE VISITORS

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

- Personnel invited by TtNUS to observe or participate in operations
- Regulatory personnel (i.e., U.S. Department of Defense (DOD), U.S. Environmental Protection Agency (EPA), (OSHA), Florida Department of Environmental Protection (FDEP), etc.)
- Southern Division Navy personnel
- Other authorized visitors.

All non-DOD personnel working on this project are required to gain initial access to the Base by coordinating with the TtNUS FOL (or designee) and following established Base access procedures.

Once access to the Base is obtained, all personnel who require access into areas of ongoing operations will be required to obtain permission from the FOL and the Base contact. Upon gaining access to the Site, all visitors wishing to observe operations in progress will be escorted by a TtNUS representative and will 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 will include information attesting to applicable training and medical surveillance, as stipulated in Section 8.0 of this document. In addition, to enter Site operational zones during planned activities, all visitors will be required to first go through Site-specific training covering the topics stipulated in Section 8.2 of this HASP.

Once 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 restrictions in effect at the Site at the time

of their visit. All visitors entering the Exclusion Zones during ongoing operations will be accompanied by a TtNUS representative. Any and all visitors not meeting the requirements stipulated in this plan for Site clearance will not be permitted to enter the operational zones during planned activities. Any incidence of unauthorized Site visitation will cause the termination of all onsite activities until the unauthorized visitor is removed from the premises. Removal of unauthorized visitors will be accomplished with support from the Base contact, who will be notified of any unauthorized visitors.

9.6 SITE SECURITY

Site security will be accomplished using TtNUS field personnel. TtNUS will retain complete control over active operational areas. As this activity takes place at a Navy facility open to public access, the first lines of security will be Exclusive Zone barriers, Site work permits, and any existing barriers at the Site to restrict the general public. The second line of security will occur at the work Site, referring interested parties to the Base contact. The Base contact will serve as a focal point for Base personnel and interested parties, and serve as the final line of security and the primary enforcement contact.

9.7 SITE MAP

Once the areas of contamination, access routes, topography, and dispersion routes are determined, a Site map will be generated and adjusted as Site conditions change. These maps will be posted to illustrate up-to-date collections of contaminants and adjustments of zones and access points.

9.8 BUDDY SYSTEM

Personnel engaged in onsite activities will practice the "buddy system" to ensure the safety of all personnel involved in this operation.

9.9 MATERIAL SAFETY DATA SHEET (MSDS) REQUIREMENTS

TtNUS and subcontractor personnel will provide MSDSs for all chemicals brought onsite. The contents of these documents will be reviewed by the SSO with user(s) of the chemical substances prior to any actual onsite use or application of the substances. An inventory of all chemicals used onsite will be developed, using the Health and Safety Guidance Manual. The MSDSs will then be maintained in a central location (i.e., temporary office) and will be available for anyone to review upon request.

9.10 COMMUNICATION

As personnel will be working in proximity to one another during field activities, a supported means of communication between field crew members will not be necessary.

External communication will be accomplished by using cellular telephones. External communication will primarily be used for resource and emergency resource communications. Prior to the commencement of activities at the Caroline and William Street Site, the FOL will determine and arrange for telephone communications.

10.0 SPILL CONTAINMENT PROGRAM

10.1 SCOPE AND APPLICATION

It is anticipated that quantities of potentially hazardous bulk materials (greater than 55 gallons) will not be handled during the Site activities. However, it is possible that, as the job progresses, disposable PPE and other non-reusable items may be generated. As needed, 55-gallon drums will be used to contain unwanted items generated during sampling activities. The drum(s) will be labeled with the Site name and address, the type of contents, and the date the container was filled, as well as an identified contact person. As warranted, samples will be collected and analyzed to characterize the material and determine appropriate disposal measures. Once characterized, the drum(s) will be removed from the staging area and disposed of in accordance with federal, state and local regulations. Given the likely solid nature of drum contents, a comprehensive Spill Containment Program is not necessary. The following discussion is provided as contingency information only.

10.2 POTENTIAL SPILL AREAS

If drums contain liquid wastes, potential spill areas will be monitored in an ongoing attempt to prevent and control further potential contamination of the environment. Areas designated for handling, loading, and unloading of potentially contaminated waters and debris present limited potential for leaks or spills.

All drums/containers used for holding liquids will be sealed, labeled, and staged within a centralized area while awaiting shipment or disposal.

10.3 LEAK AND SPILL DETECTION

To establish 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 into a new container, using a hand pump. 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, and/or sand, which may be stored at the staging area in a conspicuously marked drum. This material will also be containerized for disposal, pending analyses. All inspections will be documented in the Project Logbook.

10.4 PERSONNEL TRAINING AND SPILL PREVENTION

All personnel will be instructed on the procedures for spill prevention, containment, and collection of hazardous materials during the Site-specific training. The FOL and/or the SSO will serve as the Spill Response Coordinator for this operation, should the need arise.

10.5 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 Containment Program (depending on the likelihood that drums and/or liquid wastes are generated):

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

10.6 SPILL CONTROL PLAN

This section describes the procedures the TtNUS field crew members will employ upon detection of a spill or leak.

1) Notify the SSO or FOL immediately.

2) Take immediate actions to stop the leak or spill by plugging or patching the drum or raising the leak to the highest point. Avoid contacting drum contents. Spread the absorbent material in the area of the spill, covering it completely.

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

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 which 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
- Contains a material that has the potential to engulf an entrant
- 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 any 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 need to be addressed.

12.0 MATERIALS AND DOCUMENTATION

The TtNUS FOL will ensure that 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 all 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 where 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 all chemicals brought onsite, including decontamination solutions, sample preservatives, fuel, etc. The list should be posted in a central area.

MSDS (maintained) - The MSDSs should also be in a central area that is accessible to all Site personnel. These documents should match all listings on the chemical inventory list for all substances employed onsite. It is acceptable to have these documents within a central folder with the chemical inventory serving 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). The list identifies all Site personnel, dates of training (including Site-specific training), and medical

surveillance. The list indicates both clearance and 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 all phone communication points and in each Site vehicle.

Medical Data Sheets/Cards (maintained) - Medical Data Sheets will be filled out by onsite personnel and filed in a central location. The Medical Data Sheet will accompany any personnel having an injury or illness that requires medical attention to the medical facility. A copy of this sheet or a wallet card will be given to all personnel and is to be carried on their person.

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

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 DOT placards and acceptable (Hazard Communication 29 CFR 1910.1200(f)) labels.

The purpose of maintaining or posting this information, as stated above, is to allow Site personnel quick access. Variations concerning locations and methods of presentation are acceptable, provided that the objective is accomplished.

13.0 ACRONYMS/ABBREVIATIONS

C	Centigrade (degrees)
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action, Navy
CRZ	Contamination Reduction Zone
CTO	Contract Task Order
dBA	Decibel
DOD	U.S. Department of Defense
DOT	U.S. Department of Transportation
DPT	Direct Push Technology
EPA	U.S. Environmental Protection Agency
F	Fahrenheit (degrees)
FDEP	Florida Department of Environmental Protection
FID	Flame Ionization Detector
FOL	Field Operations Leader
HASP	Health and Safety Plan
HSA	Hollow Stem Auger
HSM	Health and Safety Manager
IDW	Investigation-derived waste
MSDS	Material Safety Data Sheet
NAS	Naval Air Station
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PHSO	Project Health and Safety Officer
PPE	Personal Protective Equipment
SSO	Site Safety Officer
SVOCs	Semivolatile Organic Compounds
TOM	Task Order Manager
TtNUS	Tetra Tech NUS, Inc.
VOCs	Volatile Organic Compounds

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 Diethorn 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.

