AIR SPARGING/SOIL VAPOR EXTRACTION TREATABILITY STUDY WORK PLAN FOR BOCA CHICA FLYING CLUB WITH TRANSMITTAL LETTER NAS KEY WEST FL
3/11/2002
TETRA TECH NUS

TETRA TECH NUS, INC.

AIK-02-0076

March 11, 2002

Project Number HK 4087 *via U.S. Mail*

Commander
Department of the Navy
SOUTHDIV NAVFACENGCOM
ATTN: Byas Glover (Code ES24)
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Reference: CLEAN Contract No. N62467-94-D-0888
Contract Task Order No. 0207

Subject: Air Sparging/Soil Vapor Extraction Treatability Study Work Plan at Boca Chica Flying Club, Rev. 2, Naval Air Facility, Key West, Florida

Dear Mr. Glover:

TtNUS is pleased to submit the enclosed PDF file for the final version of the Air Sparging/Soil Vapor Extraction Treatability Study Work Plan at Boca Chica Flying Club, Rev. 2, Naval Air Facility, Key West, Florida. This CD contains an electronic duplicate for the report that was sent to you and the Florida Department of Environmental Protection on 31 January 2002 with the exception of title page, signature page, and the Response to Comment page (Appendix A). These pages were updated to meet TtNUS's contractual obligation for CTO 0207. I am not expecting comments from you or any other members of the NAF Key West Partnering Team on the information contained in the enclosed CD.

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

Sincerely,

C. M. Bryan
Project Manager

CMB:spc

Enclosure

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Air Sparging/Soil Vapor Extraction Treatability Study Work Plan

for

Boca Chica Flying Club
Naval Air Facility
Key West, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0207

March 2002

Rev. 2
3/11/02

AIR SPARGING/SOIL VAPOR EXTRACTION TREATABILITY STUDY WORK PLAN

FOR

BOCA CHICA FLYING CLUB

NAVAL AIR FACILITY
KEY WEST, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

SUBMITTED TO:
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
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CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0207

MARCH 2002

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ACRONYMS

AST	Aboveground storage tanks
AS/SVE	Air Sparging/Soil Vapor Extraction
AVGAS	Aviation Gas
bls	Below land surface
CAR	Contamination Assessment Report
cfm	Cubic feet per minute
scfm	Standard cubic feet per minute
CLEAN	Comprehensive Long-Term Environmental Action Navy
CO_2	Carbon dioxide
COC	Chain of Custody
CTO	Contract Task Order
DO	Dissolved oxygen
EPA	United States Environmental Protection Agency
FAC	Florida Administrative Code
FID	Flame Ionization Detector
FOL	Field Operations Leader
HASP	Health and Safety Plan
IDW	Investigation-derived waste
lb	Pound
MW	Monitoring well
NAS	Naval Air Station
NSF	National Sanitation Foundation
O_2	Oxygen
O&M	Operation and Maintenance
OVA	Organic Vapor Analyzer
psi/ft	Pounds per square inch per foot
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
SOP	Standard Operating Procedure
TRPH	Total recoverable petroleum hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
UST	Underground storage tank
VOA	Volatile organic aromatic
VOC	Volatile organic compound

1.0 INTRODUCTION

1.1 PURPOSE/SCOPE

This Treatability Study Work Plan has been prepared by Tetra Tech NUS, Inc. (TtNUS) under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62467-94-D-0888, Contract Task Order (CTO) 0207. This Work Plan has been prepared to describe activities that will be conducted to assess whether Air Sparging/Soil Vapor Extraction (AS/SVE) is an appropriate remedial technology for the Boca Chica Flying Club facility at Naval Air Station (NAS) Key West. The Treatability Study will also provide information necessary for the design, installation, and operation of an AS/SVE treatability study system. The scope of this Treatability Study is limited to the soils and groundwater that have been affected by previous activities at the site.

This Work Plan summarizes data presented in the Contamination Assessment Report (CAR) (ABB 1994) and the Remedial Action Plan (RAP) (ABB 1997) to provide site history. The Work Plan also provides procedures for the installation, operation, and evaluation of a pilot-scale AS/SVE system.

1.2 REMEDIAL ACTION OBJECTIVES

The following are the remedial action objectives for Boca Chica Flying Club, Key West:

- Remediate groundwater in the vicinity of monitoring wells (MW)-6 and MW-20 to levels acceptable with applicable State of Florida Chapters 62-770 and 62-777 Florida Administrative Code (FAC) cleanup goals.

- Remediate any residual hydrocarbons in the soil to levels below the State of Florida Chapters 62-770 and 62-777 FAC cleanup goals.

1.3 SITE DESCRIPTION

NAS Key West is located approximately 150 miles southwest of Miami, Florida, in Monroe County. The Flying Club site can be found on the West, Florida, USGS Topographic 7.5 Minute Series Quadrangle (Figure 1-1) near latitude 24’ 34.829’’ and longitude -81’ 41.260”. NAS Key West consists of several facilities located in a number of properties on the lower Florida Keys and encompasses approximately 5,000 acres. The majority of these properties are concentrated on Boca Chica Key and Key West. The

goal of NAS Key West is to maintain and operate facilities that provide services and materials to support operations of aviation activities and units designated by the Chief of Naval Operations.

The former Flying Club area is located along the northwest boundary of Taxiway H of Boca Chica Field, near Buildings A133, A126, A127, and A128. The area is currently used as an electrical repair and maintenance facility (Building A126) and a transformer storage area (Building A133).

Most of the former Flying Club area is covered with broken asphalt, limestone, and grass. A 6-inch-high concrete curb runs along the northern boundary of the concrete apron of Taxiway H. Underground utilities, a storm drain, and an 8-foot-high chain-link fence parallel the curb on its north side. The fence is located approximately 75 feet from the taxiway and borders the southeast boundary of Building A133.

1.4 WORK PLAN ORGANIZATION

This Work Plan is organized in the following sections:

- Section 1.0 Short introduction, remedial action objectives, and site description
- Section 2.0 Site history
- Section 3.0 System design and installation
- Section 4.0 System operation and testing
- Section 5.0 Field sampling.

2.0 SITE HISTORY

The former Flying Club area was used for aircraft parking and refueling (southeast of Building A127), as a transportation facility (Building A126), and as an automobile hobby shop and a motor pool refueling point (Building A133). The areas southeast of Building A127 and near Building A133 were documented petroleum storage areas (Figure 2-1).

The area approximately 140 feet southeast of Building A127 contained four aboveground storage tanks (ASTs), a dispenser island, and associated pumps and piping that stored and dispensed aviation gasoline, AVGAS Three of the ASTs reportedly had capacities of 560 gallons and the other was a 1,000-gallon tank. The installation date of these ASTs is unknown, but the Boca Chica Flying Club was in operation until the late 1960s. The ASTs, fuel dispensers, and associated piping were removed in February 1992. Overfilling of the ASTs is the suspected cause of petroleum contamination found in this area.

The area near Building A133 supposedly contained underground storage tanks (USTs), piping, and pumps that stored and dispensed automotive gasoline. Discussions with activity personnel in 1994 during the environmental assessment indicted that the USTs have been removed. The installation and removal dates and tank construction details, contents, and capacities are unknown.

2.1 GEOLOGIC AND HYDROGEOLOGIC CHARACTERISTICS

2.1.1 Regional Geology and Hydrogeology

The lower Keys, which are within the southern geomorphic division of Florida, were formed during the Pleistocene era. The Keys are known as the “Oolitic Keys”, a reference to the Oolitic Member of the Miami Limestone. The Oolitic Member consists of variably sandy, fossiliferous limestone composed primarily of ooids. The Oolitic Member is divided into two lithofacies: an ooid calcarenite and an oomoldic-recrystalline facies. The Key Largo Limestone underlies the Miami Limestone. The Key Largo Limestone is a light gray to light yellow coralline limestone comprised of coral heads encased in a matrix of cacarenite. In the Key West area, the Miami Limestone is approximately 27 feet thick and the Key Largo limestone is more than 270 feet thick.

The surficial aquifer system present in the lower Keys is an unconfined, porous, highly permeable, solution-ridden unit. Rainfall recharge seeps quickly into the ocean and saltwater intrusion is common. Regionally, the water table ranges in depth from less than 1 foot to approximately 2.5 feet below mean sea

level and fluctuates diurnally due to tidal effects. The surficial aquifer is non-potable and classified G-III, due to its high total dissolved solid content.

2.1.2 Local Geology

The soil at the site is primarily fill material, composed of tan to brown calcareous sand with limestone cobbles to a depth of 5 to 6 feet below land surface (bls). The fill material is underlain by tan to light gray to white weathered limestone. Other soil types in and around Key West consist of gravelly sand, calcareous clay, marl, and weathered bedrock.

2.1.3 Local Hydrogeology

Hydrogeologic conditions of the surfical aquifer at the Flying Club area were assessed from monitoring wells, water-level measurements, and field testing of hydraulic properties. The depth to groundwater at the site varies from 2.5 to 4.0 feet bls. Groundwater flow direction is assumed to be predominantly to the northeast. A tidal influence study indicated that tidal fluctuations cause groundwater elevation changes of up to 0.2 feet. It has also been shown that tidal influences do not reverse the groundwater flow direction at the site during high tide. Static groundwater level measurements collected on January 19, 2001, were used to develop the map of the piezometric surface shown in Figure 2-2.

2.2 CONTAMINATION ASSESSMENT

The proposed AS/SVE system will address subsurface soil and groundwater contaminated with volatile organic compounds (VOCs). The following is a general discussion of the site contaminants.

2.2.1 Soils

Soils in the site area were field-screened with an Organic Vapor Analyzer (OVA) to assess for the presence of contaminated soil during the CAR conducted in April 1994. A total of 71 soil borings were advanced, each to 6 feet deep. Screening results indicated the presence of excessively contaminated soils (greater than 50 parts per million [ppm]) in four areas. The largest area measured approximately 70 feet long by 40 feet wide and was located near Building A131. Smaller areas were noted near the former AVGAS dispenser, north of Building A131 near MW-8, and north of Building A131 near MW-17. OVA readings greater than 500 ppm were identified in 20 samples.

2.2.2 Groundwater

Groundwater samples were collected from all existing wells and analyzed for Kerosene Analytical Group parameters during the CAR that was conducted in April 1994. The applicable Class G-III aquifer cleanup goals were exceeded for the compounds of benzene and total volatile organic aromatics (VOA). Two areas of VOA were identified, one near the former AVGAS ASTs and dispenser and the other near the former motor pool USTs. The highest total VOA concentrations found were in MW-4, near the former Avgas dispenser, at 1,300 micrograms per liter (µg/l). Total VOA concentrations were found in MW-6 and MW-20, near the former motor pool gasoline USTs, at 305 µg/l and 156 µg/l, respectively.

The monitoring wells were resampled in August 1996, as part of the RAP preparation. The 1996 data indicated significant changes in the degree and extent of contamination found during the CAR. Total VOA in MW-4 was measured at 133 µg/l, putting the area of the former AVGAS dispenser within the Class III guidelines. The total VOA for MW-6 and MW-20 were 1,470 µg/l and 35 µg/l, respectively. Based on the most recent sampling results, the RAP recommended a remedial action consisting of excavation of contaminated soils (an estimated amount of 2,126 cubic yards). The largest area recommended to be excavated was in the vicinity of the former motor pool USTs near Building A133.

In 1998, excavations of contaminated soil took place, based on recommendations in the RAP. Approximately 983 cubic yards of soil were excavated from the Flying Club site. The ion collide process was used to treat a portion of the contaminated soil. The excavated areas at the Flying Club site were then backfilled (BEI, 1999).

A quarterly groundwater monitoring plan was implemented in August 1999. The most recent sampling results are dated April 11, 2001. Total VOA results for MW-6 and MW-20 were 51 µg/l and 11 µg/l, respectively. These VOA results are below the applicable cleanup guidelines. However, naphthalene and total recoverable petroleum hydrocarbons (TRPH) concentrations increased in MW-20. Due to the lack of substantial decreases in the concentrations of some contaminants following several quarters of groundwater monitoring, TtNUS recommended a treatability study be performed to investigate the efficiency of enhancing the degradation of contaminants under aerobic conditions. The sampling results from April 11, 2001, are shown on Figure 2-3.

3.0 SYSTEM DESIGN AND INSTALLATION

An AS/SVE treatibility system will be installed at the site. The system will inject air into the groundwater via 16 sparge wells and extract vapors from the vadose zone via two extraction wells. The results of the Treatability Study will be used to assess the applicability of AS/SVE for removing VOCs in the soil and groundwater via volatilization and stimulation/enhancement of bioremediation.

The pilot-scale system (and associated sampling and analysis activities) is divided into two phases: a short-term test to evaluate the effectiveness of the system and its components and a long-term evaluation (Phases I and II). The results from the Phase I system operation will be used to assess the number of additional injection or extraction points required for the Phase II system operation. Phase I operation of the pilot-scale system will also be used to estimate the effective radii of influence, off-gas treatment requirement, flow rate requirements, vacuum and injection pressures, and removal efficiencies. The pilot-scale system can be designed so that it can be expanded or modified as needed for Phase II operation.

Phase I will use a temporary, trailer-mounted pilot test unit to test subsurface characteristics for AS/SVE suitability. During Phase I, four off-gas samples for VOCs, oxygen (O_2), and carbon dioxide (CO_2) will be collected from the discharge of the vapor extraction blower. Dissolved O_2 and CO_2 in groundwater will be collected in four monitoring wells, using field test kits. The system will then be shut down while initial results (including estimated flow rates, pressures, vacuums, horsepower, and electrical requirements) are evaluated. Phase I operation is anticipated to last approximately 2 days.

If Phase I results confirm that site conditions are suitable for AS/SVE, adjustments to the system will be evaluated for Phase II operation. Evaluation of the system to assess its effectiveness to remediate VOC contamination will be conducted during Phase II. TtNUS does not anticipate the need to install additional injection and extraction wells after Phase I. For estimating purposes, a 20-foot radius of influence was assumed. Depending on off-gas concentrations, treatment may or may not be required. It is assumed that two 350-pound (lb) activated carbon units will be used to treat the off-gas prior to its release to the atmosphere. It is anticipated that Phase II will last approximately 6 months.

Low-permeability vapor barriers are often placed over a site to increase the size of the impact area of each well. Part of the site's surface is paved with impermeable concrete. A vapor barrier is not planned at this time. However, if Phase I indicates that excessive short-circuiting from above the ground is occurring, a vapor barrier may be added as part of Phase II.

The native material underlying the site, mainly fill material and crushed oolitic limestone, is expected to provide good transmission of forced air and soil vapor needed for this technology. Typical air injection and extraction rates for an individual well are 4 to 6 cubic feet per minute (cfm) and 9 to 15 cfm, respectively. Given the conditions at the site, these typical airflow rates may be obtained with relatively low pressures and vacuums.

3.1 PERMITS

It is believed that the AS/SVE system will not require a permit, unless VOC emissions exceed 15 lbs/day.

It is anticipated that a permit will not be required for Phase I because the pilot tests will only be conducted approximately 8 hours per day at a source of relatively low VOC concentrations. The pilot test unit will be equipped with a 350-lb vapor phase carbon drum, installed to treat the extracted air. This will ensure that emissions will be less than the regulated amount. Extracted soil vapor containing VOCs will be evaluated during Phase I by using both real time field instruments and a fixed-based laboratory to assess if treatment of off-gas will be required during Phase II.

3.2 INSTALLATION OF PILOT-SCALE SYSTEM

The pilot-scale system consists of an air injection system, a soil vapor extraction system, and soil/vapor groundwater monitoring points. Prior to, during, and after the pilot-scale system operation, samples of groundwater and soil gas will be collected and analyzed. (See Section 5.0 for further discussion of monitoring and sampling activities).

Standard Operating Procedures (SOPs) applicable to the field work associated with this project can be found in the Florida Department of Environmental Protection (FDEP) SOP (FDEP 1992).

TtNUS will prepare specifications and obtain subcontractors for well drilling, investigation-derived waste (IDW) disposal, and laboratory analytical services. All field team members will review this Work Plan and the updated Health and Safety Plan (HASP) prior to mobilization.

A bound, weatherproof site logbook shall be maintained by the Field Operations Leader (FOL). The requirements of the site logbook are outlined in TtNUS SOP SA-6.3, Sections 5 and 7. This book will contain summaries of each day's activities.

3.2.1 Well Installation

Sixteen 2-inch-diameter air sparging wells will be installed in a 20-foot grid pattern in the area of monitoring wells MW-6 and MW-20. Two 5-inch-diameter wells will be installed proximal to MW-6 and MW-20. The locations of the proposed vapor extraction wells and air sparge injection wells are shown on Figure 3-1.

The well borings for the SVE wells will be advanced using a minimum 8-inch-outside-diameter hollow-stem auger and the injection wells will be installed using a minimum 6-inch-outside-diameter hollow-stem auger. All wells will be constructed of schedule 40, flush-joint, 2-inch-diameter, National Sanitation Foundation (NSF)-approved polyvinyl chloride (PVC) well screen and riser pipe. The well screens will have a slot size of 0.01 inches and will be supplied with a PVC end cap.

Once the screen and riser pipe are in place, the annulus of the boring will be backfilled with clean 20/30 U.S. standard sieve size silica sand from the bottom of the boring to 2 feet above the top of the well screen. Sand will always be maintained for several inches inside the augers during installation to ensure an adequate sand pack around the well. A 1-foot thickness of 30/65 U.S. standard sieve size silica sand will be installed on top of the sand pack and will serve as a seal. The thickness of the sand pack and seal will be constantly monitored, using a weighted stainless steel or plastic tape. The remainder of the annulus of the borehole (from the seal to the ground surface) will be grouted with neat cement grout through a tremie pipe. Well construction details are depicted on Figure 3-2.

3.2.2 Air Sparging/Soil Vapor Extraction Equipment

The pilot test unit consists of a rotary, positive-displacement blower and one compressor for extraction and injection of air through the system, all of which will be mounted on a wheeled trailer. The blower and compressor specifications are given in Appendix B. The desired pressure or vacuum will be regulated by throttling valves. The injection blower will be capable of evacuating the water column in the injection well plus head losses from friction in the transfer line. The pilot test unit also includes a moisture separator, activated carbon canisters for off-gas treatment, flow meters, gauges, sampling ports, and a noise silencer. A plan view of the pilot test unit is illustrated in Figure 3-1.

Power for the treatment unit will be supplied by NAS Key West near the southwest end of Building A133 and will include a 100-amp service panel.

3.2.3 Piping

Air transfer piping between the blowers and the injection and extraction wells will be installed above ground, using 2-inch-diameter schedule 40 PVC. The PVC pipes will be connected to the blowers using 2-inch hoses equipped with quick-disconnect camlocks. The system will use two 2-inch-diameter lines for the air sparge system and one 2-inch-diameter line for the vapor extraction unit. The air sparge wells will be cycled daily, with eight wells running at one time. The piping will be anchored to the asphalt surface.

3.2.4 Investigation-Derived Waste

Drill cuttings produced during well installation will be containerized in 55-gallon, DOT-approved metal drums, if soil is determined to be excessively contaminated by using a flame ionization detector (FID). Development water, purged water, and decontamination water will also be containerized separately in similar drums. All drums will be labeled, at a minimum, with the following: contents, date, and source. All IDW will be handled in accordance with the United States Environmental Protection Agency (EPA) guidance document “Management of Investigation-Derived Wastes During Site Inspections”, (EPA 1991).

4.0 SYSTEM OPERATION AND TESTING

The objectives of the treatability study are to:

- determine the effective radius of influence of the vapor extraction system, air injection system, and combined vapor extraction and air injection systems in the soil and groundwater, and

- determine the suitability of AS/SVE to site contaminants and, given site conditions, expand the system to assess the long-term effects of the AS/SVE on subsurface conditions.

Phase I will be conducted following well and system installation. During this time, the vapor extraction and air injection systems will be operated both separately and together, as noted below. Phase II operation will begin after any required modifications are installed to the Phase 1 layout. When the final well configuration is obtained, the system will be operated with monthly evaluations of system effectiveness. Soil vapor and groundwater samples will be collected by the TtNUS field team over the term of the treatability study, according to the procedures outlined in the Field Sampling Plan (Section 5.0).