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. _____

TETRA TECH NUS, INC.
INJURY/ILLNESS PROCEDURE
WORKER'S COMPENSATION PROGRAM

To: Corporate Health and Safety Manager
Human Resource Administrator

Prepared by: _____

Position: _____

Project Name: _____

Office: _____

Project No. _____

Telephone: _____

Information Regarding Injured or Ill Employee:

Name: _____ Office: _____

Home address: _____ Gender: M ☐ F ☐ No. of dependents: _____

_____ Marital status: _____

Home telephone: _____ Date of birth: _____

Occupation (regular job title): _____ Social Security No.: _____

Department: _____

Date of Accident: _____ **Time of Accident:** _____

Location of Accident Was place of accident or exposure on employer's premises Yes ☐ No ☐

Street address: _____

City, state, and zip code: _____

County: _____

Narrative Description of How Accident Occurred: (Be specific. Explain what the employee was doing and how the accident occurred.)

TETRA TECH, INC.
INJURY/ILLNESS REPORT

Did employee die? Yes ☐ No ☐
Was employee performing regular job duties? Yes ☐ No ☐
Was safety equipment provided? Yes ☐ No ☐
Was safety equipment used? Yes ☐ No ☐
Note: Attach any police reports or related diagrams to this accident report.

Witness(es):

Name:

Address:

Telephone:

Describe the Illness or Injury and Part of Body Affected:

Name the Object or Substance which Directly Injured the Employee:

Medical Treatment Required:

☐ No ☐ Yes ☐ First Aid Only

Physician's Name: _____

Address: _____

Hospital or Office Name: _____

Address: _____

_____

Telephone No.: _____

Lost Work Days:

☐ No. of Lost Work Days _____

Last Date Worked _____

Time Employee Left Work _____

Date Employee Returned to Work _____

☐ No. of Restricted Work Days _____

☐ None

Corrective Action(s) Taken by Unit Reporting the Accident:

Corrective Action Still to be Taken (by whom and when):

Name of Tetra Tech employee the injury or illness was first reported to: _____

Date of Report: _____ Time of Report: _____

	Printed Name	**Signature**	**Telephone No.**	**Date**
Project or Office Manager				
Site Safety Coordinator				
Injured Employee				

To be completed by Human Resources:

Date of hire: Hire date in current job:

Wage information: $ _____ per _____ (hour, day, week, or month)

Position at time of hire:

Shift hours:

State in which employee was hired:

Status: ☐ Full-time ☐ Part-time Hours per week: _____ Days per week: _____

Temporary job end date:

To be completed during report to workers' compensation insurance carrier:

Date reported: Reported by:

TeleClaim phone number:

TeleClaim account number:

Location code:

Confirmation number:

Name of contact:

Field office of claims adjuster:

ATTACHMENT II

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?

Identification:

- 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 III

SAFE WORK PERMITS

SAFE WORK PERMIT
MOBILIZATION AND DEMOBILIZATION ACTIVITIES
CAROLINE & WILLIAM STREET SITE
NAS KEY WEST, FLORIDA

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	☐
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 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 surveying 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 natrual hazards (e.g., ticks). Traffic Safety Vest will be worn at all times while on-site.

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	☒	☐

IX. Site Preparation

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

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

XI. Special instructions, precautions: Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Avoid potential nesting areas. Minimize contact with potentially contaminated media. Suspend site activities in the event of inclement weather.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
SOIL BORING OPRATIONS
CAROLINE & WILLIAM STREET SITE
NAS KEY WEST, FLORIDA

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

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Monitoring Well installation, using direct push technology and hollow stem auger including purging and development.

II. Required Monitoring Instruments: PID with 10.6 eV lamp or FID

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	☐
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
Bunker C Fuel Oil	Any sustained readings above 50 ppm levels in worker breathing zones.	Suspend site activities and report to an unaffected area.

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 if saturation or work cloths may occur. Traffic Safety Vest will be worn at all times while on-site.

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	☒	☐

IX. Site Preparation

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

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

XI. Special instructions, precautions. The TtNUS SOP on Utility Location and Excavation Clearance will be followed for all subsurface activities.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
GROUNDWATER AND IDW SAMPLING
CAROLINE & WILLIAM STREET SITE
NAS KEY WEST, FLORIDA

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

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Groundwater and IDW sampling.

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

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	☐
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

Chemicals of Concern	Action Level(s)	Response Measures
Bunker C Fuel Oil	Any sustained readings above 50 ppm in worker breathing zones.	Suspend site activities and report to an unaffected area.

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 if saturation or work cloths may occur. Traffic Safety Vest will be worn at all times while on-site

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	☒	☐

IX. Site Preparation

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

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

XI. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
GROUNDWATER AND IDW SAMPLING
CAROLINE & WILLIAM STREET SITE
NAS KEY WEST, FLORIDA

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). 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 and drilling.

II. Required Monitoring Instrument(s): PID with 10.6 eV lampl or FID

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)

V. Protective equipment required
Level D ☒ Level B ☐
Level C ☐ Level A ☐
Detailed on Reverse

Respiratory equipment required

Full face APR	☐	Escape Pack	☐
Half face APR	☐	SCBA	☐
SKA-PAC SAR	☐	Bottle Trailer	☐
Skid Rig	☐	None	☒

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.

VI. Chemicals of Concern	Action Level(s)	Response Measures
Bunker C Fuel Oil and decon solutions	Elevated readings are not anticipated to be encountered	If airborne readings are observed, report to an unaffected area

VII. Additional Safety Equipment/Procedures

Hard-hat	☐ Yes	☒ No	Hearing Protection (Plugs/Muffs)	☒ Yes	☐ No
Safety Glasses	☒ Yes	☐ No	Safety belt/harness	☐ Yes	☒ No
Chemical/splash goggles	☐ Yes	☒ No	Radio	☐ Yes	☒ No
Splash Shield	☒ Yes	☐ No	Barricades	☐ Yes	☒ No
Splash suits/coveralls	☒ Yes	☐ No	Gloves (Type - 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. Traffic Safety Vest will be worn at all times while on-site

VIII. 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	☒	☐

IX. Site Preparation

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

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

XI. Special instructions, precautions: Chemical hazards with decontamination because of use of fluids such as isopropyl alcohol, methanol, etc. To minimize the potential for exposure, site personnel will use PPE and prevent contact with potentially contaminated equipment. Refer to the manufacturer's MSDS regarding PPE, handling, storage, and first-aid measures related to decontamination fluids.

Permit Issued by: _____ Permit Accepted by: _____

ATTACHMENT IV

STANDARD OPERATING PROCEDURE
FOR
UTILITY LOCATING
AND
EXCAVATION CLEARANCE

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number HS-1.0	Page 1 of 11
		Effective Date 03/00	Revision 1
		Applicability Tetra Tech NUS, Inc.	
		Prepared Health & Safety	
Subject UTILITY LOCATING AND EXCAVATION CLEARANCE		Approved D. Senovich	

TABLE OF CONTENTS

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

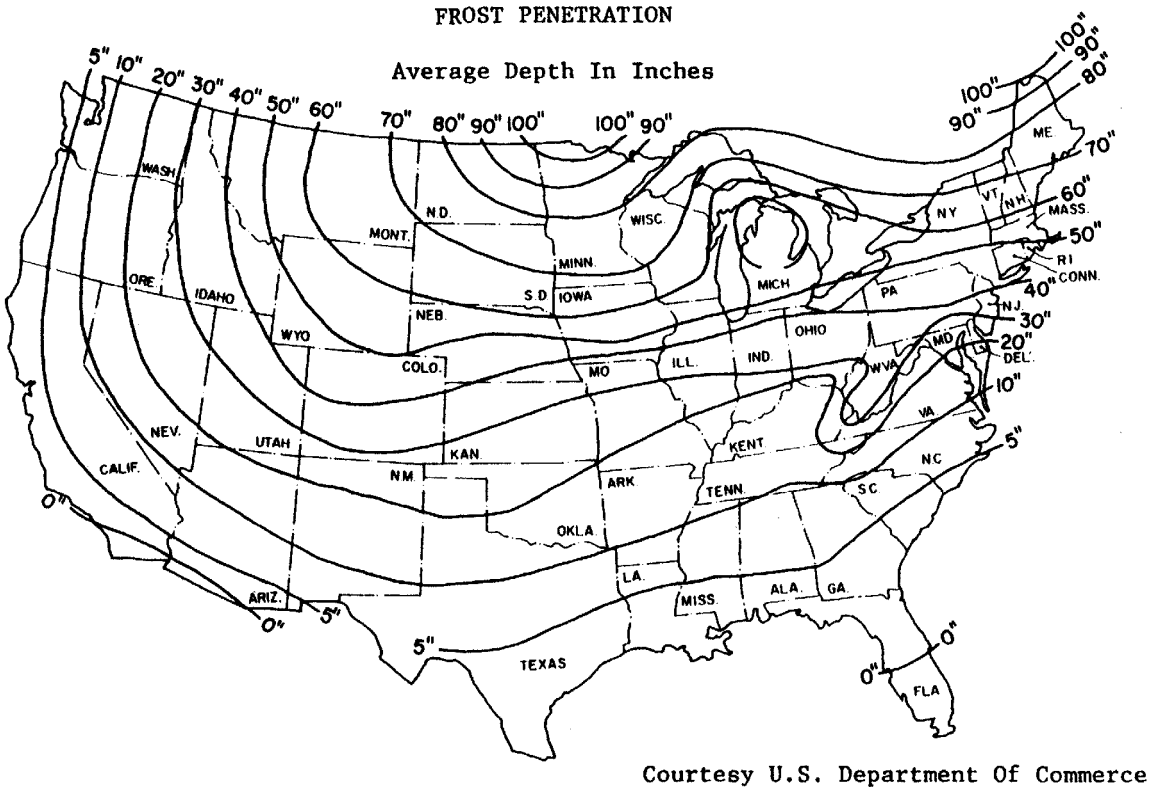
Wyoming One-Call
(800) 348-1030

Utilities Underground Location Center
(800) 454-5555

Converse County Utility Coordination Council
(800) 562-5561

ATTACHMENT 2

FROST LINE PENETRATION DEPTHS BY GEOGRAPHIC LOCATION



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: _____

_____

			Circle One
1.	Underground Utilities		
	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

			Present Absent
2.	Overhead Utilities		
	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 V

COMPRESSED GAS CYLINDER SAFETY PROCEDURE

TETRA TECH NUS
COMPRESSED GAS CYLINDER SAFETY PROCEDURE

OBJECTIVE

The objective of this procedure is to minimize the hazards and reduce the risk of injury from the handling, storage and use of compressed gases including:

- Span and Calibration gases
- Hydrogen
- Nitrogen
- Breathing Air

PURPOSE

The purpose of this procedure is to establish the minimum safety requirements for the handling, use and storage of compressed gasses.

RESPONSIBILITY

It is the responsibility of the Field Operations Leader (FOL)/ Site Safety Officer (SSO) to assure that all compressed gas cylinders are handled stored and used according to the procedures outlined in this document. Further, the FOL/SSO shall ensure that affected TtNUS personnel are trained in the safe handling procedures for compressed gases present at the site.

REQUIREMENTS

OSHA requires:

Each employer shall determine that compressed gas cylinders under his control are in a safe condition to the extent that this can be determined by visual inspection. Visual and other inspections shall be conducted as prescribed in the Hazardous Materials Regulations of the Department of Transportation (49 CFR parts 171-179 and 14 CFR part 103).

Each portable container shall be legibly marked with the name "Hydrogen" in accordance with "Marking Portable Compressed Gas Containers to Identify the Material Contained" ANSI Z48.1-1954, which is incorporated by reference as specified in Sec. 1910.6. Each manifolded hydrogen supply unit shall be legibly marked with the name Hydrogen or a legend such as "This unit contains hydrogen."

The hydrogen storage location shall be permanently placarded as follows: "HYDROGEN - FLAMMABLE GAS - NO SMOKING - NO OPEN FLAMES," or equivalent.

The following items will assist Tetra Tech NUS, Inc. field personnel in using and maintaining compressed gas cylinders in a safe manner.

Storage

#	Yes	No	Description
1			Compressed hydrogen, breathing air, and nitrogen cylinders must be stored ***outside*** of buildings and away from doors, windows, electrical lines and building air intakes.
2			Compressed gas cylinders must be protected from adverse weather, heat, and any other type of adverse atmosphere.
3			The storage area should be paved and easily accessible to delivery trucks and users.
4			Cylinders must be secured and locked in an upright position with chains or straps and secured to a poll or post
5			Cylinder storage areas must be designed to prevent flame and spark contact with the cylinders.
6			Empty cylinders are to be stored separately from full cylinders, and tagged with surveyor tape.
7			Warning signs must be posted prohibiting open flames within 50 feet of the cylinder.

Transporting

When transporting cylinders they must be secured to prevent rolling or cylinder damage. Cylinders shall only be transported in a van or pick-up truck, and only when the valve cap is secured. Department of Transportation (DOT) regulations prohibit TtNUS personnel from transporting compressed gas cylinders on public highways at any time (Eg: transporting cylinders from the vendor location to the work site). Span gases are exempted from this requirement, as they are considered to be in consumer quantity and are not regulated by DOT when transporting the cylinder in a vehicle. Shipment by a common carrier is considered a hazardous shipment and is regulated.

When moving cylinders on the ground use a two-wheeled cart or other material handling equipment specifically designed for that purpose.

Usage

#	Yes	No	Description
1			A pressure-reducing regulator must be connected to the compressed gas cylinder before usage. The cylinder shut-off valve cannot be used to control the gas discharge rate.
2			A pressure relief device must be used with hazardous compressed gases and the pressure relief system must be designed to operate and vent safely.
3			Cylinders of hydrogen, breathing air and nitrogen must be secured during usage and located in a ventilated area.
4			Operating procedures prohibit the use of oil and grease as lubricants with all system fittings.

References

"Safe Handling of Compressed Gases in Containers", Compressed Gas Association, Arlington, VA 22202.

Handbook of Compressed Gases, Compressed Gas Association, Arlington, VA 22202

Code of Federal Regulations, Title 29 Part 1910, Subpart H – Hazardous Materials

APPENDIX C

STANDARD OPERATING PROCEDURES AND SAMPLE FORMS

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number SA-6.3	Page 1 of 37
		Effective Date 01/00	Revision 1
		Applicability Tetra Tech NUS, Inc.	
		Prepared Earth Sciences Department	
Subject FIELD DOCUMENTATION		Approved D. Senovich	

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

ATTACHMENTS (EXAMPLES) **PAGE**

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: / Time: / Method:	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^{0}C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other

PURGE DATA:

	Volume	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date:								
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. (^{0}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: / Time: / Method: / Monitor Reading (ppm):	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)

COMPOSITE SAMPLE DATA:

Date: / Method: / Monitor Readings (Range in ppm):	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

ATTACHMENT B-4

CONTAINER SAMPLE & INSPECTION SHEET

Tetra Tech NUS, Inc.