4.1 PHASE I TESTING

Subsequent to the well and piping installation, Phase I will be conducted in three separate tests: SVE only, AS only, and combined AS and SVE. Test procedures are provided in Appendix C. Forms for recording the data are also included in Appendix C.

The data obtained during Phase I will be used to estimate the respective radii of influence for the AS/SVE systems. These analytical results will help in evaluating the initial effectiveness of this remedial technology for the site. The results of the off-gas analyses will be used to assess if off-gas treatment will be necessary during Phase II. The previously determined radii of influence will be used to evaluate the number of additional remediation wells required to fully influence the contamination plume.

Forms for recording pertinent Operation and Maintenance (O&M) data will be developed and included in the Technical Report, prior to the implementation of Phase II testing. These forms will include necessary activities and their schedules to properly maintain the AS/SVE system in operating condition.

4.2 PHASE II TESTING

The activities associated with Phase II include installation of a semi-permanent power source to the equipment, and O&M of the system. The O&M of the system will include monthly upkeep of the equipment and periodic air and groundwater sampling. The system will be evaluated quarterly to determine if system operation is progressing toward the remedial action objectives. If it is determined that the goals have been achieved or the system is no longer effectively reducing the levels of contamination, this phase of the study will be considered complete. The overall Phase II testing is scheduled to take six months.

5.0 FIELD SAMPLING PLAN

Field sampling will include collection of air and groundwater samples during the installation, start-up, and operation of the pilot-scale AS/SVE system. The proposed analytical testing for pilot-scale operations is summarized in Table 5-1.

Sampling activities to be conducted in conjunction with this treatability study are outlined below.

5.1 AIR AND GROUNDWATER SAMPLING

5.1.1 Field Volatile Organic Compounds Analysis

An OVA equipped with an FID will be used for VOC analysis during Phase I. VOC samples during SVE, AS, and AS/SVE tests will be collected at the frequency recommended in Appendix C.

Soil vapor samples will be collected from the exhaust of the SVE blower during the SVE and AS/SVE tests and in the observation wells during the AS test. Air samples collected from the exhaust will give an indication of the effectiveness of SVE and AS/SVE in cleaning up impacted soils and groundwater. Air samples collected from the observation wells during the AS test can also be used to estimate the radius of influence of the AS test.

Soil vapor samples will be obtained by attaching a flexible hose to a sampling port and attaching one end of the hose to a Tedlar sample bag. With the sampling port opened, air under positive pressure is allowed to purge ambient air in the hose. As soon as the Tedlar bag is connected to the hose, the valve on the Tedlar bag is opened to allow it to be filled. Once full, the bag's valve is closed and connected to the OVA for analysis. The Tedlar bag will be purged with clean air three times prior to reuse.

5.1.2 Fixed-Base Laboratory Soil Vapor Sampling

During Phases I and II, soil vapor samples for laboratory analysis will be collected. During Phase I, an untreated and undiluted air sample (without carbon and air makeup valve closed) will be collected in a SUMMA canister from the vacuum pump exhaust during SVE-only and AS-only tests.

The samples will be analyzed for VOCs, O_2 and CO_2. These analytical results will be used to evaluate the method of air treatment during Phase II and potential natural biodegradation. During Phase II, both untreated and treated air samples will be collected for VOC, O_2, and CO_2 analyses. The untreated air samples will permit calculation of the amounts of contaminants extracted and the treated air samples will indicate the effectiveness of the air treatment (if found to be required). The results of the analyses will also determine when off-gas treatment may be discontinued. The results of the treated samples will assess the effectiveness of the carbon and how the system complies with the discharge requirements.

5.1.3 Groundwater Sampling

During Phases I and II, groundwater samples will be collected for laboratory analysis. Samples from wells MW-5, MW-6, MW-10, and MW-21 will be collected monthly and analyzed according to the EPA Methods 602 and 610 parameters.

5.2 QUALITY ASSURANCE

This section identifies required Quality Assurance/Quality Control (QA/QC) measures to be employed during both the short-term testing (Phase 1) and long term evaluation (Phase II) phases of the pilot-scale AS/SVE treatability study.

The elements of the QA/QC program supporting the treatability study include the following:

- Field documentation
- Field measurements
- Field analysis
- Laboratory analysis
- Sample collection, handling preservation, and sample chain of custody (COC)
- QC samples.

5.2.1 Field Documentation Responsibilities

It will be the responsibility of the FOL to secure all documents (daily logs, sampling logs, communications, etc.) produced in the field at the end of each workday.

The possession of all records will be documented; however, only the FOL or his/her designee may remove field data from the site for reduction and evaluation.

Analytical data generated through use of field equipment will be sent to the TtNUS Task Order Manager for incorporation into the AS/SVE Quarterly Field Operations Summary Reports.

5.2.2 Field Measurements

Field measurements will include those associated with the collection of air, soil, and groundwater samples. Measurements such as flow rates, air volume, pressure, temperature, and physical water quality measurements will be recorded in the field logbook.

Field measurements will also include those associated with the completion of soil borings and well installation.

5.2.3 Field Analysis

Analyses of both air and groundwater samples will be conducted during the treatability study.

Air samples will be analyzed for VOCs, using an OVA equipped with an FID. This equipment will be operated in accordance with TtNUS Standard Operating Procedure ME-13.

Field test kits will be used to determine concentrations of dissolved oxygen (DO) and dissolved CO_2 in groundwater samples. Analysis for both DO and CO_2, using field test kits, will be conducted when a sample is collected.

Field equipment used during this project will be calibrated and operated in accordance with the manufacturers' instructions and manuals. A log will be kept, documenting the calibration result for each field instrument. The log will include the data standards, personnel, and results of the calibration.

5.2.4 Laboratory Analysis

An analytical laboratory experienced in chemical analysis will perform sample analyses to determine the presence of O_2, CO_2, and VOCs. The samples will be prepared and analyzed in accordance with method-specific requirements. The analytical methods to be used are summarized in Table 5-2.

5.2.5 Sample Handling and Preservation, Custody, and Shipment

Sample handling, preservation, custody, and shipping requirements are described in the following sections.

5.2.5.1 Sample Handling and Preservation

Sample handling includes field-related consideration regarding the selection of sample containers, preservatives, allowable holding times, and requested analyses. Table 5-3 summarizes the sample holding times and bottleware requirements for collected samples.

5.2.5.2 Sample Custody

Samples will be recorded on COC forms by the FOL. COC records must include the identification numbers of all samples collected on a given day, the times of collection, names of the samplers, and all others who subsequently held custody of the samples. The COC record must also include the chemical analyses requested.

Samples will be the responsibility of identified persons from the time they are collected until they are transferred. The FOL, or appropriate designee, is responsible for the care and custody of the samples collected until they are delivered to the analytical laboratory or entrusted to a carrier. Transfer of custody to another party (e.g., express mail or the laboratory) must be formally documented on the COC records. Stringent COC procedures will be followed to document sample possession.

Sample logs or other records must be signed and dated.

COC sample forms will be completed to the fullest extent possible prior to sample shipment. Each form must include the following: project name, sample identification number, time collected, source of the

sample location, matrix, type of sample (grab or composite), preservative, number and size of bottle(s), required analyses, and name of the sampler.

COC forms must be completed in a legible manner with waterproof ink and signed by the sampler. Similar information will be provided on the sample label that will be securely attached to the sample bottle or container.

Containers used to ship samples must be sealed according to EPA requirements to maintain sample integrity. All shipments must be accompanied by the COC record that identifies the contents. The original COC record will accompany the shipment and a copy will be retained by the field sampler.

5.2.5.3 Sample Shipment Procedures

Samples requiring refrigeration will be promptly chilled with ice to a temperature of 4° C and will be packed in insulated coolers for transport to the laboratory. Ice will be sealed in containers to prevent leakage of water. Samples will not be frozen.

Only shipping containers that meet all applicable state and Federal standards for safe shipment will be used.

Shipping containers will be sealed with nylon strapping tape and custody seals will be signed, dated, and affixed in a manner that will allow the receiver to quickly identify any tampering that may have occurred during transport to the laboratory.

Shipment will be made by overnight courier. After samples have been collected, they must be sent to the laboratory within 24 hours.

5.2.6 Quality Control Samples

This section identifies required QA/QC samples to be collected during both the short-term testing and long-term evaluation phases of the pilot-scale AS/SVE Treatability Study.

In addition to regular calibration of field equipment and appropriate documentation, QC samples will be collected during AS/SVE sampling activities. QC samples will not be required for sampling associated with monitoring the treatability system. QC samples include field blanks, field duplicates, and trip blanks. Each type of QC sample is defined in the following subsections. Table 5-2 summarizes the environmental samples by analytical parameter and methodology, media, and associated QC samples.

5.3 BOTTLEWARE

Bottleware and containers are summarized in Table 5-3. Pre-cleaned bottles and certified SUMMA canisters shall be used to collect environmental samples.

5.4 SAMPLE IDENTIFICATION SYSTEM

Each sample submitted to the fixed-base laboratory for chemical analysis shall be assigned a unique sample identification number. The sample identification number will consist of a five-segment, alpha-numeric code that identifies the site, sample type (medium) and location, sample depth, and sample period (round).

The alpha-numeric coding to be used in the sample identification system is as follows:

Field Samples

(AAA)	-	(AA)	-	(AA) (NN)	-	(NN)	-	(NN)
(Site name)	-	(Sample type)	-	(Sample Location)	-	(Sample Depth)	-	Round

Character Type: A - Alphanumeric; N - Numeric

Site Name: BCFC - BOCA Chica Flying Club

Sample Type: AS - Air Sample; GW - Groundwater sample; SB - Soil sample

Sample Location: 02 - Groundwater well (MW) 02.

Sample Depth: Soil - Depth from ground surface to soil sample.

Air and Groundwater - Use none (00).

Sample Round: 01 - Round 1

QA Sample Type Designation:

TB - Trip Blank

FB - Field Blank

FD - Field Duplicate

QA sample designations will be blind relative to field duplicates. Other pertinent information regarding sample identification will be recorded in the field logbooks and on sample log sheets.

Using this nomenclature scheme, the following is an example for a sample collected from Observation Well #3 during round 1 of sampling: BCFC - GW - OW03 - 00 – 01.

5.5 RECORD KEEPING

In addition to COC forms, certain standard forms will be completed for each sample description and documentation. These will include sample log sheets, boring logs, daily record of subsurface investigation reports, and logbooks.

A bound, weatherproof notebook will be maintained by each sampling event leader. All information related to sampling or field activities will be recorded in the field notebooks. This information will include, but is not limited to, sampling time, weather conditions, unusual events, field measurements, descriptions of photographs, etc.

At the completion of field activities, the FOL will submit to the Task Order Manager all field-relevant records, including field notebooks, COC receipts, sample log sheets, drilling logs, daily logs, and any other pertinent documents.

TABLE 5-1

PROPOSED ANALYTICAL TESTING FOR AS/SVE PILOT TEST
NAVAL AIR STATION
KEY WEST, FLORIDA
PAGE 1 OF 2

PHASE I

Task	Event	Media	Location	No. of Sample Rounds	Fixed-base Laboratory Analysis	Field Analysis
Groundwater monitoring	Prior to any Test	Groundwater	MW-5 MW-6, MW-10, and MW-21 SVE-1 and SVE-2	1 per event	N/A	DO, CO_2 , free product thickness
SVE Test	After vacuum readings become asymptotic (+/- 10%), or every 10 minutes	Soil vapor	SVE-1 (collect from SVE prior to bleed air) and SVE-2	1 per event	N/A	OVA/FID
AS Test	Start-up, every 15 minutes for the first hour, and every 30 minutes thereafter (or until DO, VOC and pressure readings become stable (+/- 10%)	Groundwater	MW-5 MW-6, MW-10, and MW-21 SVE-1 and SVE-2	4 per event	N/A	DO, OVA/FID headspace in well
AS/SVE Test	After vacuum readings become asymptotic with extraction pump only operating	Soil vapor	SVE-1 and SVE-2	1 per event	VOCs	N/A
AS/SVE Test	Start-up, every 15 minutes for the first hour, and every 30 minutes thereafter (or until DO, VOC, and pressure readings become stable	Groundwater	MW-5 MW-6, MW-10, and MW-21	3 per event	N/A	DO, CO_2
AS/SVE Test	Start-up, every 15 minutes for the first hour, and every 30 minutes thereafter (or until DO, VOC, and pressure readings become stable	Soil vapor	Vacuum pump exhaust	1 per event	N/A	OVA/FID
AS/SVE Test	After pressure/vacuum readings in the observation wells become stable	Soil vapor	Vacuum pump exhaust	1 per event	VOCs	N/A

TABLE 5-1

PROPOSED ANALYTICAL TESTING FOR AS/SVE PILOT TEST
NAVAL AIR STATION
KEY WEST, FLORIDA
PAGE 2 OF 2

PHASE II

Task	Event	Media	Location	No. of Sample Rounds	Fixed-base Laboratory Analysis	Field Analysis
Start-up	Initial sampling	Soil vapor(untreat-ed and undiluted)	Vacuum pump exhaust	1 sample	VOCs, O_2, CO_2	OVA/FID reading from vapor stream
Start-up	Initial sampling	Air (treated)	After first carbon drum	1 plus 1 blank	VOCs, O_2, CO_2	OVA/FID reading
O & M	Monthly (until emission requirements are met)	Soil vapor (untreated and undiluted)	Vacuum pump exhaust	1 sample	VOCs, O_2, CO_2	OVA/FID reading
O & M	Monthly (until emission requirements are met)	Soil vapor	After first carbon drum	1 sample	VOCs, O_2, CO_2	OVA/FID reading
O & M	Monthly (until emission requirements are met)	Groundwater	MW-5, MW-6, MW-10, and MW-21	1 each	EPA Methods 602, 610	DO, free product

Note: If the first carbon drum indicates breakthrough, the second drum will be installed in place of the first drum and a new drum installed in place of the second drum.

N/A = Not applicable.

TABLE 5-2

**AS/SVE PILOT-SCALE SYSTEM
ENVIRONMENTAL SAMPLE SUMMARY
NAVAL AIR STATION
KEY WEST, FLORIDA**

Analyte	Method	Number of Groundwater Samples	Number of Air Samples	Total Samples
VOCs(1 and 2)	TO-14A (EPA Method 18)	0	29	29
VOCs(1 and 2)	601 and 602 FLPRO	6 months × 4 wells = 24	0	24
VOCs(1 and 2)	601 and 602 FLPRO	6 months × 2 duplicates = 12	0	12
Dissolved O_2(1)	TEST KITS	4	0	4
Dissolved CO_2(1)	TEST KITS	4	0	4
Dissolved O_2(2)	TEST KITS	48	0	48
Dissolved CO_2(2)	TEST KITS	48	0	48

(1) Analyses for Phase I (short-term study).
(2) Analyses for Phase II (long-term study).

TABLE 5-3

**HOLDING TIME AND BOTTLEWARE REQUIREMENTS
FOR AS/SVE PILOT TEST
NAVAL AIR STATION
KEY WEST, FLORIDA**

Matrix	Analysis	Bottleware	Preservation	Holding Time
Air	TCL VOCs using TO-14A	Tedlar bags	None	3 days from date of collection
Groundwater	602 and 610 FLPRO	(3) 40 ml vials 1 liter 1 liter	None	3 days from date of collection

TCL = Target Compound List.

REFERENCES

ABB (ABB Environmental Services, Inc.), 1994. *Contamination Assessment Report Flying Club Site, Building A-127* prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command, Tallahassee, Florida, April.

ABB (ABB Environmental Services, Inc.), 1997. *Remedial Action Plan, Flying Club Site (UST Site 9), Naval Air Station, Key West, Florida*, prepared for Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), Charleston, South Carolina, August.

BEI (Bechtel Environmental, Inc.), 1999. Project Completion Report for Delivery Order No. 0094, Flying Club Site, Petroleum Remediation at Naval Air Station, Key West, Florida, prepared for Department of the Navy, Southern Division, Naval Facilities Engineering Command, Oak Ridge, Tennessee, January.

EPA (United States Environmental Protection Agency), 1991. *Management of Investigation - Derived Waste During Site Inspections*. DERR Directive 9345.3.02.

FDEP (Florida Department of Environmental Protection), 1992. *SOPs for Laboratory Operations and Sample Collection Activities*, DEP - QA-001/92; FDEP, Tallahassee, Florida.

APPENDIX A

RESPONSE TO COMMENTS

APPENDIX A. RESPONSE TO COMMENTS

Note: No comments were received on Rev. 0.

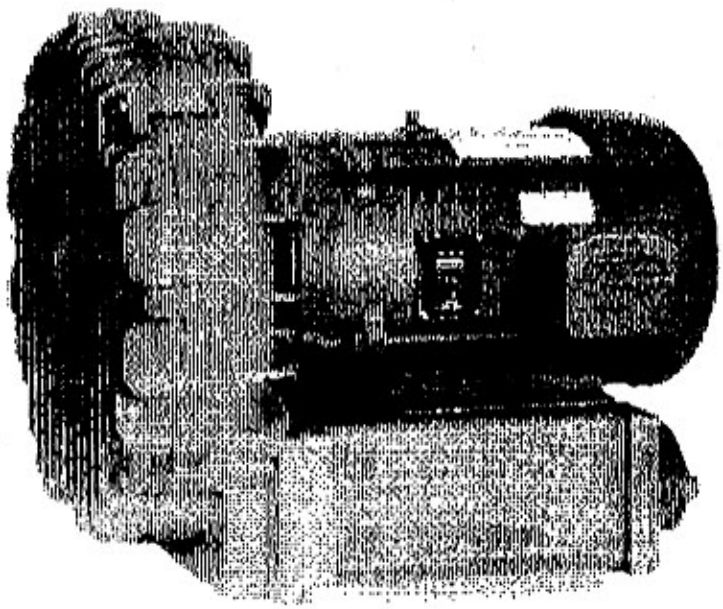
APPENDIX B

EQUIPMENT SPECIFICATIONS

EN 707 & CP 707 Three-Phase Sealed Regenerative Blower w/Explosion-Proof Motor

FEATURES

- Manufactured in the USA – ISO 9001 compliant
- Maximum flow: 295 SCFM
- Maximum pressure: 85 IWG
- Maximum vacuum: 87 IWG
- Standard motor: 5.0 HP, explosion-proof
- Cast aluminum blower housing, cover, impeller & manifold; cast iron flanges (threaded); teflon lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards



MOTOR OPTIONS

- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

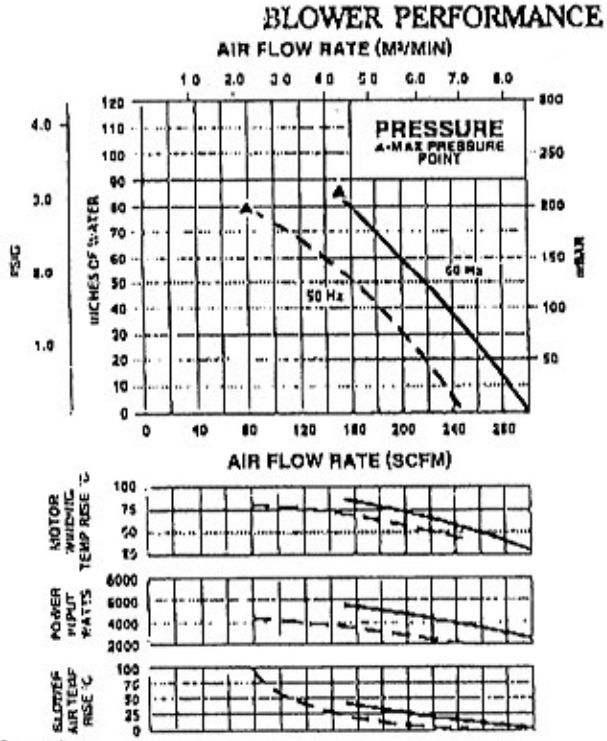
BLOWER OPTIONS

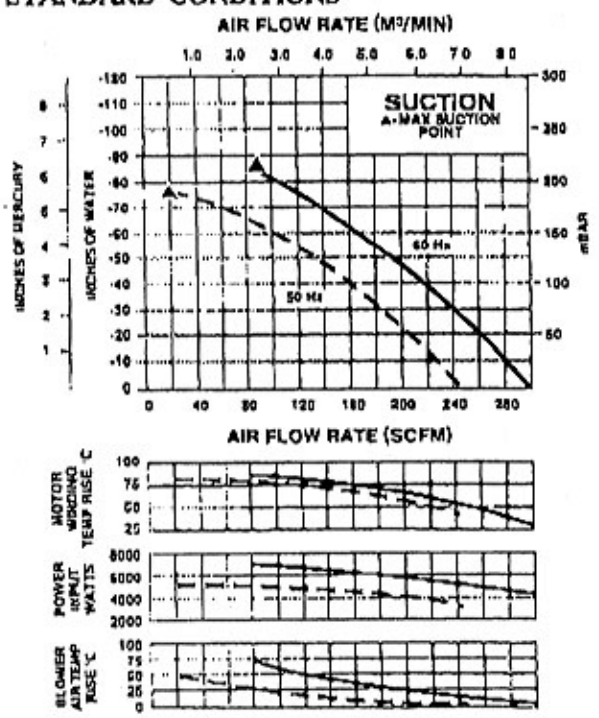
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES (See Catalog Accessory Section)

- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

BLOWER PERFORMANCE AT STANDARD CONDITIONS

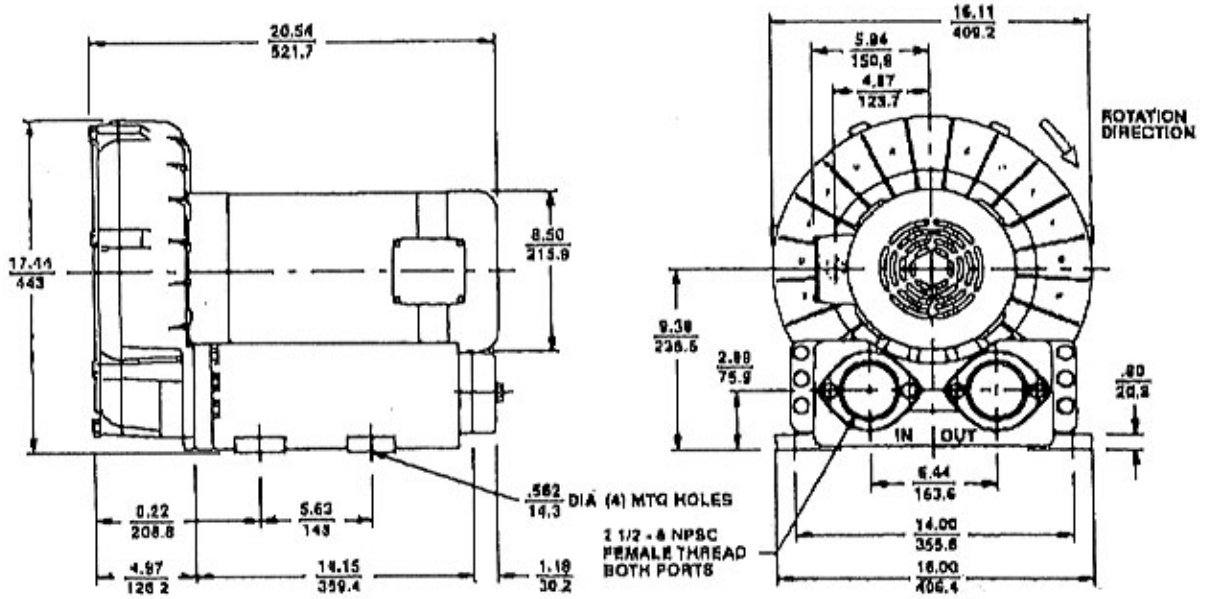




Rev 2/01

EN 707 & CP 707 Three-Phase Sealed Regenerative Blower w/ Explosion-Proof Motor

Scale CAD drawing available upon request.



DIMENSIONS: IN / MM
TOLERANCES: .XX ± 1/2.5
(UNLESS OTHERWISE NOTED)

A — Ø.75" NPT CONDUIT CONNECTION AT 12 O'CLOCK POSITION

SPECIFICATIONS

MODEL	EN707F72MXL		EN707F86MXL	CP707FW72MXLR
Part No.	038710		038711	038974
Motor Enclosure – Shaft Material	Explosion-proof – CS		Explosion-proof – CS	Chem XP – SS
Horsepower	5.0		5.0	Same as EN707F72MXL – 038710 except add Chemical Processing (CP) features from catalog inside front cover
Phase – Frequency [1]	Three - 60 Hz		Three - 60 Hz	
Voltage [1]	230	460	575	
Motor Nameplate Amps	14	7	5.7	
Max. Blower Amps [3]	15.8	7.9	6.3	
Inrush Amps	152	76	61	
Starter Size	1	0	0	
Service Factor	1.0		1.0	
Thermal Protection [2]	Class B - Pilot Duty		Class B - Pilot Duty	
XP Motor Class – Group	I-D, II-F&G		I-D, II-F&G	
Shipping Weight	174 lb (79 kg)		174 lb (79 kg)	

[1] Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

[2] Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

[3] Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

Specifications subject to change without notice. Please consult your Local Field Sales Engineer for specification updates. Rev. 2/01

EN 707, EN 808 Single-Phase and CP Options Sealed Regenerative Blower w/Explosion-Proof Motor

FEATURES

- Manufactured in the USA – ISO 9001 compliant
- Maximum flow: 295 or 345 SCFM
- Maximum pressure: 88 or 56 IWG
- Maximum vacuum: 84 or 64 IWG
- Standard motor: 5.5 HP, explosion-proof
- Cast aluminum blower housing, cover, impeller & manifold; cast iron flanges (threaded); teflon lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

MOTOR OPTIONS

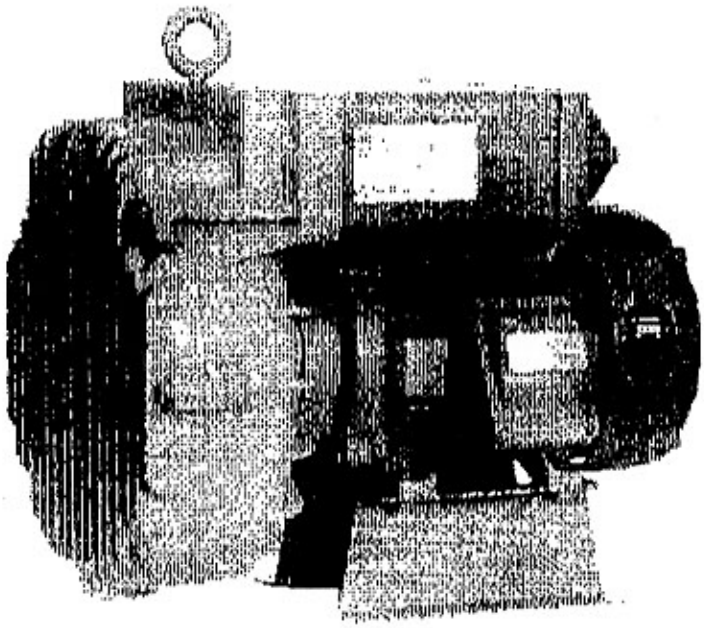
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS

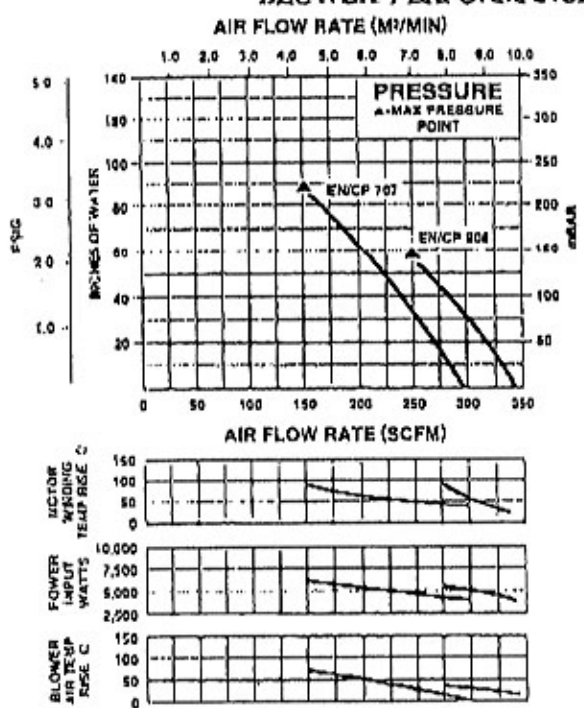
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

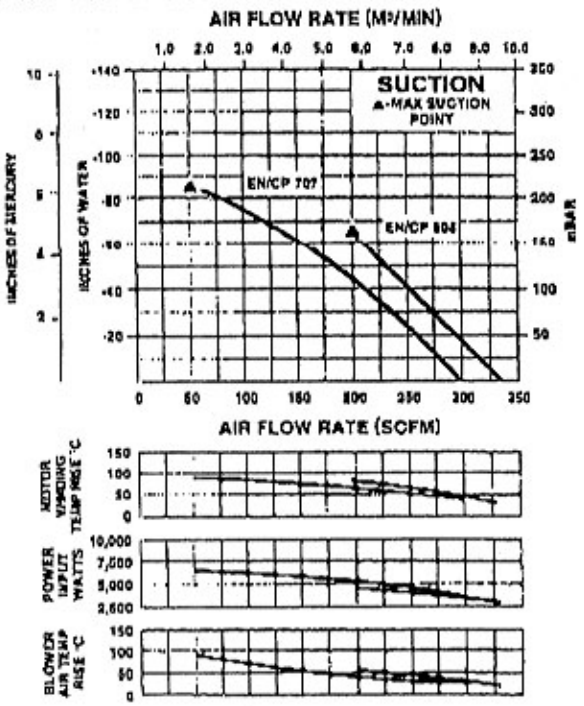
ACCESSORIES (See Catalog Accessory Section)

- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package



BLOWER PERFORMANCE AT STANDARD CONDITIONS





Rev. 2/01

APPENDIX C

AS/SVE PILOT TEST PROCEDURES AND FORMS

Pre-test Preparation

1. Record time and site conditions.
2. Position the pilot study unit as close to the test wells as possible.
3. Measure and record water level, DO, and CO_2 in observation wells (OW1, MW-1, and MW-4). Use a YSI flow-through cell (or equivalent) for DO and a HACH Kit (or equivalent) for CO_2.
4. Connect vacuum/pressure gages to the test wells and observation wells. The gauges should be installed as close as possible or at the well heads to minimize recording of friction losses.
5. Install dedicated tubing in each monitoring well. This tubing will be connected to a peristaltic pump for CO_2 sampling.
6. Collect groundwater samples.

SVE-only Test

1. Connect SVE-1 to the vacuum pump. A 90-degree piece of PVC pipe with a quick-disconnect camlock fitting on one end and a “Fernco” fitting on one end may be used to connect the extraction well to the hose leading to the vacuum pump. Ensure that all connections are airtight.
2. Measure and record distance from SVE-1 to each observation well.
3. Start the vacuum pump. Set the pump with an initial airflow of 10 standard cubic feet per minute (scfm) and record the vacuum at the extraction well.
4. Ensure that each observed vacuum does not deflect the gauge to full scale. Otherwise, replace gauge with the next higher scale. Record vacuum in each observation well every 10 minutes or until asymptotic (within +/- 10%) vacuum readings are observed.
5. Measure untreated off-gas with an OVA.
6. After asymptotic (within +/- 10%) vacuum readings are observed, increase airflow to 20 scfm. Repeat Steps 4 and 5.
7. After asymptotic (within +/- 10%) vacuum readings are observed, increase airflow to 25 scfm. Ensure that groundwater is not pumped; otherwise, decrease vacuum. Repeat Steps 4 and 5.
8. Shut down pilot test.

AS-only Test

1. Connect AS-1 and AS-2 to the blower. A 90-degree piece of PVC pipe with a quick-disconnect camlock fitting on one end and a "Fernco" fitting on one end may be used to connect the extraction well to the hose leading to the blower. Ensure that all connections are airtight.
2. Measure and record distance from AS-1 and AS-2 to each observation well and to SVE-1.
3. Calculate injection pressure. Injection pressure should overcome the hydrostatic pressure, which equals the height of the column of water in AS-1 and AS-2 from the water table to the top of the screened interval multiplied by 0.43 pounds per square inch per foot (psi/ft). Additional pressure is required to induce flow through the soils. The total injection pressure should not exceed 0.7 psi/ft or fracturing will result.
4. Start the blower. Set the blower pressure to the pressure previously determined in Step 3. Record flow rate.
5. Ensure that each observed pressure does not deflect the gauge to full scale. Otherwise, replace gauge with the next higher scale.
6. The following must be recorded sequentially at start-up, every 15 minutes for the first hour, and 30 minutes thereafter:
   - pressure in AS-1 and AS-2, observation wells, and SVE-1
   - OVA readings in observation wells
   - depth to groundwater
   - DO using YSI probe (or similar) and CO_2 using a HACH kit (or similar) in observation wells.

   Note: The wellhead of each observation well must be removed temporarily to measure depth to groundwater and to measure DO. It has been observed in sites with similar lithology that pressure usually recovers within 5 minutes after a wellhead is sealed.
7. Terminate test after VOC and DO levels and pressure readings in the observation wells become asymptotic (within +/- 10%).
8. Leave set-up as-is for the next test.

Combined AS/SVE Test

1. Measure depth to groundwater and DO in each observation well.
2. Recalculate injection pressure with the current depth to groundwater.
3. With the vacuum pump connected to SVE-1, operate SVE at 1.5 to 2 times the flow rate recorded during AS-only test.
4. After the vacuum readings in the observation wells become asymptotic (within +/- 10%), measure undiluted and untreated off-gas with an OVA.
5. Collect an undiluted and untreated air sample in a SUMMA canister or SVE line from vacuum pump exhaust.

6. Start AS blower and apply the calculated injection pressure.
7. The following must be recorded sequentially at start-up, every 15 minutes for the first hour, and 30 minutes thereafter:
    - pressure/vacuum in AS-1 and AS-2 and observation wells
    - OVA readings from the vacuum pump exhaust
    - depth to groundwater, and
    - DO, using YSI probe (or similar) and CO_2 using a HACH kit (or similar) in observation wells and MW-7.
8. After VOC and DO levels and pressure/vacuum readings in the observation wells become asymptotic (within +/- 10%), collect an undiluted and untreated air sample in a SUMMA canister from vacuum pump exhaust.
9. Terminate test.

PHASE I SVE PILOT TEST
NAVAL AIR STATION
KEY WEST, FLORIDA

Time	Pump	SVE1	Flow Rate	VOC	OW1	MW-1	MW-4
	(" H_2O Vac)	(" H_2O Vac)	(scfm)	(ppm)	(" H_2O Vac)	(" H_2O Vac)	(" H_2O Vac)

Start Time: _____

PHASE I AS PILOT TEST
NAVAL AIR STATION
KEY WEST, FLORIDA

Time	Flow Rate (scfm)	Blower Pressure	Injection Press. (psig)		Pressure (" H2O)			
	SVE1	(psig)	AS-1	AS-2	SVE1	OW1	MW-1	MW-4

Time	Depth to Water (ft)			GW Dissolved Oxygen (mg/L)		
	OW1	MW-1	MW-4	OW1	MW-1	MW-4

Start Time: _____

Time	OVA			CO_2		
	OW1	MW-1	MW-4	OW1	MW-1	MW-4

PHASE I AS/SVE PILOT TEST
NAVAL AIR STATION
KEY WEST, FLORIDA

Time	SVE				AS				
	Pump Vacuum (in H2O)	SVE1 Vacuum (in H2O)	Flow Rate (scfm)	OVA (ppm)	Pump Pressure (psi)	Pressure AS-1 (psi)	Pressure AS-2 (psi)	Flow Rate AS-1 (scfm)	Flow Rate AS-2 (scfm)

Time	OVA (ppm)			Depth to Water (ft)		
	OW1	MW-1	MW-4	OW1	MW-1	MW-4

START TIME: _____

APPENDIX D

HEALTH AND SAFETY PLAN

Treatability Study
Health and Safety Plan

Air Sparging/Soil Vapor Extraction
at
Boca Chica Flying Club
Underground Storage Tank - Site 9

Naval Air Facility
Key West, Florida

Southern Division

Naval Facilities Engineering Command

Contract Number N62467-94-D-0888

Contract Task Order 0207

March 2002

Rev. 1

Rev. 1
3/8/02

TREATABILITY STUDY
HEALTH AND SAFETY PLAN

AIR SPARGING/SOIL VAPOR EXTRACTION
AT
BOCA CHICA FLYING CLUB
UNDERGROUND STORAGE TANK - SITE 9

NAVAL AIR FACILITY
KEY WEST, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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

SUBMITTED BY:
TETRATECH NUS, INC.
661 ANDERSEN DRIVE
FOSTER PLAZA 7
PITTSBURGH, PENNSYLVANIA 15220-2745

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0207

MARCH 2002

PREPARED UNDER THE SUPERVISION OF:

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APPROVED FOR SUBMITTAL BY:

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CLEAN HEALTH & SAFETY MANAGER
TETRA TECH NUS, INC
PITTSBURGH, PENNSYLVANIA

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

AS	air sparging
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
DOD	U.S. Department of Defense
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
eV	electron Volts
FID	Flame Ionization Detector
FOL	Field Operations Leader
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
IDW	Investigation-derived waste
MSDS	Material Safety Data Sheets
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PAHs	polynuclear aromatic hydrocarbons
PHSO	Project Health and Safety Officer
PID	Photo Ionization Detector
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures
SSO	Site Safety Officer
SVE	soil vapor extraction
SVOCs	semi-volatile organic compounds
SWP	Safe Work Permit
TtNUS	Tetra Tech NUS, Inc.
TOM	Task Order Manager
UST	underground storage tank
WP	Work Plan

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed to provide practices and procedures for Tetra Tech NUS, Inc. (TtNUS) personnel engaged in the Treatability Study activities at the Naval Air Station Key West (NAS Key West) in Key West, Florida. 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 Number N62467-94-D-0888, Contract Task Order Number 0207. This HASP must be used in conjunction with the TtNUS Health and Safety Guidance Manual; both documents must be present at the site during the performance of all site activities. The Guidance Manual provides detailed information pertaining to the HASP as well as applicable TtNUS Standard Operating Procedures (SOPs). This HASP and the contents of the Guidance Manual were developed to comply with the requirements stipulated in 29 Code of Federal Regulations (CFR) 1910.120 (Occupational Safety and Health Administration's) [OSHA's] Hazardous Waste Operations and Emergency Response Standard).

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

1.1 KEY PROJECT PERSONNEL AND ORGANIZATION

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

- The TtNUS TOM is responsible for the overall direction of health and safety for this project.

- The PHSO is responsible for developing this HASP in accordance with applicable OSHA regulations. Specific responsibilities include:

  – Providing information regarding site contaminants and physical hazards associated with the site

- Establishing air monitoring and decontamination procedures
- Assigning personal protective equipment (PPE) according to task and potential hazards
- Determining emergency response procedures and emergency contacts
- Stipulating training requirements and reviewing appropriate training and medical surveillance certificates
- Providing standard work practices to minimize potential injuries and exposures associated with hazardous waste work
- Modifying this HASP as it becomes necessary.

- The TtNUS Field Operations Leader (FOL) is responsible for implementation of the HASP with the assistance of an appointed Site Safety Officer (SSO). The FOL manages field activities, executes the Work Plan, and enforces safety procedures as they apply to the Work Plan.