Page____ of ____

Project Site Name: _____
Project Number: _____
Site Identification: _____
Container Number(s): _____
Sample Type: () Grab
() Composite

Sample ID No. _____
Sampled By: _____
C.O.C. No. _____
Concentration: () High
() Medium
() Low

CONTAINER SOURCE

DRUM:
() Bung Top
() Lever Lock
() Bolted Ring
() Other _____

TANK:
() Plastic
() Metal
() Other _____

OTHER: _____

CONTAINER DESCRIPTION

COLOR: _____

CONDITION: _____

MARKINGS: _____

VOL. OF CONTENTS: _____

OTHER: _____

CONTAINER DISPOSITION

SAMPLED: _____

OPENED BUT NOT SAMPLED:
Reason _____
_____

NOT OPENED:
Reason _____
_____

CONTENTS DESCRIPTION

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 orH
% of Total Volume	_____	_____	_____

MONITOR READING:

SAMPLE and /or INSPECTION DATE & TIME:
_____HRS.
METHOD:_____

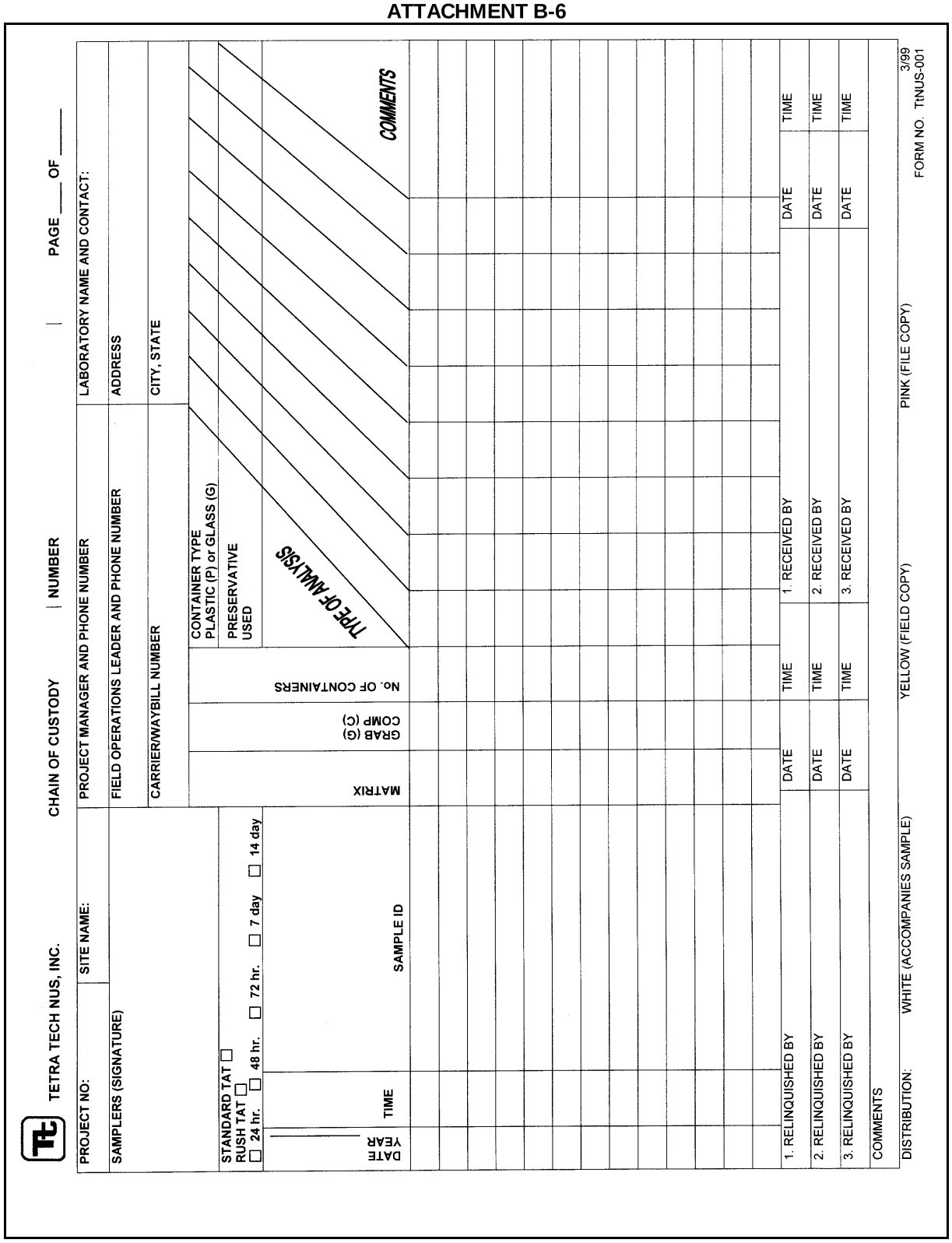
SAMPLER(S) and / or INSPECTOR(S) SIGNATURE:

ANALYSIS:

ATTACHMENT B-5

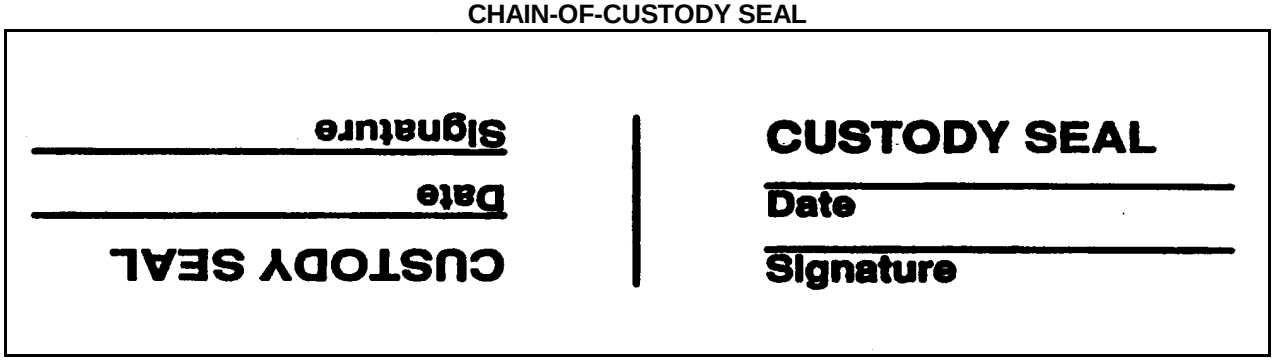
Tetra Tech NUS, Inc. 661 Andersen Drive Pittsburgh, 15220 (412)921-7090	**Project:** **Site:** **Location:**	
Sample No:		**Matrix:**
Date:	**Time:**	**Preserve:**
Analysis:		
Sampled by:	**Laboratory:**	

ATTACHMENT B-6



ATTACHMENT B-7

CHAIN-OF-CUSTODY SEAL



ATTACHMENT B-8

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc. 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:

Date: / Time: / Method:	Color (Visual)	pH (S.U.)	S.C. (mS/cm)	Temp. (^{0}C)	Turbidity (NTU)	DO (mg/l)	Salinity (%)	Other

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:

Analysis Time: _____
Equipment: HACH Digital Titrator AL-DT CHEMetrics (Range: _____mg/L) 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)

FIELD ANALYTICAL LOG SHEET
GEOCHEMICAL PARAMETERS

Tetra Tech NUS, Inc.