- The SSO supports site activities by advising the FOL on all aspects of health and safety onsite. These duties may include:

  - Coordinating all health and safety activities with the FOL
  - Selecting, applying, inspecting, and maintaining PPE
  - Establishing work zones and control points in areas of operation
  - Implementing air monitoring programs for onsite activities
  - Verifying training and medical clearance status of onsite personnel in relation to site activities
  - Implementing hazard communication, respiratory protection programs, and other associated health and safety programs as they may apply to site activities
  - Coordinating emergency services
  - Providing site-specific training for all onsite personnel
  - Investigating all accidents and injuries (see Attachment I - Illness/Injury Procedure and Report Form)
  - Providing input to the PHSO regarding the need to modify this HASP or associated applicable health and safety documents, per site-specific requirements.

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

Note: In some cases, one person may be designated responsibilities for more than one position. For example, at NAS Key West, the FOL may also be responsible for SSO duties. This action will be performed only as credentials or experience permits.

1.2 SITE INFORMATION AND PERSONNEL ASSIGNMENTS

Site Name: Naval Air Station Key West
Key West, Florida

Client Contact: Mr. Robert Courtright
Phone Number: (305) 293-2881

Scheduled Activities: TtNUS will conduct a Treatability Study at the Boca Chica Flying Club. See section 3.0 and 4.0 for details concerning details site background and scope of work.

Dates of scheduled activities: January 2002 – July 2002

Project Team:

TtNUS Management Personnel:	Discipline/Tasks Assigned:
Chuck Bryan	Task Order Manager (TOM)
Emily Harrison McRee	Field Operations Leader (FOL)
TBD	Site Safety Officer (SSO)
Matthew M. Soltis, CIH, CSP	CLEAN Health and Safety Manager
Jim Laffey	Project Health and Safety Officer (PHSO)

Other Potential TtNUS Project Personnel:

Skip Vallincourt	
Gary Braganza	

Prepared by: Jim Laffey, CIH, CSP

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. All site activities will be coordinated with the client contact, Robert Courtright. In the event of an emergency that cannot be mitigated using onsite resources, personnel will evacuate to a safe place of refuge and the appropriate emergency response agencies will be notified. It has been determined that the majority of potential emergency situations would be better supported by outside emergency responders. Based on this determination, TtNUS personnel will not provide emergency response support beyond the capabilities of onsite response. Workers who are ill or who have suffered a non-serious injury may be transported by site personnel to nearby medical facilities, provided that such transport does not aggravate or further endanger the welfare of the injured/ill person. 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 site operations, which ensures adequate emergency response time. NAS Key West contact Robert Courtright will be notified any time outside response agencies are contacted. This Emergency Action Plan conforms to the requirements of 29 CFR 1910.38(a), as allowed in 29 CFR 1910.120(l)(1)(ii).

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

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

2.2 PRE-EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, emergencies resulting from chemical, physical, or fire hazards are considered unlikely to be encountered during site activities. Nonetheless, to minimize and eliminate the potential for any emergency situations, pre-emergency planning activities will include the following (which are the responsibility of the SSO and/or the FOL):

- Coordinating with local emergency response personnel to ensure that TtNUS emergency action activities are compatible with existing emergency response procedures. Base Fire Protection and Emergency Services will be notified of scheduled events and activities. This is imperative in situations where their services may be required.

- Establishing and maintaining information at the project staging area (Support Zone) for easy access in the event of an emergency. This information will include the following:

  - Chemical Inventory (of chemicals used onsite), with Material Safety Data Sheets (MSDSs)
  - Onsite personnel medical records (Medical Data Sheets)
  - A logbook identifying personnel onsite each day
  - Hospital route maps with directions (these should also be placed in each site vehicle)
  - Emergency notification phone numbers.

The TtNUS FOL will be responsible for the following tasks:

- Identifying a chain of command for emergency action

- Educating site workers to the hazards and control measures associated with planned activities at the site, and providing early recognition and prevention, where possible.

- Periodically performing practice drills to ensure that site workers are familiar with incident response measures

- Providing the necessary equipment to safely accomplish identified tasks.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Emergency situations that may be encountered during site activities will generally be recognized by visual observation. To adequately recognize chemical exposures, site personnel must have a clear knowledge of exposure signs and symptoms associated with site contaminants. This information is provided in Table 6-1. Tasks to be performed at the site, potential hazards associated with those tasks, and recommended control methods are discussed in detail in Sections 5.0 and 6.0. Additionally, early recognition

of hazards will be supported by daily site surveys to eliminate any situation that could be an emergency. The FOL and/or the SSO will be responsible for performing surveys of work areas prior to initiating site operations and periodically while operations, are being conducted. Survey findings will be documented by the FOL and/or the SSO in the Site Health and Safety Logbook; however, all site personnel will be responsible for reporting hazardous situations. Where potential hazards exist, TtNUS will initiate control measures to prevent adverse effects to human health and the environment.

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

2.3.2 Prevention

TtNUS personnel will minimize the potential for emergencies by following the Health and Safety Guidance Manual and ensuring compliance with the HASP and applicable OSHA regulations. Daily site surveys of work areas (prior to the commencement of that day's activities) by the FOL and/or the SSO will also assist in prevention of illness/injuries when hazards are recognized early and control measures initiated.

2.4 EVACUATION ROUTES, PROCEDURES, AND PLACES OF REFUGE

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

In the event of an emergency requiring evacuation, all personnel will immediately stop activities and report to the designated safe place of refuge, unless doing so would pose additional risks. When evacuation to the primary place of refuge is not possible, personnel will proceed to a designated alternate location and remain there until further notification from the TtNUS FOL. Safe places of refuge will be identified by the SSO prior to the commencement of site activities and the information will be conveyed to personnel as part of the pre-activities training session. This information will also be repeated during daily safety meetings. Whenever possible, the safe place of refuge will also serve as the telephone communications point for that area. During an evacuation, personnel will remain at the refuge location until directed otherwise by the TtNUS FOL or the onsite Incident Commander of the Emergency Response Team. The FOL or the SSO will perform a head count at this location to account for and confirm the locations of all site personnel. Emergency response

personnel will be immediately notified of any unaccounted-for personnel. The SSO will list the names of all onsite personnel (on a daily basis) in the site Health and Safety Logbook. This information will be utilized to perform the head count in the event of an emergency.

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

2.5 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 would requiring 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**.** Attachment I provides the procedure to follow when reporting an injury/illness, and the form to be used for this purpose. **If the emergency involves personnel exposures to chemicals, the steps provided in Figure 2-1 will be followed.**

2.6 EMERGENCY CONTACTS

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

TABLE 2-1

**EMERGENCY REFERENCES
NAVAL AIR STATION
KEY WEST, FLORIDA**

AGENCY	TELEPHONE
Key West Police/Rescue Services	(305) 293-2971
NAS Key West Point of Contact, Robert Courtright	(305) 293-2881
Base Police	(305) 293-2114
Base Fire Department Boca Chica	(305) 293-3333
Hospital: Lower Florida Keys Health System	(305) 294-5531
Base Officer of the Day (OOD)	(305) 293-2971
Chemtrec National Response Center	(800) 424-9300 (800) 424-8802
Task Order Manager/ Field Operations Leader, Chuck Bryan	(803) 649-7963 x345
Health and Safety Manager, Matthew M. Soltis, CIH, CSP	(412) 921-8912
Project Health and Safety Officer, Jim Laffey, CIH, CSP	(412) 921-8678

2.7 EMERGENCY ROUTE TO HOSPITAL

The closest hospital to NAS Key West is Lower Florida Keys Health System. Directions are as follows :

> From Boca Chica, exit NAS Key West and get on U.S. 1 South. Go west across the bridge, pass Texaco, and turn right on Junior College Road. Golf course will be on left and, on right, you will see hospital sign. Follow road to hospital which will be on the left. Hospital is located at 5900 College Road on Stock Island.

A map, indicating the travel route from the site to the hospital is shown in Figure 2-2.

2.8 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 sight 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 will be followed:

- Initiate the evacuation via hand signals, voice commands, line of sight communication, or vehicle horns. The following signals will be utilized when communication via vehicle horn is necessary:

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

- Report to the designated refuge point.

- Once all non-essential personnel are evacuated, appropriate response procedures will be enacted to control the situation.

- 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.

Call the pertinent emergency contacts listed in Table 2-1 and 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.

2.9 PPE AND EMERGENCY EQUIPMENT

A first-aid kit, eye wash units (or bottles of disposable eyewash solution), and fire extinguishers (strategically placed) will be maintained onsite and shall be immediately available for use in the event of an emergency. This equipment will be located in the field office as well as in each site vehicle. At least one first aid kit, supplied with equipment to protect against bloodborne pathogens, will also be available onsite. Personnel

identified within the field crew with bloodborne pathogen and first-aid training will be the only personnel permitted to offer first-aid assistance.

As soon as possible, Navy contact Robert Courtright must be informed of any incident or accident that requires medical attention.

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, provide hazard information from Table 6-1 to medical service personnel**.**

Figure 2-1
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, 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 Tetra Tech NUS employee, call the medical facility and advise them that the patient(s) is/are being sent and that they can anticipate a call from the Continuum Healthcare physician. Continuum Healthcare will contact the medical facility and request specific testing which may be appropriate. The care of the victim will be monitored by Continuum Healthcare physicians. Site officers and personnel should not attempt to get this information, as this activity leads to confusion and misunderstanding.
- Call Continuum Healthcare at 1-800-229-3674, being 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 Tetra Tech NUS, Inc. employee(s).
  - Name and phone number of an informed site officer who will be responsible for further investigations.
  - Fax appropriate MSDS to Continuum Healthcare at (770) 457-1429.
- Contact 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, this information should be forwarded to the Continuum Healthcare Medical Director or Assistant Medical Director.

Continuum Healthcare 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 in addition to being distributed to appropriately designated company 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 Continuum Healthcare.

Figure 2-1 (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	Chest Tightness / Pressure
Tearing	Nausea / Vomiting
Headache	Dizziness
Cough	Weakness
Shortness of Breath	

Delayed Symptoms:

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

IV. Present Status of Symptoms (check off appropriate symptoms)

Burning of eyes, nose, or throat	Nausea / Vomiting
Tearing	Dizziness
Headache	Weakness
Cough	Loss of Appetite
Shortness of Breath	Abdominal Pain
Chest Tightness / Pressure	Numbness / Tingling
Cyanosis	

Have symptoms: (please check off appropriate response and give duration of symptoms)

Improved: _____ Worsened: _____ Remained Unchanged: _____

V. Treatment of Symptoms (check off appropriate response)

None: _____ Self-Medicated: _____ Physician Treated: _____

3.0 SITE BACKGROUND

3.1 SITE HISTORY

NAS Key West is in southern Monroe County, Florida. The U.S. Navy manages 6,323 acres of land that are divided into 20 separate tracts in the lower Florida Keys, concentrated around Key West and Boca Chica Key (see Figure 1-1 of the Work Plan). The Naval Station at Key West was dis-established in 1974, resulting in the relocation of several units. At present, NAS Key West is proceeding with realignment of aviation operations, a research laboratory, communications intelligence, counternarcotics air surveillance operations, a weather service, and several other activities on Key West. In addition to the Naval activities and units, other U.S. Department of Defense (DOD) and Federal agencies at NAS Key West include the U.S. Air Force, U.S. Army, and U.S. Coast Guard.

Several installations in various parts of the lower Florida Keys comprise the Naval Complex at Key West. Most of these are on Key West and Boca Chica Key. Key West, one of the two westernmost major islands of the Florida Keys, is approximately 150 miles southwest of Miami and 90 miles north of Havana, Cuba. Key West connects to the mainland by the Overseas Highway (U.S. Highway No. 1). The topography at NAS Key West is generally flat.

3.2 PROJECT SITE DESCRIPTION

A contamination assessment and remedial action were performed at the site (Flying Club Underground Storage Tank [UST]-Site 9). Petroleum-contaminated soil was excavated, treated, and returned to the site. Contaminated groundwater remains at the site. The remedial action plan for the site recommended groundwater monitoring, which showed no significant decrease in groundwater contaminants. The remedial action plan recommended a Treatability Study for the site.

The Treatability Study will consist of installing air sparging (AS) wells, in which air will be injected into the groundwater, causing the contaminants to volatilize. The vapors will then be extracted through the soil vapor extraction (SVE) wells that will also be installed.

4.0 SCOPE OF WORK

This section describes the project tasks that will be performed at NAS Key West. Additionally, each task has been evaluated and the associated hazards and recommended control measures are listed in Table 5-1 of this HASP. If new tasks are to be performed at the site, Table 5-1 and this section will be modified accordingly. Specific tasks to be conducted include, but are not necessarily limited to, the following:

- Mobilization and demobilization
- Monitoring well installation
- AS/SVE
- Piping installation (trenching)
- Installation of AS/SVE equipment (compressor and wiring)
- Air and soil vapor sampling
- Groundwater sampling
- Investigation-derived waste (IDW) management
- Decontamination of equipment.

The above listing summarizes the tasks as they apply to the scope and application of this HASP. For more detailed description of the associated tasks, refer to the Treatability Study Work Plan (WP). If additional tasks are determined to be necessary, this HASP will be amended and a hazard evaluation of the additional tasks will be performed.

5.0 TASKS/HAZARDS/ASSOCIATED CONTROL MEASURES SUMMARIZATION

Table 5-1 of this section serves as the primary portion of this HASP and identifies the tasks that are to be performed as part of the scope of work. This table may be modified if new or additional tasks become necessary. For each of the planned tasks, Table 5-1 specifies the anticipated hazards, recommended control measures, air hazard monitoring procedures, required PPE, and decontamination procedures.

By using the table, site personnel can determine which hazards are associated with each task at each site, and which 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, as well as proper air monitoring techniques.

As discussed earlier, a Health and Safety Guidance Manual accompanies this 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 of TtNUS' SOPs are also provided in this Guidance Manual.

Safe Work Permits (SWPs) issued for all Exclusion Zone activities (See Section 9.2) will use elements defined in Table 5-1 a primary reference. The FOL and/or the SSO completing the SWPs will be required to add certain task-specific information. The SWPs are to be used by the SSO as the outline for task-specific tailgate safety briefings, which will be conducted prior to the initiation of each task, and at the beginning of each work shift.

5.1 GENERAL SAFE WORK PRACTICES

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

- Note 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, SWPs, 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, and equipment to the SSO.

- Matches and lighters are restricted from entering in 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.

- A competent person (the SSO or designee) will inspect all drilling rigs prior to acceptance of the equipment at the site and prior to the use of the equipment. All identified repairs or deficiencies will be corrected prior to use. The inspection will be accomplished using the Equipment Inspection Checklist provided in Attachment I. 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

- To the extent possible, minimize contact with contaminated tooling and environmental media.

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

- Only qualified operators and knowledgeable ground crew personnel will participate in 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 determined cleanliness prior to moving to the next location, exiting the site, or prior to downtime for maintenance.

- All motorized equipment will be fueled prior to 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, with emergency brakes set and wheels chocked.

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

TABLE 5-1
TASKS-SPECIFIC HAZARD AND HAZARD CONTROL SUMMARY
NAVAL AIR STATION
KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Air Hazard Monitoring	**Personal Protective Equipment** *(Items in italics are deemed optional as conditions or the FOL or SSO require.)*	Decontamination Procedures
Mobilization/ Demobilization	***Chemical hazards:*** 1) Exposure to potential site contaminants are not anticipated during this activity. However, chemicals brought on site in support of field activities are to be identified, inventoried, accompanied by an appropriate MSDS, and properly stored. ***Physical hazards:*** 2) Lifting (strain/muscle pulls) 3) Pinches and compressions 4) Slip, trips, and falls 5) Heavy equipment hazards (rotating equipment, hydraulic lines, etc.) 6) Vehicular and foot traffic 7) Ambient temperature extremes ***Natural hazards:*** 8) Insect/animal bites and stings	1) To eliminate potential chemical hazards associated with this task ensure the following: - A chemical inventory list must be generated and maintained for all chemicals brought to the site (complete Section 5.0 of the TtNUS Health and Safety Guidance Manual). - Material Safety Data Sheets must be available for all chemicals brought on site. - Materials are to be stored in accordance with recommended practices and according to compatibility (See MSDS for storage and compatibility recommendations). - Persons using or handling chemicals must observe the requirements and restrictions presented on MSDS and container labels. 2) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 3) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. 4) Preview work locations for unstable/uneven terrain. 5) All equipment will be - Inspected in accordance with OSHA, and manufacturer's design. - Operated by knowledgeable operators, and knowledgeable ground crew. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 7) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. 8) Avoid nesting areas, use repellents. Report potential hazards to the SSO. Follow guidance presented in Section 4 of the Health and Safety Guidance Manual.	Not required	Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants) - Steel Toe Safety shoes - *Safety glasses* - *Hardhat (when overhead hazards exists, or as designated by the SSO)* - *Reflective vest for high traffic areas* - *Hearing protection for high noise areas, or as designated by the SSO.* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	Not required

TABLE 5-1
TASKS-SPECIFIC HAZARD AND HAZARD CONTROL SUMMARY
NAVAL AIR STATION
KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Air Hazard Monitoring	Personal Protective Equipment *(Items in italics are deemed optional as conditions or the FOL or SSO require.)*	Decontamination Procedures
Installation of Vapor Extraction and Piezometer wells (via Hollow Stem Auguring)	***Chemical hazards:*** 1) Primary types of contaminants include Diesel Range Organics, including diesel fuel and general Polynuclear Aromatic Hydrocarbons (PAHs). Note that these contaminants may be bound to particulates (dusts, soils, etc.) and contact should be avoided whenever possible. See Table 6-1 for more information on the chemicals of concern. 2) Transfer of contamination into clean areas or onto persons ***Physical hazards***: 3) Heavy equipment hazards (pinch/compression points, rotating equipment, hydraulic lines, etc.) 4) Noise in excess of 85 dBA 5) Energized systems (contact with underground or overhead utilities) 6) Lifting (strain/muscle pulls) 7) Slip, trips, and falls 8) Vehicular and foot traffic 9) Ambient temperature extremes ***Natural hazards:*** 10) Insect/animal bites and stings	1) Use real-time monitoring instrumentation, action levels, and identified PPE to control exposures to potentially contaminated media (air, water, soil, etc.). Generation of dusts should be minimized. If airborne dusts are observed, area wetting methods may be used. If area wetting methods are not feasible, termination of activities may be used to minimize exposure to excessive 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 Equipment Inspection Sheet (see Attachment III of this HASP). - Operated by knowledgeable operators and ground crew. - Only manufacturer-approved equipment may be used in conjunction with equipment repair procedures. In addition to the equipment considerations, the following standard operating procedures will be employed: - All personnel not directly supporting the soil boring or direct push operation will remain at least 25 feet from the point of operation. - All loose clothing/protective equipment will be secured to avoid possible entanglement. - Hand signals will be established prior to the commencement of soil boring or direct push activities. - A remote sampling device must be used to sample cuttings near rotating tools. - Work areas will be kept clear of clutter. - All personnel will be instructed in the location and operations of the emergency shut off device(s). This device will be tested initially (and then periodically) to ensure its operational status (See Equipment Inspection Form Attachment III of this HASP) - Areas will be inspected prior to the movement of drill rigs and support vehicles to eliminate any physical hazards. This will be the responsibility of the FOL and/or SSO. 4) Hearing protection will be used during all subsurface activities. 5) All utility clearances shall be obtained, in writing, prior to subsurface activities (contact the NAS Key West Onsite Representative). Prior to any subsurface investigations, the locations of all underground utilities will be identified and marked.(See Attachment II Utility Clearance SOP) 6) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 7) Preview work locations for unstable/uneven terrain. 8) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 9) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. 10) Avoid nesting areas, use repellents. Report potential hazards to the SSO. Follow guidance presented in Section 4 of the Health and Safety Guidance Manual	Direct reading instrument such as a Photoionization Detector (PID) with an 9.24 eV source (or higher) or Flame Ionization Detector (FID) will be used as a general screening instrument to detect volatile organic compounds and to evaluate airborne concentrations of potential site contaminants: Source areas (sample locations, borings, etc.) will be monitored using a PID or FID at regular intervals to be determined by the SSO. Positive sustained results at a source or downwind location(s) which may impact operations crew will require the following actions: **Excessive chemical contamination concentrations affecting the field crews during this task is not anticipated. The following information is based as a contingency action only.** - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above 25 ppm in the breathing zone areas of the at-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker breathing zone areas return to below 25 ppm. If elevated readings in worker breathing zone persist, the PHSO and HSM will be contacted to determine necessary actions and levels of protection. Site 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. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides.	All subsurface operations are to be initiated in Level D protection. Level D protection constitutes the following minimum protection - Standard field attire (Sleeved shirt; long pants) - Steel toe safety shoes - Safety glasses - Hardhat - Hearing protection (ear plugs or muffs) - Reflective vest for traffic areas - *Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential exists for significantly soiling work attire.* - *Nitrile gloves or leather gloves with surgical style inner gloves* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** - Will consist of a soap/water wash and rinse for reusable protective equipment (e.g., gloves). This function will take place at an area adjacent to the soil boring operations bordering the support zone. This decontamination procedure for Level D protection will consist of - Equipment drop - Soap/water wash and rinse of reusable outer gloves, as applicable - Outer coveralls, boot covers, and/or outer glove removal - Removal, segregation, and disposal of non-reusable PPE in bags/containers provided - Wash hands and face, leave contamination reduction zone.

TABLE 5-1
TASKS-SPECIFIC HAZARD AND HAZARD CONTROL SUMMARY
NAVAL AIR STATION
KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Air Hazard Monitoring	Personal Protective Equipment *(Items in italics are deemed optional as conditions or the FOL or SSO require.)*	Decontamination Procedures
Installation of the Vapor Extraction System This task includes trenching (via Ditch Witch or other trenching device), assembly of PVC piping system, and associated system hardware (e.g., blower/compressor) NOTE: Hazards/controls for electrical wiring is not addressed, as this is not in scope. Utility hook up is to perform only by properly qualified professionals. Also, no construction activities are anticipated in this task. If a Control Building is erected it will either be delivered completely constructed (skid mounted, so that it merely needs to be put in place) or it will be assembled by the firm that delivers the prefabricated structure.	***Chemical hazards:*** - Contact with site contaminants is not anticipated during this task. The only chemical concerns recognized include the use of chemical products such as primer and adhesives that will be needed to assemble the PVC piping system. Chemicals such as these that brought on site in support of field activities are to be identified, inventoried, accompanied by an appropriate MSDS, and properly stored. ***Physical hazards:*** - Noise in excess of 85 Dba when operating equipment such as the trenching machine - Excavation cave ins 5) Lifting (strain/muscle pulls) - Pinches and compressions - Slip, trips, and falls - Ambient temperature extremes - Vehicular and foot traffic - Hand cuts when using hand tools (such as hacksaws, utility knives, etc., which are commonly used when assembling sections of PVC piping) ***Natural hazards:*** - Insect/animal bites and stings	- To eliminate potential chemical hazards associated with this task ensure the following: - Use of PVC primer and adhesives is restricted to outdoor areas only - A chemical inventory list must be generated and maintained for all chemicals brought to the site (complete Section 5.0 of the TtNUS Health and Safety Guidance Manual). - Material Safety Data Sheets must be available for all chemicals brought on site. - Materials are to be stored in accordance with recommended practices and according to compatibility (See MSDS for storage and compatibility recommendations). - Persons using or handling chemicals must observe the requirements and restrictions presented on MSDS and container labels. 3) Trenching machine operator and any persons within 25 feet of trenching operations must wear hearing protection. 4) Restrict personnel from entering excavations. Assemble PVC piping outside of trench and lower it into the trench after it has been assembled. Also, do not leave trenches open any longer than absolutely necessary. 5) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 6) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. 7) Restrict unnecessary personnel from approaching within 4 feet of open trench excavations 8) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. - Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. trenching arm + 3 feet). - Secure all loose articles to avoid possible entanglement. - All activities are to be conducted consistent with the Base requirements. 10) Use hand tools only in their intended function. Inspect hand tools prior to use. If any defects are found, repair or replace prior to use. When using hacksaw or other cutting devices ensure that piece being cut is properly secured (e.g., in a vise) so that it does not have to be held by hand. Gloves constructed of cut-resistant material (i.e., leather or heavy cotton) should be worn whenever hand cutting or when handling sharp edges of cut PVC pipe. 11) Avoid potential nesting areas of biting/stinging insects and snakes. Use commercially available insect repellents. Wear appropriate clothing, including snake chaps where warranted. Tape ankle and wrists areas to prevent ticks and chiggers, etc. from attaching themselves to you skin. Wear light colored clothing so that biting insects can be easily visible and be removed. Follow directions as specified in Section 6.3 of this HASP and Section 4.0 of the Health and Safety Guidance Manual concerning natural hazards.	Use of direct reading monitoring instruments is not required for this task. Site 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. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides.	All subtasks under this task are to be initiated in Level D protection. The specific PPE requirements for each of these subtasks are as follows: **Trenching** - Standard field attire (Sleeved shirt; long pants) - Steel toe safety shoes - Safety glasses - Hardhat - Hearing protection (ear plugs or muffs) - Other PPE may be specified at the SSO's discretion **PVC piping assembly** - Observe any PPE requirements specified on container labels and MSDS for PVC primer and adhesive - Standard field attire (Sleeved shirt; long pants) - Steel toe safety shoes - Safety glasses - Other PPE may be specified at the SSO's discretion **Installation of system hardware** - Standard field attire (Sleeved shirt; long pants) - Steel toe safety shoes - Safety glasses - *Hard hat, and other PPE at the SSO's discretion* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** –For these subtasks, contact with contaminated media in concentrations that could represent a health hazard are not anticipated. Therefore, personnel decontamination will require simple observance of good personal hygiene (wash hands and face prior to eating, drinking, etc.) and avoidance of hand-to-mouth activities.

TABLE 5-1
TASKS-SPECIFIC HAZARD AND HAZARD CONTROL SUMMARY
NAVAL AIR STATION
KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Air Hazard Monitoring	Personal Protective Equipment *(Items in italics are deemed optional as conditions or the FOL or SSO require.)*	Decontamination Procedures
Multi-media sampling, including subsurface soil, groundwater, and air sampling.	***Chemical hazards:*** 1) Primary types of contaminants include Diesel Range Organics, including diesel fuel and general Polynuclear Aromatic Hydrocarbons (PAHs). Note that these contaminants may be bound to particulates (dusts, soils, etc.) and contact should be avoided whenever possible. See Table 6-1 for more information on the chemicals of concern. 2) Transfer of contamination into clean areas ***Physical hazards:*** 3) Noise in excess of 85 dBA 4) Lifting (strain/muscle pulls) 5) Pinches and compressions 6) Slip, trips, and falls 7) Ambient temperature extremes 8) Vehicular and foot traffic 9) Spilling product during risk mitigation ***Natural hazards:*** 10) Insect/animal bites and stings	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. If airborne dusts are observed, area wetting methods may be used. If area wetting methods are not feasible, termination of activities may be used to minimize exposure to observed airborne dusts. 2) Establish the Exclusion Zone for this activity at 10 feet surrounding the well head and discharge collection container. 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 outside of 25 feet from the drill rig should be incorporated under the following condition: If you have to raise your voice to talk to someone who is within 2 feet of your location, hearing protection must be worn. 4) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 5) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. - A remote sampling device must be used to sample cuttings near rotating tools. The equipment operator shall shutdown machinery if the sampler is near moving machinery parts. 6) Preview work locations for unstable/uneven terrain. 7) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. 8) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 9) When hand bailing or peristaltic pumping free product from wells take all precautions to avoid spilling product. Cover the immediate area around the well and under the transfer bucket with plastic. Use absorbent materials to contain spilled material. Properly deliver waste into a 55-gallon drum and label as Hazardous Waste. 10) Avoid potential nesting areas of biting/stinging insects and snakes. Use commercially available insect repellents. Wear appropriate clothing, including snake chaps where warranted. Tape ankle and wrists areas to prevent ticks and chiggers, etc. from attaching themselves to you skin. Wear light colored clothing so that biting insects can be easily visible and be removed. Follow directions as specified in Section 6.3 of this HASP and Section 4.0 of the Health and Safety Guidance Manual concerning natural hazards.	Direct reading instrument such as a Photoionization Detector (PID) with an 9.24 eV source (or higher) or Flame Ionization Detector (FID) will be used as a general screening instrument to detect volatile organic compounds and to evaluate airborne concentrations of potential site contaminants: Source areas (sample locations, borings, etc.) will be monitored using a PID or FID at regular intervals to be determined by the SSO. Positive sustained results at a source or downwind location(s) which may impact operations crew will require the following actions: **Excessive chemical contamination concentrations affecting the field crews during this task is not anticipated. The following information is based on a contingency action only.** - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above 25 ppm in the breathing zone areas of the at-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker breathing zone areas return to below 25 ppm. If elevated readings in worker breathing zone persist, the PHSO and HSM will be contacted to determine necessary actions and levels of protection. Site 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. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides.	Level D protection will be utilized for the initiation of all sampling activities. Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants) - Steel Toe Safety shoes - Safety glasses - Surgical style gloves (double-layered if necessary) - Reflective vest for high traffic areas - *Hardhat (when overhead hazards exists, or identified as a operation requirement)* - *Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential for soiling work attire exists.* - *Hearing protection for high noise areas, or as directed on an operation by operation scenario.* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** will consist of a removal and disposal of non-reusable PPE (gloves, coveralls, etc., as applicable). The decon function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Outer coveralls, boot covers, and/or outer glove removal (as applicable) - Removal, segregation, and disposal of non-reusable PPE in bags/containers provided - Soap/water wash and rinse of reusable PPE (e.g., hardhat) if potentially contaminated - Wash hands and face, leave contamination reduction zone.

TABLE 5-1
TASKS-SPECIFIC HAZARD AND HAZARD CONTROL SUMMARY
NAVAL AIR STATION
KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Air Hazard Monitoring	Personal Protective Equipment *(Items in italics are deemed optional as conditions or the FOL or SSO require.)*	Decontamination Procedures
Long-term system operation and monitoring This task also includes confirmatory sampling to determine appropriateness of system closure and dismantlement.	***Chemical hazards:*** 1) Primary types of contaminants include Diesel Range Organics, including diesel fuel and general Polynuclear Aromatic Hydrocarbons (PAHs). ***Physical hazards:*** 2) Slip, trips, and falls 3) Ambient temperature extremes 4) Noise from operating systems ***Natural hazards:*** 5) Insect/animal bites and stings	1) To eliminate potential chemical hazards associated with this task ensure the following: - A chemical inventory list must be generated and maintained for all chemicals brought to the site (complete Section 5.0 of the TtNUS Health and Safety Guidance Manual). - Material Safety Data Sheets must be available for all chemicals brought on site. - Materials are to be stored in accordance with recommended practices and according to compatibility (See MSDS for storage and compatibility recommendations). - Persons using or handling chemicals must observe the requirements and restrictions presented on MSDS and container labels. 2) Preview work locations for unstable/uneven terrain. 3) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding cold/heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. 4) The use of hearing protection will be required under the following condition: If you have to raise your voice to talk to someone who is within 2 feet of your location, hearing protection must be worn 5) Avoid nesting areas, use repellents. Report potential hazards to the SSO. Follow guidance presented in Section 4 of the Health and Safety Guidance Manual.	Occasional screening with a PID or FID may be required to determine system checks. In these cases, breathing zone readings should also be taken periodically. If any breathing zone readings approach 25 PPM and last for 1 minute or longer, retreat to an unaffected area and continue only if these readings subside.	Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants) - Steel Toe Safety shoes - *Safety glasses* - *Hardhat (when overhead hazards exists, or as designated by the SSO)* - *Hearing protection if system components are generating high noise levels or as designated by the SSO.* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	Not required
Decontamination of Sampling and Heavy Equipment	***Chemical hazards:*** 1) Primary types of contaminants include Diesel Range Organics, including diesel fuel and general Polynuclear Aromatic Hydrocarbons (PAHs). Note that these contaminants may be bound to particulates (dusts, soils, etc.) and contact should be avoided whenever possible. See Table 6-1 for more information on the chemicals of concern. 2) Decontamination fluids - Liquinox (detergent), acetone or isopropanol ***Physical hazards:*** 3) Lifting (strain/muscle pulls) 4) Noise in excess of 85 dBA 5) Flying projectiles 6) Vehicular and foot traffic 7) Slips, trips, and falls 8) Ambient temperature extremes (heat stress)	1) and 2) Employ protective equipment to minimize contact with site contaminants and hazardous decontamination fluids. Establish the exclusion zone for this activity at leas 25 feet surrounding the gross contamination wash and rinse as well as 25 feet surrounding the heavy equipment decontamination area. Obtain manufacturer's MSDS for any decontamination solvents used onsite. Use appropriate PPE as identified on MSDS. All chemicals used must be listed on the Chemical Inventory for the site, and site activities must be consistent with the Hazard Communication section of the Health and Safety Guidance Manual (Section 5). 3) Use multiple persons where necessary for lifting and handling sampling equipment for decontamination purposes. 4) Wear hearing protection when operating pressure washer. 5) Use eye and face protective equipment when operating pressure washer. All other personnel must be restricted from the area. 6) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 7) Preview work locations for unstable/uneven terrain. 8) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual.	Use visual observation, and real-time monitoring instrumentation to ensure all equipment has been properly cleaned of contamination and dried. After decon is completed, screen equipment with a PID/FID. If any elevated readings (i.e., above background) are observed, perform decon again and re-screen. Repeat until no elevated PID/FID readings are noted.	For Heavy Equipment This applies to high pressure soap/water, steam cleaning wash and rinse procedures. Level D Minimum requirements - - Standard field attire (Long sleeve shirt; long pants) - Steel Toe Safety shoes - Chemical resistant boot covers - Nitrile outer gloves - Hard Hat - *PVC Rainsuits or PE or PVC coated Tyvek* - *Safety glasses underneath a splash shield required when using pressure washer* - *Hearing protection (plugs or muffs) required when using pressure washer* For sampling equipment (trowels, bailers, etc.), the following PPE is required Level D Minimum requirements - - Standard field attire (Long sleeve shirt; long pants) - Safety shoes (Steel toe/shank) - Nitrile outer gloves - Safety glasses In the event of overspray of chemical decontamination fluids employ PVC Rainsuits or PE or PVC coated Tyvek as necessary. **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** will consist of a soap/water wash and rinse for reusable outer protective equipment (boots, gloves, PVC splash suits, as applicable). The decon function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Soap/water wash and rinse of outer boots and gloves, as applicable - Soap/water wash and rinse of the outer splash suit, as applicable - Disposable PPE will be removed and bagged. **Equipment Decontamination** - All heavy equipment decontamination will take place at a centralized decontamination pad utilizing steam or pressure washers. Heavy equipment will have the wheels and tires cleaned along with any loose debris removed, prior to transporting to the central decontamination area. All site vehicles will have restricted access to exclusion zones, and have their wheels/tires sprayed off as not to track mud onto the roadways servicing this installation. Roadways shall be cleared of any debris resulting from the onsite activity. **Sampling Equipment Decontamination** Sampling equipment will be decontaminated as per the requirements in the Sampling and Analysis Plan and/or Work Plan. MSDS for any decon solutions (Alconox, isopropanol, etc.) will be obtained and used to determine proper handling / disposal methods and protective measures (PPE, first-aid, etc.). All equipment used in the exclusion zone will require a complete decontamination between locations and prior to removal from the site. The FOL or the SSO will be responsible for evaluating equipment arriving onsite and leaving the site. No equipment will be authorized access or exit without this evaluation.

TABLE 5-1
TASKS-SPECIFIC HAZARD AND HAZARD CONTROL SUMMARY
NAVAL AIR STATION
KEY WEST, FLORIDA

Tasks/Operation/ Locations	Anticipated Hazards	Recommended Control Measures	Air Hazard Monitoring	Personal Protective Equipment *(Items in italics are deemed optional as conditions or the FOL or SSO require.)*	Decontamination Procedures
IDW management and moving IDW drums to storage area	***Chemical hazards:*** 1) Primary types of contaminants include Diesel Range Organics, including diesel fuel and general Polynuclear Aromatic Hydrocarbons (PAHs). Note that these contaminants may be bound to particulates (dusts, soils, etc.) and contact should be avoided whenever possible. See Table 6-1 for more information on the chemicals of concern. 2) Transfer of contamination into clean areas ***Physical hazards:*** 3) Noise in excess of 85 dBA 4) Lifting (strain/muscle pulls) 5) Pinches and compressions 6) Slip, trips, and falls 7) Vehicular and foot traffic 8) Ambient temperature extremes (heat stress) ***Natural hazards:*** 9) Insect/animal bites and stings	1) Employ real-time monitoring instrumentation, action levels, and identify PPE to control exposures to potentially contaminated media (e.g. air, water, and soils). 2) An Investigative Derived Waste (IDW) area will be constructed and barricaded. Only authorized personnel will be allowed access. Decontaminate all equipment and supplies, if they become contaminated, between locations and prior to leaving the site. 3) When working near heavy equipment, use hearing protection. 4) Use machinery or multiple personnel for heavy lifts. Use proper lifting techniques. 5) Keep any machine guarding in place. Avoid moving parts. Use tools or equipment where necessary to avoid contacting pinch points. 6) Preview work locations for unstable/uneven terrain. 7) Traffic and equipment considerations are to include the following: - Establish safe zones of approach (i.e. Boom + 3 feet). - Secure all loose articles to avoid possible entanglement. - All equipment shall be equipped with movement warning systems. - All activities are to be conducted consistent with the Base requirements. 8) Wear appropriate clothing for weather conditions. Provide acceptable shelter and liquids for field crews. Additional information regarding heat stress concerns is provided in Section 4 of the TtNUS Health and Safety Guidance Manual. 9) Avoid nesting areas, use repellents. Report potential hazards to the SSO. Follow guidance presented in Section 4 of the Health and Safety Guidance Manual.	Direct reading instrument such as a Photoionization Detector (PID) with an 9.24 eV source (or higher) or Flame Ionization Detector (FID) will be used as a general screening instrument to detect volatile organic compounds and to evaluate airborne concentrations of potential site contaminants: Source areas (sample locations, borings, etc.) will be monitored using a PID or FID at regular intervals to be determined by the SSO. Positive sustained results at a source or downwind location(s) which may impact operations crew will require the following actions: **Excessive chemical contamination concentrations affecting the field crews during this task is not anticipated. The following information is based on a contingency action only.** - Monitor the breathing zone of at-risk and downwind employees. Any sustained readings (greater than 1 minute in duration) above 25 ppm in the breathing zone areas of the at-risk employees requires site activities to be suspended and site personnel to retreat to an unaffected area. - Work may only resume if airborne readings in worker breathing zone areas return to below 25 ppm. If elevated readings in worker breathing zone persist, the PHSO and HSM will be contacted to determine necessary actions and levels of protection. Site 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. Evaluation of dust concentrations will be performed by observing work conditions for visible dust clouds. Potential exposure to contaminated dust will be controlled using water suppression, by avoiding dust plumes, or evacuating the operation area until dust subsides.	Level D protection will be utilized for the initiation of all sampling activities. Level D - (Minimum Requirements) - Standard field attire (Sleeved shirt; long pants) - Nitrile or cotton/leather work gloves with surgical style inner gloves - Safety Steel Toe Shoes - Safety glasses - *Hardhat (when overhead hazards exists, or identified as a operation requirement)* - *Reflective vest for high traffic areas* - *Tyvek coveralls and disposable boot covers if surface contamination is present or if the potential for soiling work attire exists.* - *Hearing protection for high noise areas, or as directed on an operation by operation scenario.* - *Work/rest regimen* **Note:** The Safe Work Permit(s) for this task (see Attachment IV) will be issued at the beginning of each day to address the tasks planned for that day. As part of this task, additional PPE may be assigned to reflect site-specific conditions or special considerations or conditions associated with any identified task.	**Personnel Decontamination** will consist of a soap/water wash and rinse for reusable outer protective equipment (boots, gloves, PVC splash suits, as applicable). The decon function will take place at an area adjacent to the site activities. This procedure will consist of: - Equipment drop - Soap/water wash and rinse of outer boots and gloves, as applicable - Soap/water wash and rinse of the outer splash suit, as applicable - Disposable PPE will be removed and bagged.