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** ______________

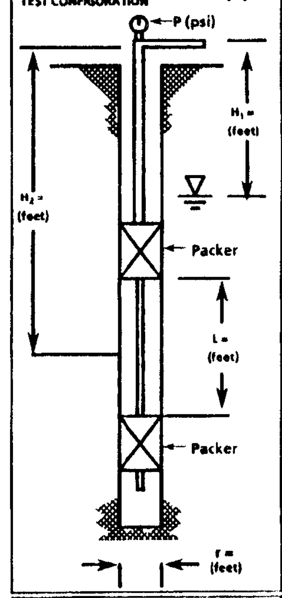
Flow Test					Calculated Results							
Pressure, p (psi)	Elapsed Time (min)	Flow Reading	Δ Flow, ΔQ (ft^3)	Δ Flow, ΔQ (gal)	Flow Rate Q (gal/min)	H_1* (ft)	Hp(Ft) = 2.31·(psi)	H_2* (ft)	H = Hp + (H1 or H2)	Cp	K (ft/yr) = Cp·Q/H	K (cm/sec) = 9.67 x 10^{-7} K (ft/yr)

$CP = (1/(2\pi L)) \ln(L/r) (70,315.5)$
7.48 Gallons = 1 Ft^3
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: ____

TEST CONFIGURATION



Length of Test Section in feet, l	Cp			
	Drilling Bit Size			
	EX (1.5")	AX (1.875")	BX (2.37")	NX (1")
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	8,200
8	6,800	6,500	6,100	5,800
10	5,700	5,400	5,200	4,900
15	4,100	3,900	3,700	3,600
20	3,200	3,100	3,000	2,800

ATTACHMENT C-4

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: _____ BORING No.: _____
PROJECT NUMBER: _____ DATE: _____
DRILLING COMPANY: _____ GEOLOGIST: _____
DRILLING RIG: _____ DRILLER: _____

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	MATERIAL DESCRIPTION: Color	MATERIAL DESCRIPTION: Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	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			GROUP SYMBOL	TYPICAL NAMES
	DAY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
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.)

Q-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

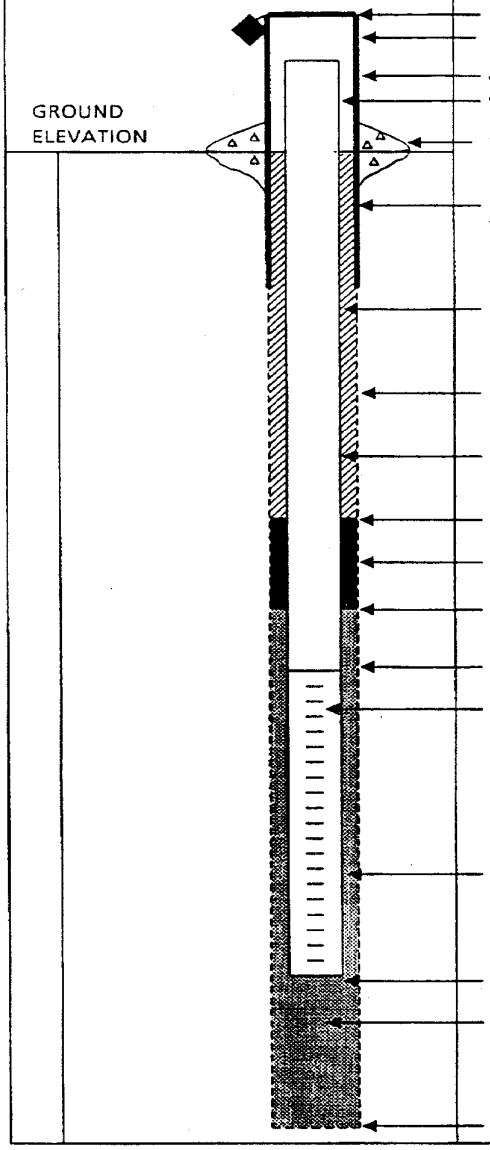
ATTACHMENT C-5
EXAMPLE OVERBURDEN MONITORING WELL SHEET

BORING NO.: _____

OVERBURDEN
MONITORING WELL SHEET

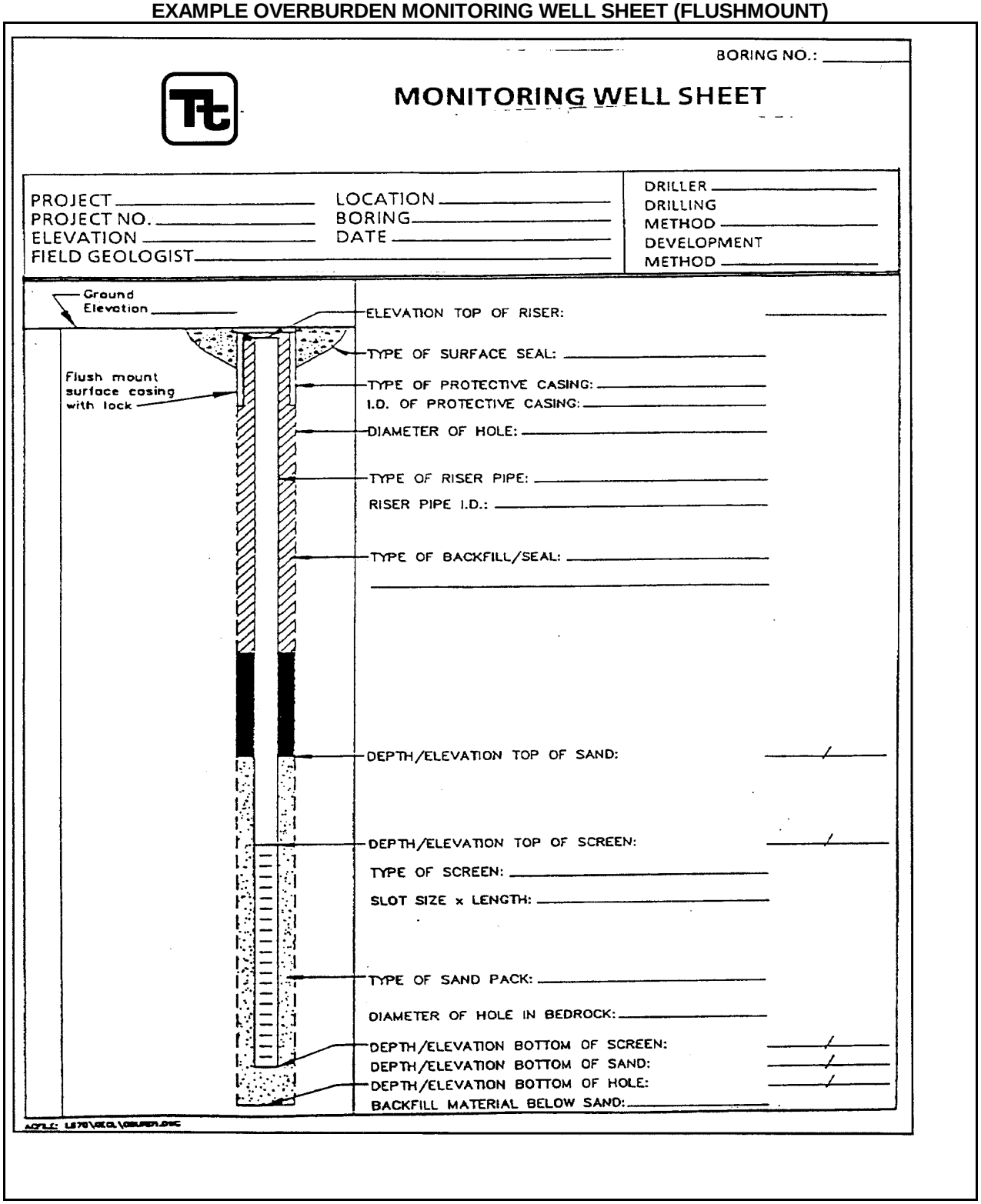
PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

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)