6.0 HAZARD ASSESSMENT

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

6.1 CHEMICAL HAZARDS

The potential health hazards associated with the Boca Chica Flying Club at NAS Key West include inhalation, ingestion, and dermal contact of various contaminants that may be present in soil and groundwater. The primary class of these contaminants, including specific compound(s) of interest is semi-volatile organic compounds (SVOCs), including petroleum compounds and, specifically, diesel fuel, waste oils, and general polynuclear aromatic hydrocarbons (PAHs).

Table 6-1 provides information on the substances likely to be present at the investigation site including information on their toxicological, chemical, and physical properties. It is anticipated that the greatest potential for exposure to site contaminants is during intrusive activities (e.g., well installation, groundwater sampling). Exposure to these compounds is most likely to occur through ingestion and inhalation of contaminated soil and water, or hand-to-mouth contact during intrusive activities. For this reason, PPE and basic hygiene practices (washing face and hands before leaving the site) will be extremely important. Inhalation exposure will be avoided by using appropriate PPE and engineering controls where necessary. Significant exposure via inhalation is not anticipated during the planned scope of work.

6.2 PHYSICAL HAZARDS

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

- Slips, trips, and falls
- Lifting (strains/muscle pulls)
- Ambient temperature extremes (heat stress)
- Pinches and compressions
- Vehicular traffic.

These physical hazards are discussed in Table 5-1, as they apply to each site task. These hazards are also discussed in detail in Section 4.0 of the Health and Safety Guidance Manual.

6.3 NATURAL HAZARDS

Insect/animal bites and stings, inclement weather, and other natural hazards must be considered, given the location of activities to be conducted. In general, avoidance of areas of known infestation or nesting will be the preferred exposure control. Use of additional PPE with joints (ankles and wrists) taped, such as long pants tucked into boots or coveralls, is also recommended. Specific discussion on principal hazards of concern follows.

6.3.1 Fire Ants

Fire ants present a unique situation when working outdoors in Florida. Their aggressive behavior and their ability to sting repeatedly can pose a health threat. The sting injects venom that causes an extreme burning sensation. Pustules form and 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, sometimes supported by a wall or shrub. The mound has no external opening. The size of the mound can range from a few inches across to some that exceed of two feet in height and diameter. When disturbed, the ants defend it by swarming out and over the mound, even running up grass blades and sticks.

6.3.2 Snakes, Insects, and Other Animals

The site is suspected of supporting a large population of Eastern Diamondback rattlesnakes. Given that areas to be investigated could be prime nesting and/or hiding locations for snakes and insects, precautions will be taken when opening manholes and other access doors. When possible, doors and manhole covers will be opened away from personnel to allow snakes or insects to escape. 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 be notified.

There are various areas throughout the U.S. where Lyme Disease is endemic, although, 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 a 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. An Office of Natural Resources or similar entity on the Base should be contacted for further direction on the hazards and precautions of naturally occurring wildlife and insects.

6.3.3 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.

7.0 AIR MONITORING

Direct reading instruments will be used at the site to detect and evaluate the presence of site contaminants and other potentially hazardous conditions. 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 Health and Safety Guidance Manual, Section 1.0, contains detailed information regarding direct reading 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 observing instrument action levels. Action levels are discussed in Table 5-1 as they may apply to a specific task or location.

7.1.1 Photo Ionization Detector or Flame Ionization Detector

In order to accurately monitor for any substances that may present an exposure potential to site personnel, a Photo Ionization Detector (PID) (using a lamp energy of 10.6 electron Volts [eV] or higher) will be used. This instrument will be used to monitor potential source areas and to screen the breathing zones of employees during site activities. The PID has been selected because it is capable of detecting the organic vapors of concern (Note**:** A Flame Ionization Detector [FID] may be used as an alternative to the PID).

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), and site location must be documented in the field operations logbook or other site documentation (e.g., sample log sheet).

7.1.2 Hazard Monitoring Frequency

Table 5-1 presents the frequencies at which hazard monitoring will be performed, as well as the action levels that will initiate the use of elevated levels of protection. The SSO may decide to increase these frequencies, based on instrument responses and site observations. The frequency 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 (e.g., the PID 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 employee health and safety training, the manufacturers' recommendations, and with the applicable manufacturer's SOP (copies of which can be found in the Health and 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 instead be recorded in a field operations logbook, provided that all information specified in Figure 7-1 is recorded. This required information includes the following:

- Date calibration was performed
- Name of individual calibrating the instrument
- Instrument name, model, and serial number
- Any relevant instrument settings and readings before and after calibration
- Identification of the calibration standard (lot number, source concentration, supplier)
- Any relevant comments or remarks.

Figure 7-1

Documentation of Field Calibration

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

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

8.0 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

8.1 INTRODUCTORY/REFRESHER/SUPERVISORY TRAINING

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

All TtNUS personnel must complete 40 hours of introductory hazardous waste site training prior to performing work at NAS Key West. Additionally, 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 project. Copies of certificates or other official documentation will be used to fulfill these requirements.

TtNUS will conduct a pre-activities training session prior to initiating site work. Additionally, a brief daily meeting will be held to discuss operations planned for that day. At the end of the workday, a short meeting will be held to discuss the operations completed and any problems encountered. This activity will be supported through the use of an SWP system (See Section 9.2).

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.

8.2 SITE-SPECIFIC TRAINING

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

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

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

8.3 MEDICAL SURVEILLANCE

All TtNUS personnel participating in project field activities will have had a physical examination meeting the requirements of TtNUS' medical surveillance program, and will be medically qualified to perform hazardous waste site work with respiratory protection. Documentation for medical clearances will be maintained in the TtNUS Pittsburgh and/or Aiken offices and made available as necessary.

Each field team member and visitor entering the Exclusion Zone(s) will be required to complete and submit a copy of the Medical Data Sheet presented in Figure 8-4. 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.

8.3.1 Medical Surveillance Requirements for Subcontractors

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

Subcontractors having company medical surveillance programs that meet the requirements of paragraph (f) of OSHA 29 CFR 1910.120 can substitute the "Subcontractor Medical Approval Form" as presented in Figure 8-3 or with a letter on company letterhead, containing all information in the example letter.

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 the Medical Data Sheet (example in Figure 8.4) 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

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

For 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 that may be exempt from training and medical surveillance requirements may 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.

Figure 8-1

Example Training Letter

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

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

Month, day, year

Mr. Chuck Bryan
Task Order Manager
Tetra Tech NUS, Inc.
900 Tail 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)

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 in Key West, Florida, and that I have received site-specific training that included the elements presented below:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present on site
- Use of personal protective equipment
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Contents of the Health and Safety Plan
- Emergency response procedures (evacuation and assembly points)
- Spill response procedures
- Review of contents of relevant Material Safety Data Sheets

My signature below indicates that I have been given the opportunity to ask questions and that all of my questions have been answered to my satisfaction, and that the dates of my training and medical surveillance indicated below are accurate.

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
Page 1 of 2

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 2 of 2

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

   _____
   _____
   _____

2. Any detected medical conditions which 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
Medical Data Sheet

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

Project _____

Name _____ Home Telephone _____

Address _____

Age _____ Height _____ Weight _____

Name of Next Kin _____

Drug or other Allergies _____

Particular Sensitivities _____

Do You Wear Contacts? _____

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

_____

_____

What medications are you presently using? _____

_____

_____

Do you have any medical restrictions? _____

_____

_____

_____

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

_____

_____

_____

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

_____ _____

Signature Date

9.0 SITE CONTROL

Site operations and control will be facilitated through the use of established work zones and security and control of those zones. These activities will minimize the impact and spread of contaminants brought to the surface through demolition and excavation methods, as well as protect personnel and visitors within these zones during ongoing operations.

9.1 WORK ZONES

TtNUS will delineate and use work zones in conjunction with decontamination procedures to prevent the spread of contaminants to other areas of the site. A three-zone approach will be used for work at this site: an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone. These will be used to control access to the work areas (restricting the general public), avoid potentials to spread any contaminants, and protect individuals who are not cleared to enter by way of training and/or medical surveillance qualifications.

9.1.1 Exclusion Zone

An Exclusion Zone will be established at each location where intrusive site work will be performed. The purpose of an Exclusion Zone is to define an area where specified requirements and restrictions must be observed (such as PPE usage, restrictions against smoking/eating, etc.). These are areas that could be adversely impacted by either chemical or physical hazards. Exclusion Zone sizes and dimensions can vary based on various factors, such as:

- The nature of planned activities and the size of the area needed to safely perform them
- Physical and topographical features of the site
- Weather conditions
- Field and analytical measurements of air and environmental contaminants
- Air dispersion calculations
- Physical, chemical and toxicological properties of the contaminants being investigated.

The following dimensions are to be observed for establishing the initial size of Exclusion Zones for this project:

- Monitoring well installation (by Direct Push Technology/Hollow Stem Auger): The Exclusion Zone for this activity will be set at the height of the drilling rig mast plus 5 feet or 25 feet, whichever is greater. This distance will also apply for subsurface sampling activities associated with drilling operations.

- Monitoring well sampling and risk mitigation of free product: The Exclusion Zone for this activity will be set at 10 feet surrounding the well head and discharge collection container.

- Soil and groundwater sampling: The Exclusion Zone for this activity will be set at five feet surrounding the point of operation for manual excavation and sample acquisition.

- Trenching: The planned area of the trench that is to be installed, plus no less than four feet on either side of the trench line.

- SVE: The interior of the control system building and five feet from any system discharge points or sampling ports.

- Decontamination operation: The Exclusion Zone for this activity will be set at 25 feet surrounding the gross contamination wash and rinse area, as well as 25 feet surrounding the heavy equipment decontamination area.

- IDW: The area will be constructed and barricaded. Only authorized personnel will be allowed access.

All Exclusion Zones will remain marked until the SSO has evaluated the restoration effort and has authorized changing the zone status.

Exclusion Zones will be marked by fencing, barrier tape, traffic cones, and/or drive poles. Signs will be posted to inform and direct site personnel and site visitors.

9.1.2 Contamination Reduction Zone

The Contamination Reduction Zone will be split to represent two separate functions. The first function will be a control/supply point for supporting Exclusion Zone activities. The second function, which may take place a sufficient distance from the Exclusion Zone, is the decontamination of personnel and heavy equipment.

In order to move from the Exclusion Zone to a separate location, the following activities will take place:

- As samplers move from location to location during sampling activities, dedicated sampling devices and PPE will be washed of gross contamination, removed, separated, and bagged. Personnel will use hygienic wipes, such as Handy Wipes, as needed for personnel decontamination until they can access the centralized decontamination unit. At the first available opportunity, personnel will wash their faces and hands. This is also true prior to breaks and lunch, when contamination can be transferred to the

mouth through hand-to-mouth contact. This route of exposure is estimated to have the greatest and most likely potential for exposure to contaminants of concern.

- Muddy over-boots and gloves may be required to go through a gross contamination wash at the Exclusion Zone. These items will then be cleaned thoroughly at the centralized decontamination unit.

- Potentially contaminated tooling and PPE will be wrapped, when necessary, for transport to the decontamination area.

- Upon completion of the assigned tasks, all personnel will move through the central decontamination area to clean reusable PPE and field equipment. Based on ambient conditions, medical evaluations may take place at the termination point of the decontamination line. These evaluations will include pulse rate, oral temperature, and breathing rate to evaluate physiological demands on site personnel. As stated earlier, these evaluations will be based on ambient conditions and acclimation periods.

9.1.3 Support Zone

The Support Zone will consist of a field trailer, storage, lay-down areas, or some other uncontaminated and controlled point. The Support Zone for this project will include a staging area where site vehicles can be parked, equipment can be unloaded, and where food and drink containers will be maintained. In all cases, the Support Zones will be established in clean areas of the site.

9.2 SAFE WORK PERMITS

All Exclusion Zone work and certain support tasks conducted during this project will be performed by using SWPs to guide and direct field crews on a task-by-task basis. Partially completed SWPs have been prepared for each of the planned tasks and are included in Attachment III of this HASP. The SSO is responsible for completing the remaining portions of these permits and for reviewing them with all task participants as part of daily task-specific tailgate meetings. A blank SWP form is included in Figure 9-1 as an example.

The use of these permits will ensure that site-specific considerations and changing conditions are incorporated and addressed field activities. All SWPs will require the signatures of either the FOL or the SSO, as well as the signature of a representative of any subcontractors that will participate in the task (when appropriate). All personnel engaged in onsite activities must be made aware of the contents of the appropriate SWPs before participating in any covered tasks. If additional tasks become necessary, the PHSO is to be notified so this HASP can be appropriately reviewed/modified and necessary SWPs can be

prepared.

The use of these permits will establish (and provide for reviewing) protective measures and hazards associated with each operation. This HASP will be used as the primary reference for selecting levels of protection and control measures. The SWPs will take precedence over the HASP when more conservative measures are required, based on specific site conditions.

Upon completion of the work for which the SWPs was assigned, the permit will be turned in to the FOL or the SSO. Concerns, complaints, and suggestions may be made on the reverse side of the SWPs for consideration by the FOL and/or SSO. All permits turned in with suggestions, difficulties, or complaints will be forwarded to the PHSO for review.

9.3 SITE MAP

Once areas of contamination, access routes, topography, and dispersion routes are determined, a site map will be generated and adjusted as site conditions change. The map will provide up-to-date information of contaminants and adjustments of zones and access points and will be posted at the field support trailer or other centralized location. Figure 2-1 in the Work Plan will serve as the preliminary version until investigation reveals more information. A map of the Base is included in this HASP as Figure 9-2.

9.4 BUDDY SYSTEM

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

9.5 MATERIAL SAFETY DATA SHEET 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 the user(s) of the chemical substances prior to any actual use or application of the substances onsite. The MSDSs will be maintained in a central location (i.e., temporary office) and will be available for anyone to review upon request. The SSO will be responsible for implementing a site-specific Hazard Communication Program (See Section 5.0 of the TtNUS Health and Safety Guidance Manual). This includes collection of MSDSs, creation and maintenance of an accurate Chemical Inventory Listing, container labeling, and personnel training issues, as well as other aspects of hazard communication.

FIGURE 9-1

EXAMPLE SAFE WORK PERMIT

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

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

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

II. Names: _____

III. 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 ☐

Respiratory equipment required

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

Modifications/Exceptions: _____

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

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

VI. Additional Safety Equipment/Procedures

Hardhat	☐ Yes	☐ No	Hearing Protection (Plugs/Muffs)	☐ Yes	☐ No
Safety Glasses	☐ Yes	☐ No	Safety belt/harness	☐ Yes	☐ No
Chemical/splash goggles	☐ Yes	☐ No	Radio	☐ Yes	☐ No
Splash Shield	☐ Yes	☐ No	Barricades	☐ Yes	☐ No
Splash suit/coveralls (Type:_____)	☐ Yes	☐ No	Gloves (Type)	☐ Yes	☐ No
Steel toe/shank Workboots	☐ Yes	☐ No	Work/rest regimen	☐ Yes	☐ No
Chemical Protective Over-boots (Type:_____)	☐ Yes	☐ No			

Modifications/Exceptions: _____

VII. Procedure review with permit acceptors

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

VII.Site Preparation

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

VIII. Additional Permits required (Hot work, confined space entry, excavation, etc.). ☐Yes ☐No
If yes, See SSO for appropriate permit

IX. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____

9.6 COMMUNICATION

It is anticipated that site personnel will be working in close proximity during proposed field activities. In the event that site personnel are in isolated areas or are separated by significant distances, a supported means of communication between field crews will be utilized. Two-way radio communication devices, if needed, will be used only with ISC approval.

External communications may be accomplished by using telephones that have been/can be installed at predetermined and approved locations, or through cellular phones. External communication will primarily be used for the purpose of resource and emergency resource communications. Prior to the commencement of site activities, the FOL will determine and arrange for appropriate means to accomplish external communications.

The phone will be switched off in any area with a potentially explosive atmosphere and all signals and instructions will be obeyed. Most manufacturers advise users to switch off the phone when at a refueling point. Do not use phones near fuels or chemicals or where blasting is in progress. Also, any restrictions or regulations related to cellular phone use in force at the Base must be observed.

9.7 SITE VISITORS

Potential site visitors that may be encountered during the performance of the fieldwork could include the following:

- Personnel invited by TtNUS to observe or participate in operations
- Regulatory personnel (i.e., DOD, VDEQ, EPA, OSHA, etc.)
- U.S. Coast Guard Personnel
- Other authorized visitors (Airfield Operations).

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

Once access to the Base is obtained, all personnel who require access to TtNUS work sites (areas of ongoing operations) will be required to obtain permission from the FOL and the Base Contact. Upon gaining access to the work site, all visitors wishing to observe operations in progress will be required to meet the minimum requirements as stipulated 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), who he/she represents, and the purpose for the visit. **The FOL is responsible for ensuring that site visitors are escorted at all times.**

- All site visitors will be required to produce the necessary information supporting clearance on to the site. This includes information attesting to applicable training (40-hours of Hazardous Waste Operation and Emergency Response [HAZWOPER], 8-Hour Refresher, as applicable), and medical surveillance, as stipulated in Section 8.3, 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 site and applicable operational areas. All visitors are required to observe protective equipment and site restrictions in effect at the work areas visited. Any and all visitors not meeting the requirements stipulated in this plan for site clearance will not be permitted to enter site operational zones during planned activities. Any incidence of unauthorized site visitation will cause all onsite activities to be terminated until that visitor can be removed. Removal of unauthorized visitors will be accomplished with support from the Base Contact, if necessary. At a minimum, the Base Contact will be notified of any unauthorized visitors.

9.8 SITE SECURITY

As this activity will take place at an active U.S. Coast Guard facility, the first line of security will be provided by the Bbase gate that restricts the general public. The second line of security will take place at the work site, referring interested parties to the FOL and Base Contact.

Security at the work areas will be accomplished by using field personnel. This is a multiple-person operation involving multiple operational zones. TtNUS personnel will retain complete control over active operational zones.

The Base Contact will serve as the focal point for Base personnel and interested parties and will also serve as the primary enforcement contact.

9.9 SANITATION AND BREAK AREAS

This section will address the following items:

- Toilets
- Potable water
- Showers and change rooms
- Break reas.

9.9.1 Toilets

One toilet will be provided for every 20 people. All toilets will be unisex and will have locking doors. The toilet provided will be either a chemical toilet or a flush toilet, depending on the site location.

9.9.2 Potable Water

Potable water and electrolyte-balance sports drinks (such as Gatorade) will be provided to field crews for fluid replacement. Storage and dispensing will proceed as follows:

- All containers will be cleaned and replenished daily.

- All containers will clearly marked as to their contents (Potable Water – Drinking Water Only, Gatorade, etc.).

- Dispensing locations will be in identified break areas within the Support Zone. The most likely location will be a break trailer. This will serve as an area for cooling or warming, as well as an identified food and drink consumption area.

- If larger containers are used, dispensing cups will be provided.

- The coolers used for storage of potable drinks and cups will be stored away from potentially contaminating materials. Coolers used for shipping samples are not acceptable for storing food or drink.

Fluid intake recommendations will be made, based on medical evaluations conducted at the end of the decontamination process, as necessary based on ambient conditions.

9.9.3 Showers/Change Rooms and Break Areas

Based on this scope and theduration of the project, shower facilities and locker rooms will not be provided.

Suitable locations will be provided for field personnel for the following uses:

- Break areas for food and drink consumption
- Areas suitable for warming and cooling regimens
- Areas suitable for safety meetings.

These will be located in either the project trailer or separate trailers, based on the crew size. These areas will be climate-control led to provide suitable shelter to combat heat or cold stress.

10.0 SPILL CONTAINMENT PROGRAM

10.1 SCOPE AND APPLICATION

It is not anticipated that bulk hazardous materials (over 55 gallons) will be accumulated or handled as part of the scope of work. It is also not anticipated that spillage of stored materials would constitute a danger to human health or the environment. As intended in the project scope of work, potentially contaminated soil will be containerized in 55-gallon drums for transportation offsite and disposal. Disposal will be in accordance with Federal, State, and local regulations. Based on previous sampling activities, the wastes have already been characterized and identified. While these soils remain in the staging area, this spill containment program will be instituted.

10.2 POTENTIAL SPILL AREAS

Potential spill areas will be monitored in an ongoing attempt to prevent and control potential further contamination of the environment. Currently, there are several areas vulnerable to this hazard, including the area used for central staging and decontamination. Additionally, areas designated for handling, loading, and unloading of potentially contaminated soils present a limited potential for leaks or spills.

10.3 LEAK AND SPILL DETECTION

To establish early detection of potential spills or leaks, a walk-around by personnel staging or disposing of containers will be conducted at least once each week while site activities are under way. These inspections are to be performed during working hours, to visually determine that containers are not leaking. Any leaks identified will be collected and contained using absorbents such as Oil-dry, vermiculite, or sand and stored at the staging area in a conspicuously marked drum. This material, too, will be containerized for disposal, pending analysis. All inspections are to be documented in the Project Logbook.

10.4 PERSONNEL TRAINING AND SPILL PREVENTION

All personnel will be instructed in the site-specific training on the procedures for spill prevention, containment, and collection of hazardous materials. The FOL or 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 examples of the equipment that may be maintained at the staging area for the purpose of supporting this Spill Prevention/Containment Program.

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

10.6 SPILL CONTROL PLAN

It is not anticipated that a spill will occur that the field crews cannot handle. Should one occur, however, the FOL or SSO will notify appropriate emergency response agencies. The following describes the steps field personnel will implement upon detecting a spill or leak.

1. Notify the SSO or FOL immediately upon detection of a leak or spill.

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

3. Transfer the material to a new drum/container, collect, and containerize the absorbent material. Label the new drum/container appropriately. Await analysis for shipment or disposal options.

4. Re-containerize solid spills of visibly contaminated and suspected contaminated soil; wait for test results for treatment or disposal options.

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, under the provisions of this HASP, personnel 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 (e.g., 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 which 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 have 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)
- A copy of the confined-space entry program, with extra copies of permits.

12.1 MATERIALS TO BE POSTED OR MAINTAINED AT THE SITE

The following documentation is to be posted at the site for quick reference purposes. In situations where posting of these documents is not feasible (such as no office trailer), these documents should be filed in a transportable file container and immediately accessible. The file should remain in the FOL's possession.

Chemical Inventory Listing - This list represents all chemicals brought onsite, including decontamination solutions, sample preservatives, fuel, calibration gases, etc. The list should be posted in a central area.

MSDSs - The MSDSs should also be in a central area and accessible to all site personnel. These documents should match all the 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. A copy of the OSHA poster is included in Attachment V of this HASP.

Site Clearance Posting (maintanined) - This list is found within the training section of the HASP (See Figure 8-1). The list identifies all site personnel, dates of training (including site-specific training), and medical surveillance and indicates not only clearance, but also status. If personnel do not meet these requirements, they do not enter the site while site personnel are engaged in project activities.

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

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

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

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 not 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

HEAT STRESS

HEAT STRESS

Because some physically demanding fieldwork is expected to take place during warmer months or periods, heat related disorders are a potential problem. Discussed below are the common heat-related disorders and the recommended actions to prevent heat stress.

Heat Related Disorders

Heat Rash

Also known as prickly heat, this condition affects the skin. It occurs in situations where the skin remains wet most of the time. The sweat ducts become plugged and a skin rash soon appears.

Signs and Symptoms

- Skin rash will appear on affected areas of the body.
- Tingling or prickling sensation will be felt on the affected areas.

Heat Cramps

Heat cramps are muscle pains, usually in the lower extremities, the abdomen, or both, that occur after profuse sweating with accompanying salt depletion. Heat cramps most often afflict people in good physical condition, who overwork in conditions of high temperature and humidity. Untreated, heat cramps may progress to heat exhaustion.

Signs and Symptoms

- Cramps in the extremities and abdomen that begin suddenly during vigorous activity. Heat cramps can be mild with only slight abdominal cramping and tingling in the extremities, but more commonly present intense and incapacitating pain in the abdomen and extremities.
- Respiration rate will increase, decreasing after the pain subsides.
- Pulse rate will increase
- Skin will be pale and moist.
- Body temperature will be normal
- Generalized weakness will be noted as the pain subsides.
- Loss of consciousness and airway maintenance are seldom problems with this condition.

Treatment for heat cramps is aimed at eliminating the exposure and restoring the loss of salt and water.

Heat Exhaustion

Heat exhaustion is a more severe response to salt and water loss, as well as an initial disturbance in the body's heat-regulations system. Like heat cramps, heat exhaustion tends to occur in people working in hot environments. Heat exhaustion may progress to heat stroke. Treatment for heat exhaustion is similar in principle to that for heat cramps.

Signs and Symptoms

- Heat exhaustion may be accompanied present by a headache, fatigue, dizziness, or nausea with occasional abdominal cramping. More severe cases of heat exhaustion may resulting partial or complete temporary loss of respiration nd circulation due to cerebral ischemia.

- Sweating will be profuse.
- Pulse rate will be rapid and weak.
- Respiration rate will be rapid and shallow.
- The skin will be pale and clammy
- The body temperature will be normal or decreased.
- The person could be irritable and restless.

Heat Stroke

Heat stroke is caused by a severe disturbance in the body's heat-regulating system and is a profound emergency: The mortality rate ranges from 25 to 50 percent. It is most common in men over 40, especially alcoholics. It can also occur to people of any age having too much exposure to the sun or prolonged confinement in a hot atmosphere. Heat stroke comes on suddenly. As the sweating mechanism fails, the body temperature begins to rise precipitously, reaching 106°F (41°C) or higher within 10 to 15 minutes. If the situation is not corrected rapidly, the body cells -- especially have very vulnerable cells to the brain--are literally cooked, and the central nervous system is irreversibly damaged. The treatment for heat stroke is aimed at maintaining vital functions and causing as rapid a decrease of body temperature as possible.

Signs and Symptoms

- The person's pulse will be strong and bounding.
- The skin will be hot, dry, and flushed.
- The worker may experience headache, dizziness, and dryness of mouth
- Seizures and coma can occur.
- Loss of consciousness and airway maintenance problems can occur.

These are only guidelines for heat related emergencies. Actual training in emergency medical care or basic first aid is recommended.

<u>Controlling Heat Stress</u>

The SSO shall visually monitor personnel to note for signs of heat stress. Field personnel will also be instructed to observe for symptoms of heat stress and methods on how to control it. One or more of the following control measures can be used to help control heat stress:

- Provide adequate liquids to replace lost body fluids. Personnel must replace water and salt lost from sweating. Personnel must be encouraged to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement.
- Replacement fluids can be commercial mixes such as Gatorade®.
- Establish a work regime that will provide adequate rest periods for cooling down. This may require additional shifts of workers.
- Cooling devices such as vortex tubes or cooling vests can be worn beneath protective garments.
- Breaks are to be taken in a cool rest area (77°F is best).
- Personnel shall remove impermeable protective garments during rest periods.
- Personnel shall not be assigned other tasks during rest periods.

- Personnel shall be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

The heat stress of personnel onsite may be monitored utilizing biological monitoring.

One of the following biological monitoring procedures may be utilized by the SSO to monitor heat stress concerns.

- Heart rate (HR) shall be measured by the pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of rest period stays the same. If the pulse rate is 100 beats/minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent. The length of the initial work period will be determined by using the table below.

PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES

	Work Load		
Work-Rest Regimen	Light	Moderate	Heavy
Continuous	80.0°F	80.0°F	77.0°F
75% Work - 25% Rest, Each Hour	87.0°F	82.4°F	78.6°F
50% Work - 50% Rest, Each Hour	88.5°F	85.0°F	82.2°F
25% Work - 75% Rest, Each Hour	90.0°F	88.0°F	86.0°F

- Body temperature shall be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99°F. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. However, if the oral temperature exceeds 99.7°F at the beginning of the next rest period, the following work cycle shall be further shortened by 33 percent. OT should be measured at the end of the rest period to make sure that it has dropped below 99°F. At no time shall work begin with the oral temperature above 99°F.

NOTE: External temperatures in excess of those stated above shall be regarded as inclement weather. Work continuation, termination, or alteration of the work schedule will be at the discretion of the FOL or SSO.

ATTACHMENT III

SAFE WORK PERMITS

SAFE WORK PERMIT
DECONTAMINATION ACTIVITIES
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 drilling equipment.

II. Required Monitoring Instrument(s): PID with 9.24 eV or higher lamp source (used to screen equipment)

III. Field Crew: _____

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

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

IV. Protective equipment required

Level D ☒ Level B ☐
Level C ☐ Level A ☐
Detailed on Reverse

Respiratory equipment required

Full face APR	☐	Escape Pack	☐
Half face APR	☐	SCBA	☐
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, field crews will also wear hearing protection, and face shields. Coveralls and boot covers are at the SSO's discretion.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Diesel range organics and Poly nuclear aromatic hydrocarbons	Any sustained readings above background 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: PVC rain suits or PE or PVC coated Tyvek may be required (at the SSO's discretion) for protection against splashes and overspray. Chemical resistant boot covers if excessive liquids are generated or to protected footwear.

VII. Procedure review with permit acceptors

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

VIII. 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	☐	☐	☐

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

X. Special instructions, precautions: If decontamination solvents are used (such as isopropyl alcohol, methanol, etc.), consult appropriate MSDS and container labels. Avoid or control visible dust clouds. To minimize the potential for exposure, site personnel will use PPE and prevent contact with potentially contaminated equipment..

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT FOR
INSTALLATION OF VAPOR EXTRACTION AND PIEZOMETER WELLS
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): Hollow stem auguring to install soil vapor extraction and piezometer wells.

II. Required Monitoring Instrument(s): FID or PID with 9.24 eV lamp (or higher) lamp source

III. Field Crew: _____

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

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

IV. Protective equipment required

Level D ☒ Level B ☐
Level C ☐ Level A ☐
Detailed on Reverse

Respiratory equipment required

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

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, steel toe safety shoes, safety glasses, hardhat, and hearing protection. The following items are at the SSO's discretion: nitrile or leather gloves with surgical-style inner gloves; Tyvek coveralls, and; boot covers.

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

Chemicals of Concern	Action Level(s)	Response Measures
Diesel range organics and Polynuclear aromatic hydrocarbons	Any sustained readings above 25 ppm in worker breathing zones*. *See Special Instructions	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/leather)	☐ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☐ No

Modifications/Exceptions: Reflective vests for high traffic areas. Tyvek coverall and impermeable boots if there is a potential for soiling work clothes.

VII. Procedure review with permit acceptors

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

VIII. 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	☐	☐	☐

IX. Additional Permits required: Excavation/Utility Clearance ☒ Yes ☐ No

If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: * Work may resume if PID/FID readings in worker breathing zone return to background levels. Avoid or control airborne dusts.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT FOR
IDW HANDLING, SAMPLING, AND STAGING OF DRUMS
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): IDW management and moving IDW drums to storage area.

II. Required Monitoring Instruments: FID or PID with 9.24 eV (or higher) lamp detect presence of VOCs

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	☐	Airline/SCBA	☐
SAR	☐	Bottle trailer	☐
Skid Rig	☐	None	☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety shoes,safety glasses, nitrile outer or cotton/leather outer gloves with surgical-style inner gloves, impermeable boot covers. Hardhat, Tyvek, boot covers, hearing protection, and reflective vests at SSO's discretion.

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

Diesel range organics and Polynuclear aromatics | Any sustained readings above background 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 -_____)	☒ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☐ No

Modifications/Exceptions: Work/rest regimen to be determined by SSO & site personnel

VII. Procedure review with permit acceptors

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

VIII. 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	☐	☐	☐

IX. Additional Permits required (Hot work, confined space entry, excavation etc.). ☐ Yes ☒ No

If yes, complete permit required or contact Health Sciences, Pittsburgh Office

X. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
MOBILIZATION AND DEMOBILIZATION ACTIVITIES NA
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 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)

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: Minimum requirement include sleeved shirt, long pants and safety footwear. Safety glasses are required if any potential eye hazards are noted. Hard hats and hearing protection will be worn when working near operating equipment. Reflective vests required in high traffic areas.

V. Chemicals of Concern	Action Level(s)	Response Measures
None anticipated given the nature of surveying activities and limited contact w/ media.	None	Not Applicable

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

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

VII. Procedure review with permit acceptors

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

VIII. Equipment Preparation

	Yes	NA
Equipment drained/depressurized	☐	☒
Equipment purged/cleaned	☐	☒
Isolation checklist completed	☐	☒
Electrical lockout required/field switch tested	☐	☒
Blinds/misalignments/blocks & bleeds in place	☐	☒
Hazardous materials on walls/behind liners considered	☐	☒

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

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

Permit Issued by: _____ Permit Accepted by:

SAFE WORK PERMIT FOR
MULTI-MEDIA SAMPLING
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): Multi-media sampling including , subsurface soils and groundwater. IDW sampling is also included in this task.

II. Required Monitoring Instrument(s): FID or PID with 9.24 eV lamp (or higher) lamp source; Combination Meter with LEL/O2/CO

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 shoes, surgical style gloves, and safety glasses. Hard hats and hearing protection will be worn when working near operating equipment or when required by the SSO.

V.

Chemicals of Concern	Action Level(s)	Response Measures
Diesel Range Organics and General Polynucular Aromatic Hydrocarbons	Any sustained readings above 25 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 – Surgical Style)	☒ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☒ No

Modifications/Exceptions: Reflective vests for high traffic areas. Tyvek coverall if there is a potential for soiling work clothes.

VII. Procedure review with permit acceptors

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

VIII. 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	☒	☐	☐

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

X. Special instructions, precautions _____

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
SURVEYING ACTIVITIES
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): Geographical surveys

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)

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: Minimum requirements include sleeved shirt and long pants and safety footwear. Safety glasses, hard hats, and hearing protection will be worn when working near operating equipment.

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

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

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: Tyvek coverall to protect against natural hazards (e.g., ticks). If working in areas where snakes are a threat, wear snake chaps to protect against bites. In high traffic areas wear high visibility vests.

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

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT FOR
INSTALLATION OF VAPOR EXTRACTION SYSTEM
ICS PORTSMOUTH, VIRGINIA

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

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): Installation of the soil vapor extraction system. This includes the following subtasks: Trenching; Assembly of PVC piping system; Installation of system components. **No building construction or utility (i.e., electric) connections are authorized**.

II. Required Monitoring Instrument(s): None required for this task.

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 requirements for all subtasks include sleeved shirt and long pants, steel toe safety shoes, safety glasses. Hardhat and hearing protection required when trenching. Cut-resistant gloves when using handtools (hacksaw or utility knife) and when handling cut ends of PVC piping. Also, consult appropriate PVC primer and adhesive MSDSs and container labels for PPE specifications. Other PPE items are at the SSO's discretion.

V.

Chemicals of Concern	Action Level(s)	Response Measures
PVC primer and adhesive	Observe MSDS and container	Observe MSDS and container
Contact with site contaminants is not anticipated	label specifications	label specifications

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 –_____)	☐ Yes	☐ No
Steel toe Work shoes or boots	☒ Yes	☐ No	Work/rest regimen	☐ Yes	☐ No

Modifications/Exceptions: Reflective vests for high traffic areas.

VII. Procedure review with permit acceptors

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

VIII. 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	☐	☐	☐

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

X. Special instructions, precautions: Restrict access to open trenches. No entry into trenches is permitted. Assemble PVC piping sections at ground level and then lower them into the trenches. When using hacksaws or other hand tools to cut PVC pipe, ensure that pipe is secured (e.g., in a vise) so that it is not necessary to attempt to hold it by hand. Wear cut resistant gloves when cutting or when handling cut ends of piping to prevent cuts.

Permit Issued by: _____ Permit Accepted by: _____

ATTACHMENT IV

STANDARD OPERATING PROCEDURES

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number SA-2.5	Page 1 of 6
		Effective Date 01/00	Revision 2
		Applicability Tetra Tech NUS, Inc.	
		Prepared Earth Sciences Department	
Subject DIRECT PUSH TECHNOLOGY (GEOPROBE®/HYDROPUNCH™)		Approved D. Senovich	

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1.0 PURPOSE

The purpose of this procedure is to provide general reference information on Direct Push Technology (DPT). DPT is designed to collect soil, groundwater, and soil gas samples without using conventional drilling techniques. The advantage of using DPT over conventional drilling includes the generation of little or no drill cuttings, sampling in locations with difficult accessibility, reduced overhead clearance requirements, no fluid introduction during probing, and typical lower costs per sample than with conventional techniques. Disadvantages include a maximum penetration depth of approximately 15 to 40 feet in dense soils (although it may be as much as 60 to 80 feet in certain types of geological environments), reduced capability of obtaining accurate water-level measurements, and the inability to install permanent groundwater monitoring wells. The methods and equipment described herein are for collection of surface and subsurface soil samples and groundwater samples. Soil gas sampling is discussed in SOP SA-2.4.

2.0 SCOPE

This procedure provides information on proper sampling equipment and techniques for DPT. Review of the information contained herein will facilitate planning of the field sampling effort by describing standard sampling techniques. The techniques described shall be followed whenever applicable, noting that site-specific conditions or project-specific plans may require adjustments in methodology.

3.0 GLOSSARY

Direct Push Technology (DPT) - DPT refers to sampling tools and sensors that are driven directly into the ground without the use of conventional drilling equipment. DPT typically utilizes hydraulic pressure and/or percussion hammers to advance the sampling tools. A primary advantage of DPT over conventional drilling techniques is that DPT results in the generation of little or no investigation derived waste.

Geoprobe® - Geoprobe® is a manufacturer of a hydraulically-powered, percussion/probing machines utilizing DPT to collect subsurface environmental samples. Geoprobe® relies on a relatively small amount of static weight (vehicle) combined with percussion as the energy for advancement of a tool string. The Geoprobe® equipment can be mounted in a multitude of vehicles for access to all types of environmental sites.

HydroPunch™ - HydroPunch™ is a manufacturer of stainless steel and Teflon® sampling tools that are capable of collecting representative groundwater and/or soil samples without requiring the installation of a groundwater monitoring well or conventional soil boring. HydroPunch™ is an example of DPT sampling equipment.

Flame Ionization Detector (FID) - A portable instrument for the measurement of many combustible organic compounds and a few inorganic compounds in air at parts-per million levels. The basis for the detection is the ionization of gaseous species utilizing a flame as the energizing source.

Photo Ionization Detector (PID) - A portable instrument for the measurement of many combustible organic compounds and a few inorganic compounds in air at parts-per million levels. The basis for the detection is the ionization of gaseous species utilizing ultraviolet radiation as the energizing source.

4.0 RESPONSIBILITIES

Project Manager - The Project Manager is responsible for selecting and/or reviewing the appropriate DPT drilling procedure required to support the project objectives.

Field Operations Leader (FOL)- The FOL is primarily responsible for performing the DPT in accordance with the project-specific plan.

5.0 SOIL SAMPLING PROCEDURES

5.1 General

The common methodology for the investigation of the vadose zone is soil boring drilling and soil sampling. However, drilling soil borings can be very expensive. Generally the advantage of DPT for subsurface soil sampling is the reduced cost of disposal of drilling cuttings and shorter sampling times.

5.2 Sampling Equipment

Equipment needed for conducting DPT drilling for subsurface soil sampling includes, but is not limited to, the following:

- Geoprobe® Sampling Kit
- Cut-resistant gloves
- 4-foot x 1.5-inch diameter macrocore sampler
- Probe sampling adapters
- Roto-hammer with 1.5-inch bit
- Disposable acetate liners for soil macrocore sampler
- Cast aluminum or steel drive points
- Geoprobe® AT-660 Series Large Bore Soil Sampler, or equivalent
- Standard decontamination equipment and solutions

For health and safety equipment and procedures, follow the direction provided in the Safe Work Permit in Attachment 1, or the more detailed directions provided in the project's Health and Safety Plan.