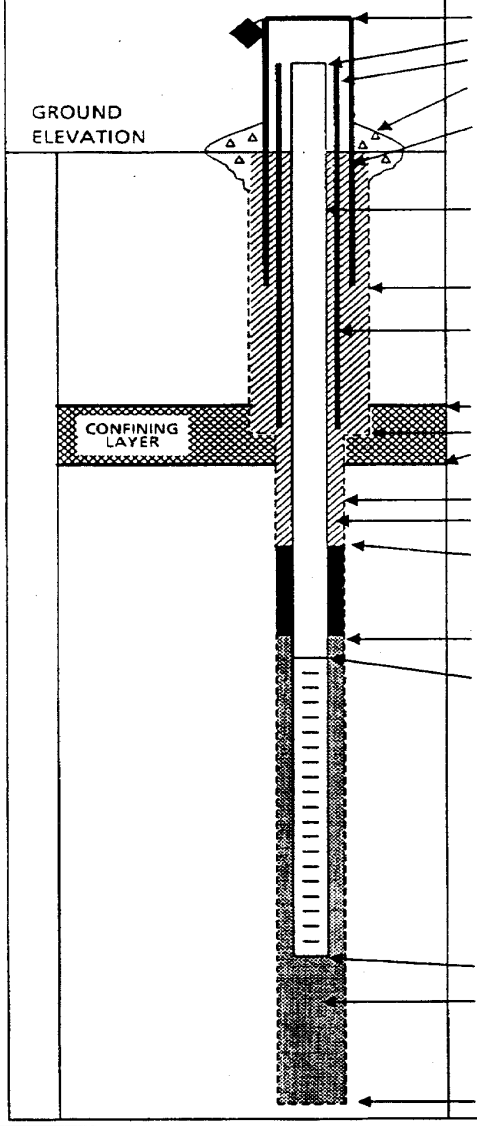
ATTACHMENT C-6
EXAMPLE CONFINING LAYER MONITORING WELL SHEET

BORING NO.: _____

CONFINING LAYER
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: _____
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: _____

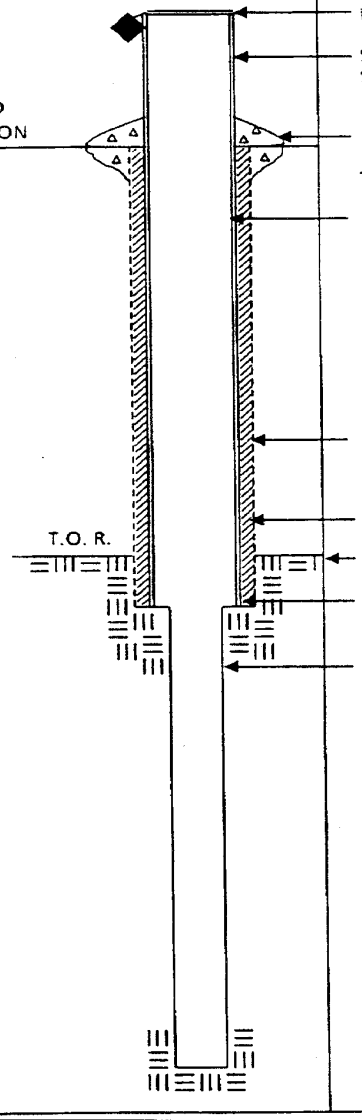
ATTACHMENT C-7
EXAMPLE BEDROCK MONITORING WELL SHEET - OPEN HOLE WELL

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: _____/_____

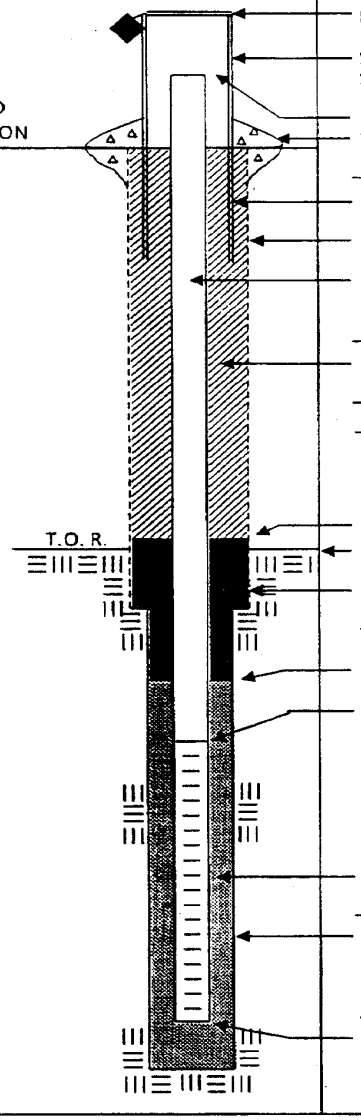
ATTACHMENT C-8
EXAMPLE BEDROCK MONITORING WELL SHEET - WELL INSTALLED IN BEDROCK

BORING NO.: _____

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

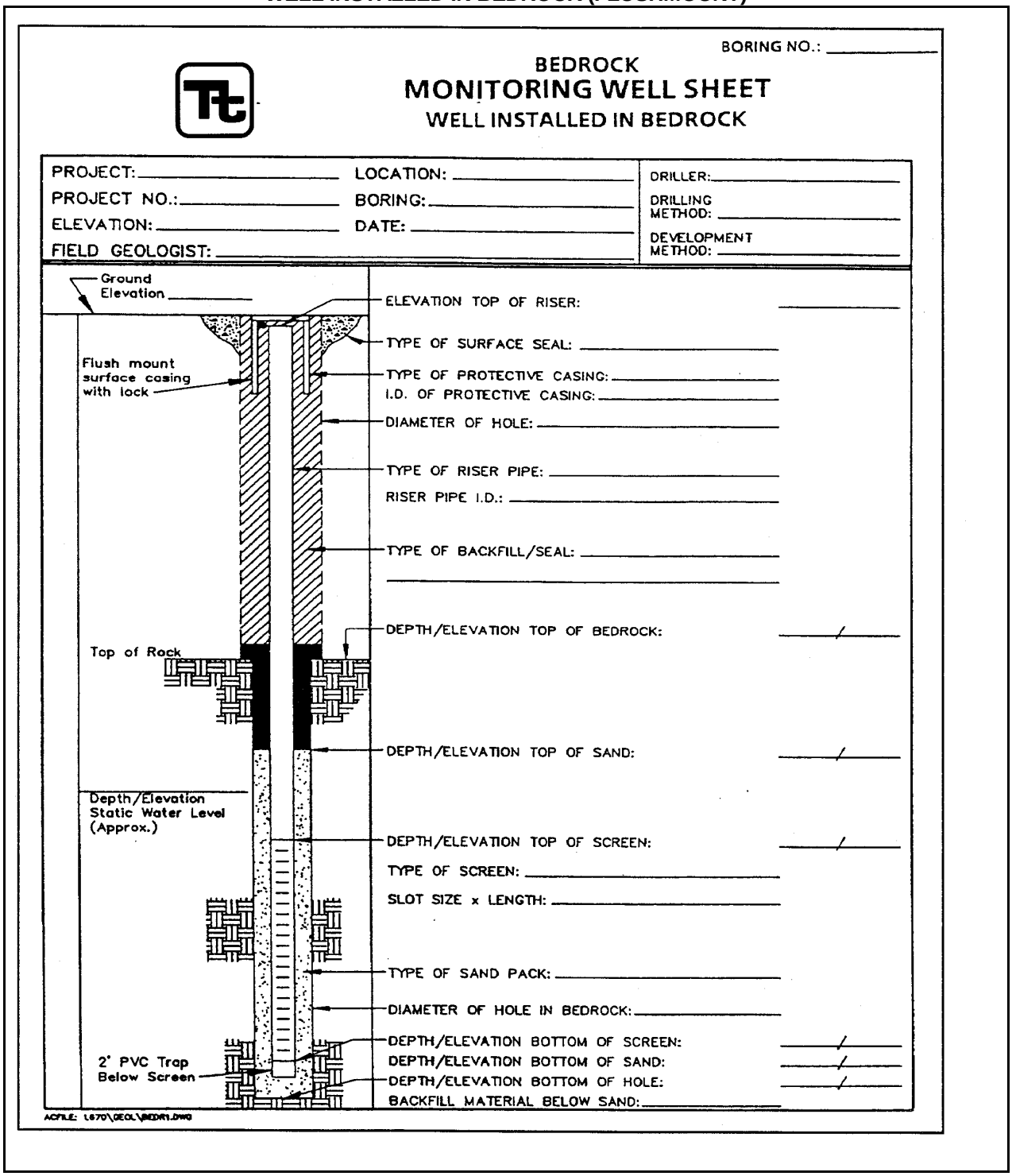
PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

DRILLER _____
DRILLING METHOD _____
DEVELOPMENT METHOD _____



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)



ATTACHMENT C-10
EXAMPLE TEST PIT LOG

TEST PIT LOG

Tetra Tech NUS, Inc.

PROJECT: _____ TEST PIT NO.:

PROJECT NO _____ DATE: _____

LOCATION: _____

FIELD GEOLOGIST: _____

DEPTH (ft.)	LITHOLOGY CHANGE (Depth ft.)	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 Geologist: ______________________

Site Name: ______________________ Drilling Company: ______________________

Date Installed: ______________________ Driller:______________________

Project Name: ______________________ 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: _____

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number SA-7.1	Page 1 of 9
		Effective Date 03/16/98	Revision 2
		Applicability Tetra Tech NUS, Inc.	
		Prepared Earth Sciences Department	
Subject DECONTAMINATION OF FIELD EQUIPMENT AND WASTE HANDLING		Approved D. Senovich	

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this procedure is 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 addresses drilling equipment and monitoring well materials decontamination, as well as chemical sampling and field analytical equipment decontamination. 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.

Deionized Water - Deionized (analyte free) water is tap water that has been treated by passing through a standard deionizing resin column. Deionized water should contain no detectable heavy metals or other inorganic compounds at or above the analytical detection limits for the project.

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.

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.

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).

5.0 PROCEDURES

To ensure that analytical chemical results reflect actual contaminant concentrations present at sampling locations, the various drilling equipment and chemical sampling and analytical equipment used to acquire the environment sample must be properly decontaminated. Decontamination minimizes the potential for cross-contamination between sampling locations, and the transfer of contamination off site.

5.1 Drilling Equipment

Prior to the initiation of a drilling program, all drilling equipment involved in field sampling activities shall be decontaminated by steam cleaning at a predetermined area. The steam cleaning procedure shall be performed using a high-pressure spray of heated potable water producing a pressurized stream of steam. This steam shall be sprayed directly onto all surfaces of the various equipment which might contact environmental samples. The decontamination procedure shall be performed until all equipment is free of all visible potential contamination (dirt, grease, oil, noticeable odors, etc.) In addition, this decontamination procedure shall be performed at the completion of each sampling and/or drilling location, including soil borings, installation of monitoring wells, test pits, etc. Such equipment shall include drilling rigs, backhoes, downhole tools, augers, well casings, and screens. Where the drilling rig is set to perform multiple borings at a single area of concern, the steam-cleaning of the drilling rig itself may be waived with proper approval. Downhole equipment, however, must always be steam-cleaned between borings. Where PVC well casings are to be installed, decontamination is not required if the manufacturer provides these casings in factory-sealed, protective, plastic sleeves (so long as the protective packaging is not compromised until immediately before use).

The steam cleaning area shall be designed to contain decontamination wastes and waste waters and can be a lined excavated pit or a bermed concrete or asphalt pad. For the latter, a floor drain must be provided which is connected to a holding facility. A shallow above-ground tank may be used or a pumping system with discharge to a waste tank may be installed.

In certain cases such an elaborate decontamination pad is not possible. In such cases, a plastic lined gravel bed pad with a collection system may serve as an adequate decontamination area. Alternately, a lined sloped pad with a collection pump installed at the lower end may be permissible. The location of the steam cleaning area shall be onsite in order to minimize potential impacts at certain sites.

Guidance to be used when decontaminating drilling equipment shall include:

- As a general rule, any part of the drilling rig which extends over the borehole, shall be steam cleaned.
- All drilling rods, augers, and any other equipment which will be introduced to the hole shall be steam cleaned.
- The drilling rig, all rods and augers, and any other potentially contaminated equipment shall be decontaminated between each well location to prevent cross contamination of potential hazardous substances.

Prior to leaving at the end of each work day and/or at the completion of the drilling program, drilling rigs and transport vehicles used onsite for personnel or equipment transfer shall be steam cleaned, as practicable. A drilling rig left at the drilling location does not need to be steam cleaned until it is finished drilling at that location.

Error! Bookmark not defined.**5.2 Sampling Equipment**

5.2.1 Bailers and Bailing Line

The potential for cross-contamination between sampling points through the use of a common bailer or its attached line is high unless strict procedures for decontamination are followed. For this reason, it is preferable to dedicate an individual bailer and its line to each sample point, although this does not eliminate the need for decontamination of dedicated bailers. For non-dedicated sampling equipment, the following conditions and/or decontamination procedures must be followed.

Before the initial sampling and after each successive sampling point, the bailer must be decontaminated. The following steps are to be performed when sampling for organic contaminants. Note: contract-specific requirements may permit alternative procedures.

- Potable water rinse
- Alconox or Liquinox detergent wash
- Scrubbing of the line and bailer with a scrub brush (may be required if the sample point is heavily contaminated with heavy or extremely viscous compounds)
- Potable water rinse
- Rinse with 10 percent nitric acid solution*
- Deionized water rinse
- Pesticide-grade isopropanol (unless otherwise required)
- Pesticide-grade hexane rinse**
- Copious distilled/Deionized water rinse
- Air dry

If sampling for volatile organic compounds (VOCs) only, the nitric acid, isopropanol, and hexane rinses may be omitted. Only reagent grade or purer solvents are to be used for decontamination. When solvents are used, the bailer must be thoroughly dry before using to acquire the next sample.

In general, specially purchased pre-cleaned disposable sampling equipment is not decontaminated (nor is an equipment rinsate blank collected) so long as the supplier has provided certification of cleanliness. If decontamination is performed on several bailers at once (i.e., in batches), bailers not immediately used may be completely wrapped in aluminum foil (shiny-side toward equipment) and stored for future use. When batch decontamination is performed, one equipment rinsate is generally collected from one of the bailers belonging to the batch before it is used for sampling.

It is recommended that clean, dedicated braided nylon or polypropylene line be employed with each bailer use.

5.2.2 Sampling Pumps

Most sampling pumps are low volume (less than 2 gpm) pumps. These include peristaltic, diaphragm, air-lift, pitcher and bladder pumps, to name a few. If these pumps are used for sampling from more than one sampling point, they must be decontaminated prior to initial use and after each use.

The procedures to be used for decontamination of sampling pumps compare to those used for a bailer except that the 10 percent nitric acid solution is omitted. Each of the liquid factions is to be pumped through the system. The amount of pumping is dependent upon the size of the pump and the length of the intake and discharge hoses. Certain types of pumps are unacceptable for sampling purposes. For peristaltic pumps, the tubing is replaced rather than cleaned.

An additional problem is introduced when the pump relies on absorption of water via an inlet or outlet hose. For organic sampling, this hose should be Teflon. Other types of hoses leach organics (especially phthalate esters) into the water being sampled or adsorb organics from the sampled water. For all other sampling, the hose should be Viton, polyethylene, or polyvinyl chloride (listed in order of preference).

---

* Due to the leaching ability of nitric acid on stainless steel, this step is to be omitted if a stainless steel sampling device is being used and metals analysis is required with detection limits less than approximately 50 ppb.

** If sampling for pesticides, PCBs, or fuels.

Whenever possible, dedicated hoses should be used. It is preferable that these types of pumps not be used for sampling, only for purging.