5.3 DPT Sampling Methodology

There are several methods for the collection of soil samples using DPT drilling. The most common method is discussed in the following section. Variations of the following method may be conducted upon approval of the Project Manager in accordance with the project-specific plan.

- Macrocore samplers fitted with detachable aluminum or steel drive points are driven into the ground using hydraulic pressure. If there is concrete or pavement over a sampling location, a Roto-hammer is used to drill a minimum 1.5-inch diameter hole through the surface material. A Roto-hammer may also be used if very dense soils are encountered.

- The sampler is advanced continuously in 4-foot intervals or less if desired. No soil cuttings are generated because the soil which is not collected in the sampler is displaced within the formation.

- The sampler is retracted from the hole, and the 4-foot continuous sample is removed from the outer coring tube. The sample is contained within an inner acetate liner.

- Attach the metal trough from the Geoprobe® Sampling Kit firmly to the tail gate of a vehicle. If a vehicle with a tail gate is not available, secure the trough on another suitable surface.

- Place the acetate liner containing the soils in the trough.

- While wearing cut-resistant gloves (constructed of leather or other suitable material), but the acetate liner through its entire length using the double-bladed knife that accompanies the Geoprobe® Sampling Kit. Then remove the strip of acetate from the trough to gain access to the collected soils. Do not attempt to cut the acetate liner while holding it in your hand.

- Field screen the sample with an FID or PID, and observe/examine the sample (according to SOP GH-1.3). If appropriate, transfer the sample to sample bottles for laboratory analysis. If additional volume is required, push an additional boring adjacent to the first and composite/mix the same interval. Field compositing is usually not acceptable for sample requiring volatile organics analysis.

- Once sampling has been completed, the hole is backfilled with bentonite chips or bentonite cement grout, depending upon project requirements. Asphalt or concrete patch is used to cap holes through paved or concrete areas. All holes should be finished smooth to existing grade.

- In the event the direct push van/truck cannot be driven to a remote location or a sampling location with difficult accessibility, sampling probes may be advanced and sampled manually or with battery/electric operated equipment (e.g., jack hammer).

- Sampling equipment is decontaminated prior to collecting the next sample.

6.0 GROUNDWATER SAMPLING PROCEDURES

6.1 General

The most common methodology for the investigation of groundwater is the installation and sampling of permanent monitoring wells. If only groundwater screening is required, the installation and sampling of temporary well points may be performed. The advantage of temporary well point installation using DPT is reduced cost due to no or minimal disposal of drilling cuttings and well construction materials, and shorter installation/times sampling.

Two disadvantages of DPT drilling for well point installation are:

- In aquifers with low yields, well points may have to be sampled without purging or development.
- If volume requirements are high, this method can be time consuming for low yield aquifers.

6.2 Sampling Equipment

Equipment needed for temporary well installation and sampling using DPT includes, but is not limited, to the following:

- 2-foot x 1-inch diameter mill-slotted (0.005 to 0.02-inch) well point
- Connecting rods
- Roto-hammer with 1.5-inch bit
- Mechanical jack
- 1/4-inch OD polyethylene tubing
- 3/8-inch OD polyethylene tubing
- Peristaltic pump
- Standard decontamination equipment and solutions

6.3 DPT Temporary Well Point Installation and Sampling Methodology

There are several methods for the installation and sampling of temporary well points using DPT. The most common methodology is discussed below. Variations of the following method may be conducted upon approval of the Project Manager in accordance with the project specific plan.

- A 2-foot x 1-inch diameter mill-slotted (0.005 to 0.02-inch) well point attached to connecting rods is driven into the ground to the desired depth using a rotary electric hammer or other direct push drill rig. If there is concrete or pavement over a sampling location, a Roto-hammer or electric coring machine is used to drill a hole through the surface material.

- The well point will be allowed to equilibrate for at least 15 minutes, after which a measurement of the static water level will be taken. The initial measurement of the water level will be used to assess the amount of water which is present in the well point and to determine the amount of silt and sand infiltration that may have occurred.

- The well point will be developed using a peristaltic pump and polyethylene tubing to remove silt and sand which may have entered the well point. The well point is developed by inserting polyethylene tubing to the bottom of the well point and lifting and lowering the tubing slightly while the pump is operating. The pump will be operated at a maximum rate of approximately 2 liters per minute. After removal of sediment from the bottom of the well point, the well point will be vigorously pumped at maximum capacity until discharge water is visibly clear and no further sediments are being generated. Measurements of pH, specific conductance, temperature, and turbidity shall be recorded every 5 minutes during the purging process. After two consistent readings of pH, specific conductance, temperature and turbidity ($\pm$10 percent), the well may be sampled.

- A sample will be collected using the peristaltic pump set at the same or reduced speed as during well development. Samples (with the exception of the samples to be analyzed for volatile organic compounds, VOCs) will be collected directly from the pump discharge. Sample containers for VOCs will be filled by (first shutting off the pump) crimping the discharge end of the sample tubing when filled, removing the inlet end of the sample tubing from the well, suspending the inlet tubing above the vial, and allowing water to fill each vial by gravity flow.

- Once the groundwater sample has been collected, the connecting rods and well point will be removed from the hole with the direct push rig hydraulics. The hole will be backfilled with bentonite chips or bentonite cement grout, depending upon project requirements. Asphalt or concrete patch will be used to cap holes through paved or concrete areas. All holes will be finished smooth to existing grade.

- In the event the direct push van/truck cannot be driven to a remote location or sampling location with difficult accessibility, sampling probes may be advanced and sampled manually or with battery/electric-operated equipment (e.g., jack hammer).

- Decontaminate the equipment before moving to the next location.

7.0 RECORDS

A record of all field procedures, tests, and observations must be recorded in the field logbook, boring logs, and sample log sheets, as needed. Entries should include all pertinent data regarding the investigation. The use of sketches and field landmarks will help to supplement the investigation and evaluation.

ATTACHMENT 1
SAFE WORK PERMIT FOR DPT OPERATIONS

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

SECTION I: General Job Scope

I. Work limited to the following (description, area, equipment used): **Monitoring well drilling and installation through direct push technology**

II. Required Monitoring Instruments: _____

III. Field Crew: _____

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

Level D Minimum Requirements: Sleeved shirt and long pants, safety footwear, and work gloves. Safety glasses, hard hats, and hearing protection will be worn when working near or sampling in the vicinity of the DPT rig.

Modifications/Exceptions.

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

VII. Additional Safety Equipment/Procedures

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

Modifications/Exceptions: Reflective vests for high traffic areas.

VIII. Procedure review with permit acceptors

	Yes	NA		Yes	NA
Safety shower/eyewash (Location & Use)	☐	☒	Emergency alarms	☐	☐
Daily tail gate meetings	☒	☐	Evacuation routes	☐	☐
Contractor tools/equipment/PPE inspected	☐	☐	Assembly points	☐	☐

IX. Site Preparation

Utility Clearances obtained for areas of subsurface investigation	☐ Yes ☐ No
Physical hazards removed or blockaded	☐ Yes ☐ No
Site control boundaries demarcated/signage	☐ Yes ☐ No

X. Equipment Preparation

	Yes	NA
Equipment drained/depressurized	☐	☒
Equipment purged/cleaned	☐	☒
Isolation checklist completed	☐	☒
Electrical lockout required/field switch tested	☐	☒
Blinds/misalignments/blocks & bleeds in place	☐	☒
Hazardous materials on walls/behind liners considered	☐	☒

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

XII. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____

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	

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1.0 PURPOSE

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

The purpose of this procedure is to provide minimum requirements and technical guidelines regarding the appropriate procedures to be followed when performing subsurface and overhead utility locating services. It is the policy of Tetra Tech NUS, Inc. (TtNUS) to provide a safe and healthful work environment for the protection of our employees. The purpose of this Standard Operating Procedure (SOP) is to aid in achieving the objectives of the TtNUS Utility Locating and Clearance Policy. The TtNUS Utility Locating and Clearance Policy must be reviewed by anyone potentially involved with underground or overhead utility services.

2.0 SCOPE

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

3.0 GLOSSARY

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

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

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

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

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

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

4.0 RESPONSIBILITIES

Project Manager (PM)/Task Order Manager (TOM) - Responsible for ensuring that all field activities are conducted in accordance with this procedure and the TtNUS Utility Locating and Clearance Policy.

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

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

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

Site Personnel – Responsible for understanding and implementing this SOP and the TtNUS Utility Locating and Clearance Policy.

5.0 PROCEDURES

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

5.1 Buried Utilities

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

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

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

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

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

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

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

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

6. Where utility locations are not confirmed with a high degree of confidence through drawings, schematics, location services, etc., the work area must be thoroughly investigated prior to beginning the excavation. In these situations, utilities must be identified using such methods as passive and intrusive surveys, physical probing, or hand augering. Each method has advantages and disadvantages including complexity, applicability, and price. It also should be noted that in many states, initial excavation is required by hand to a specified depth.

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

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

5.2 Overhead Power Lines

If it is necessary to work within the minimum clearance distance of an overhead power line, the overhead line must be de-energized and grounded, or re-routed by the utility company or a registered electrician. If protective measures such as guarding, isolating, or insulating are provided, these precautions must be

adequate to prevent employees from contacting such lines directly with any part of their body or indirectly though conductive materials, tools, or equipment.

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

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

6.0 UNDERGROUND LOCATING TECHNIQUES

6.1 Geophysical Methods

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

Electromagnetic Induction

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

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

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

Magnetics

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

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

Ground Penetrating Radar

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

6.2 Passive Detection Surveys

Acoustic Surveys

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

Thermal Imaging

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

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

6.3 Intrusive Detection Surveys

Vacuum Excavation

Vacuum excavation is used to physically expose utility services. The process involves removing the surface material over approximately a 1' x 1' area at the site location. The air-vacuum process proceeds with the simultaneous action of compressed air-jets to loosen soil and vacuum extraction of the resulting debris. This process ensures the integrity of the utility line during the excavation process, as no hammers, blades, or heavy mechanical equipment comes into contact with the utility line, eliminating the risk of damage to utilities. The process continues until the utility is uncovered. Vacuum excavation can be used at the proposed site location to excavate below the "utility window" which is usually 8 feet.

Hand-auger Surveys

When the identification and location of underground utilities cannot be positively confirmed through document reviews and/or other methods, borings must be hand-augered for all locations where there is a potential to impact buried utilities. The minimum hand-auger depth that must be reached is to be determined considering the geographical location of the work site. This approach recognizes that the

placement of buried utilities is influenced by frost line depths that vary by geographical region. Attachment 2 presents frost line depths for the regions of the contiguous United States. At a minimum, hand-auger depths must be at least to the frost line depth plus two (2) feet, but never less than 4 feet below ground surface (bgs). For augering, the hole must be reamed by hand to at least the diameter of the drill rig auger or bit prior to drilling. For soil gas surveys, the survey probe shall be placed as close as possible to the cleared hand-auger. It is important to note that a post-hole digger must not be used in place of a hand-auger.

Tile Probe Surveys

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

7.0 INTRUSIVE ACTIVITIES SUMMARY

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

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

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

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

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

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

8.0 REFERENCES

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

ATTACHMENT 1
LISTING OF UNDERGROUND UTILITY CLEARANCE RESOURCES

ALABAMA Alabama Line Location (800) 292-8525 Tucson Blue Stake Center (800) 782-5348
Alaska Locate Call Center of Alaska Inc. (800) 478-3121
Arizona Arizona Blue Stake Inc. (800) 782-5348
Arkansas Arkansas One Call System Inc. (800) 482-8998
California Underground Service Alert North (800) 227-2600 Underground Service Alert South (800) 227-2600
Colorado Utility Notification Center of Colorado (800) 922-1987
Connecticut Call Before You Dig (800) 922-4455
Delaware Miss Utility of Delmarva (800) 282-8555
District of Columbia Miss Utility (800) 257-7777
Florida Call Sunshine (800) 432-4770
Georgia Utilities Protection Center Inc. (800) 282-7411
Idaho Palouse Empire Underground Coordinating Council (800) 882-1974 Utilities Underground Location Center (800) 424-5555 Kootenai Country Utility Coordinating Council (800) 428-4950 Shoshone County One Call (800) 398-3285 Dig Line (800) 342-1585 One Call Concepts (800) 626-4950
Illinois Julie Inc. (800) 892-0123 Digger (Chicago Utility Alert Network) (312) 744-7000
Indiana Indiana Underground Plant Protection Services (800) 382-5544
Iowa Underground Plant Location Service Inc. (800) 292-8989
Kansas Kansas One-Call Center (800) 344-7233
Kentucky Kentucky Underground Protection Inc. (800) 752-6007
Louisiana Louisiana One Call (800) 272-3020

Maine Dig Safe – Maine (800) 225-4977
Maryland Miss Utility (800) 257-777 Miss Utility of Delmarva (800) 282-8555
Massachusetts Dig Safe – Massachusetts (800) 322-4844
Michigan Miss Dig System (800) 482-7171
Minnesota Gopher State One Call (800) 252-1166
Mississippi Mississippi One-Call System Inc. (800) 227-6477
Missouri Missouri One Call System Inc. (800) 344-7483
Montana Utilities Underground Location Center (800) 424-5555 Montana One Call Center (800) 551-8344
Nebraska Diggers Hotline of Nebraska (800) 331-5666
Nevada Underground Service Alert North (800) 227-2600
New Hampshire Dig Safe – New Hampshire (800) 225-4977
New Jersey New Jersey One Call (800) 272-1000
New Mexico New Mexico One Call System Inc. (800) 321-ALERT Las Cruces-Dona Utility Council (505) 526-0400
New York Underground Facilities Protection Organization (800) 962-7962 New York City: Long Island One Call Center (800) 272-4480
North Carolina The North Carolina One-Call Center Inc. (800) 632-4949
North Dakota Utilities Underground Location Center (800) 795-0555
Ohio Ohio Utilities Protection Service (800) 362-2764 Oil & Gas Producers Underground Protection Service (800) 925-0988
Oklahoma Call Okie (800) 522-6543

Oregon
Utilities Underground Location Center
(800) 424-5555

Douglas Utilities Coordinating Council
(503) 673-6676

Josephine Utilities Coordinating Council
(503) 476-6676

Rogue Basin Utility Coordinating Council
(503) 779-6676

Utilities Notification Center
(800) 332-2344

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

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

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

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

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

Texas
Texas One Call System (800) 245-4545

Texas Excavation Safety System (800) 344-8377

Lone Star Notification Center (800) 669-8344

Utah
Blue Stakes Location Center (800) 662-4111

Vermont
Dig Safe – Vermont (800) 225-4977

Virginia
Miss Utility of Virginia (800) 552-7001

Miss Utility (800) 257-7777

Miss Utility of Delmarva (800) 441-8355

Washington
Utilities Underground Location Center
(800) 424-5555

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

Utilities County of Cowlitz County
(360) 425-2506

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

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

Inland Empire Utility Coordinating Council
(509) 456-8000

Palouse Empire Utilities Coordinating Council
(800) 822-1974

Utilities Notification Center (800) 332-2344

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

Wisconsin
Diggers Hotline Inc. (800) 242-8511

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

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

Fremont County Utility Coordinating Council
(800) 489-8023

Central Wyoming Utilities Coordinating Council
(800) 759-8035

Southwest Wyoming One Call (307) 362-8888

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

Albany County Utility Coordinating Council
(307) 742-3615

Southeast Wyoming Utilities Coordinating Council
(307) 638-6666

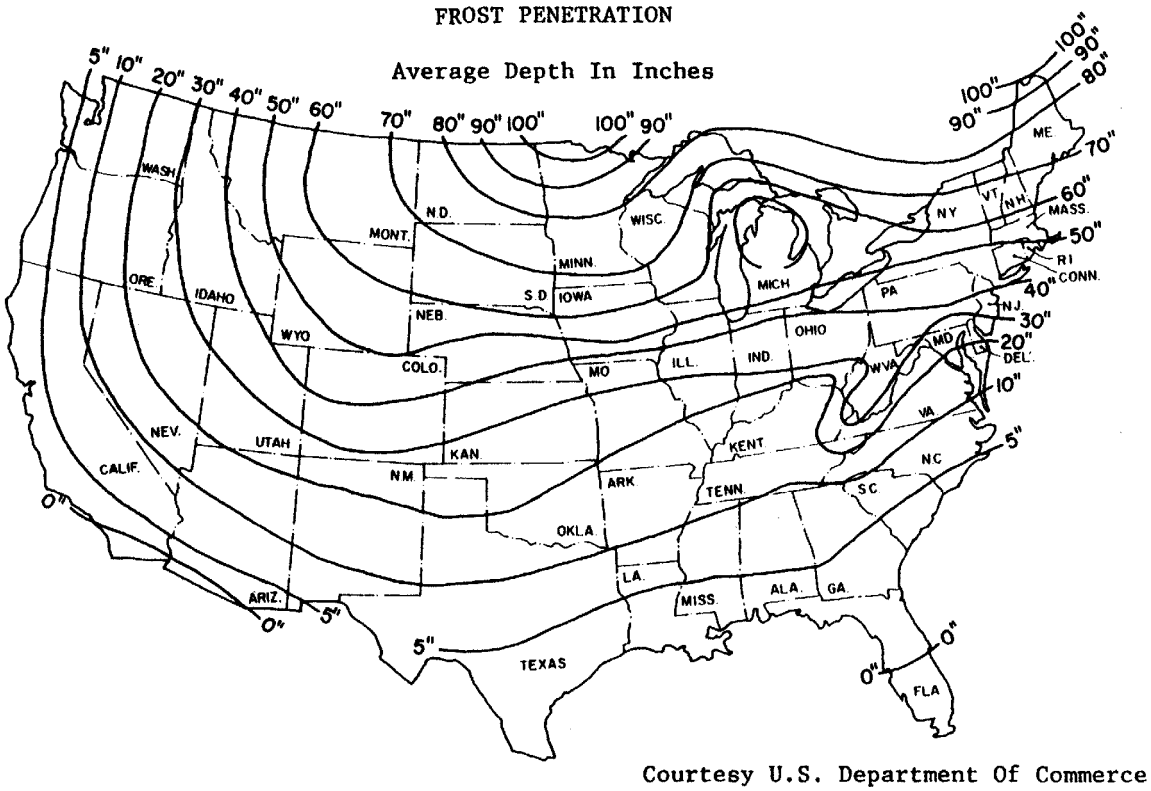
Wyoming One-Call
(800) 348-1030

Utilities Underground Location Center
(800) 454-5555

Converse County Utility Coordination Council
(800) 562-5561

ATTACHMENT 2

FROST LINE PENETRATION DEPTHS BY GEOGRAPHIC LOCATION



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

OSHA POSTER

You Have a Right to a Safe and Healthful Workplace.

IT'S THE LAW!

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in the inspection.
- You can file a complaint with OSHA within 30 days of discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have a right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violation.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records or records of your exposure to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.

The *Occupational Safety and Health Act of 1970 (OSH Act)*, P.L. 91-596, assures safe and healthful working conditions for working men and women throughout the Nation. The Occupational Safety and Health Administration, in the U.S. Department of Labor, has the primary responsibility for administering the *OSH Act*. The rights listed here may vary depending on the particular circumstances. To file a complaint, report an emergency, or seek OSHA advice, assistance, or products, call 1-800-321-OSHA or your nearest OSHA office: • Atlanta (404) 562-2300 • Boston (617) 565-9860 • Chicago (312) 353-2220 • Dallas (214) 767-4731 • Denver (303) 844-1600 • Kansas City (816) 426-5861 • New York (212) 337-2378 • Philadelphia (215) 861-4900 • San Francisco (415) 975-4310 • Seattle (206) 553-5930. Teletypewriter (TTY) number is 1-877-889-5627. To file a complaint online or obtain more information on OSHA federal and state programs, visit OSHA's website at **www.osha.gov**. If your workplace is in a state operating under an OSHA-approved plan, your employer must post the required state equivalent of this poster.

1-800-321-OSHA
www.osha.gov

U.S. Department of Labor • Occupational Safety and Health Administration • OSHA 3165