5.2.3 Filtering Equipment

On occasion, the sampling plan may require acquisition of filtered groundwater samples. Field-filtering is addressed in SOP SA-6.1 and should be conducted as soon after sample acquisition as possible. To this end, three basic filtration systems are most commonly used: the in-line disposable Teflon filter, the inert gas over-pressure filtration system, and the vacuum filtration system.

For the in-line filter, decontamination is not required since the filter cartridge is disposable, however, the cartridge must be disposed of in an approved receptacle and the intake and discharge lines must still be decontaminated or replaced before each use.

For the over-pressure and the vacuum filtration systems, the portions of the apparatus which come in contact with the sample must be decontaminated as outlined in the paragraphs describing the decontamination of bailers. (Note: Varieties of both of these systems come equipped from the manufacturer with Teflon-lined surfaces for those that would come into contact with the sample. These filtration systems are preferred when decontamination procedures must be employed.)

5.2.4 Other Sampling Equipment

Field tools such as trowels and mixing bowls are to be decontaminated in the same manner as described above.

5.3 Field Analytical Equipment

5.3.1 Water Level Indicators

Water level indicators that come into contact with groundwater must be decontaminated using the following steps:

- Rinse with potable water
- Rinse with deionized water

Water level indicators that do not come in contact with the groundwater but may encounter incidental contact during installation or retrieval need only undergo the first and last steps stated above.

5.3.2 Probes

Probes (e.g., pH or specific-ion electrodes, geophysical probes, or thermometers) which would come in direct contact with the sample, will be decontaminated using the procedures specified above unless manufacturer's instructions indicate otherwise (e.g., dissolved oxygen probes). Probes that contact a volume of groundwater not used for laboratory analyses can be rinsed with deionized water. For probes which make no direct contact, (e.g., OVA equipment) the probe is self-cleaning when exposure to uncontaminated air is allowed and the housing can be wiped clean with paper-towels or cloth wetted with alcohol.

5.4 Waste Handling

For the purposes of these procedures, contaminated materials are defined as any byproducts of field activities that are suspected or known to be contaminated with hazardous substances. These byproducts

include such materials as decontamination solutions, disposable equipment, drilling muds, well-development fluids, and spill-contaminated materials and Personal Protection Equipment (PPE).

The procedures for obtaining permits for investigations of sites containing hazardous substances are not clearly defined at present. In the absence of a clear directive to the contrary by the EPA and the states, it must be assumed that hazardous wastes generated during field activities will require compliance with Federal agency requirements for generation, storage, transportation, or disposal. In addition, there may be state regulations that govern the disposal action. This procedure exclusively describes the technical methods used to control contaminated materials.

The plan documents for site activities must include a description of control procedures for contaminated materials. This planning strategy must assess the type of contamination, estimate the amounts that would be produced, describe containment equipment and procedures, and delineate storage or disposal methods. As a general policy, it is wise to select investigation methods that minimize the generation of contaminated spoils. Handling and disposing of potentially hazardous materials can be dangerous and expensive. Until sample analysis is complete, it is assumed that all produced materials are suspected of contamination from hazardous chemicals and require containment.

5.5 Sources of Contaminated Materials and Containment Methods

5.5.1 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. Larger equipment such as backhoes and tractors must be decontaminated in an area provided with an impermeable liner and a liquid collection system. A decontamination area for large equipment could consist of a bermed concrete pad with a floor drain leading to a buried holding tank.

5.5.2 Disposable Equipment

Disposable equipment that could become contaminated during use typically includes PPE, rubber gloves, boots, broken sample containers, and cleaning-wipes. These items are small and can easily be contained in 55-gallon drums with lids. These containers should be closed at the end of each work day and upon project completion to provide secure containment until disposed.

5.5.3 Drilling Muds and Well-Development Fluids

Drilling muds and well-development fluids are materials that may be used in groundwater monitoring well installations. Their proper use could result in the surface accumulation of contaminated liquids and muds that require containment. The volumes of drilling muds and well-development fluids used depend on well diameter and depth, groundwater characteristics, and geologic formations. There are no simple mathematical formulas available for accurately predicting these volumes. It is best to rely on the experience of reputable well drillers familiar with local conditions and the well installation techniques selected. These individuals should be able to estimate the sizes (or number) of containment structures required. Since guesswork is involved, it is recommended that an slight excess of the estimated amount of containers required will be available.

Drilling muds are mixed and stored in what is commonly referred to as a mud pit. This mud pit consists of a suction section from which drilling mud is withdrawn and pumped through hoses, down the drill pipe to the bit, and back up the hole to the settling section of the mud pit. In the settling section, the mud's velocity is reduced by a screen and several flow-restriction devices, thereby allowing the well cuttings to settle out of the mud/fluid.

The mud pit may be either portable above-ground tanks commonly made of steel (which is preferred) or stationary in-ground pits as depicted in Attachment A. The above-ground tanks have a major advantage over the in-ground pits because the above-ground tanks isolate the natural soils from the contaminated fluids within the drilling system. These tanks are also portable and can usually be cleaned easily.

As the well is drilled, the cuttings that accumulate in the settling section must be removed. This is best done by shoveling them into drums or other similar containers. When the drilling is complete, the contents of the above-ground tank are likewise shoveled or pumped into drums, and the tank is cleaned and made available for its next use.

If in-ground pits are used, they should not extend into the natural water table. They should also be lined with a bentonite-cement mixture followed by a layer of flexible impermeable material such as plastic sheeting. Of course, to maintain its impermeable seal, the lining material used would have to be nonreactive with the wastes. An advantage of the in-ground pits is that well cuttings do not necessarily have to be removed periodically during drilling because the pit can be made deep enough to contain them. Depending on site conditions, the in-ground pit may have to be totally excavated and refilled with uncontaminated natural soils when the drilling operation is complete.

When the above-ground tank or the in-ground pit is used, a reserve tank or pit should be located at the site as a backup system for leaks, spills, and overflows. In either case, surface drainage should be such that any excess fluid could be controlled within the immediate area of the drill site.

The containment procedure for well-development fluids is similar to that for drilling muds. The volume and weight of contaminated fluid will be determined by the method used for development. When a new well is pumped or bailed to produce clear water, substantially less volume and weight of fluid result than when backwashing or high-velocity jetting is used.

5.5.4 Spill-Contaminated Materials

A spill is always possible when containers of liquids are opened or moved. Contaminated sorbents and soils resulting from spills must be contained. Small quantities of spill-contaminated materials are usually best contained in drums, while larger quantities can be placed in lined pits or in other impermeable structures. In some cases, onsite containment may not be feasible and immediate transport to an approved disposal site will be required.

5.6 Disposal of Contaminated Materials

Actual disposal techniques for contaminated materials are the same as those for any hazardous substance, that is, incineration, landfilling, treatment, and so on. The problem centers around the assignment of responsibility for disposal. The responsibility must be determined and agreed upon by all involved parties before the field work starts. If the site owner or manager was involved in activities that precipitated the investigation, it seems reasonable to encourage his acceptance of the disposal obligation. In instances where a responsible party cannot be identified, this responsibility may fall on the public agency or private organization investigating the site.

Another consideration in selecting disposal methods for contaminated materials is whether the disposal can be incorporated into subsequent site cleanup activities. For example, if construction of a suitable

onsite disposal structure is expected, contaminated materials generated during the investigation should be stored at the site for disposal with other site materials. In this case, the initial containment structures should be evaluated for use as long-term storage structures. Also, other site conditions such as drainage control, security, and soil type must be considered so that proper storage is provided. If onsite storage is expected, then the containment structures should be specifically designed for that purpose.

6.0 REFERENCES

Brown & Root Environmental: Standard Operating Procedure No. 4.33, Control of Contaminated Material.

ATTACHMENT A

TWO TYPES OF MUD PITS USED IN WELL DRILLING